Article XX.—OBSERVATIONS ON THE GENUS BARRETTIA WOODWARD, WITH DESCRIPTIONS OF TWO NEW SPECIES.

By R. P. WHITFIELD.

PLATES XXVII–XXXVIII.

In 1862 Mr. S. P. Woodward described a fossil from the Cretaceous limestone on Grand River, Portland Parish, Jamaica, W. I., under the name *Barrettia monilifera*, basing the genus on it, and considering it as a member of the Rudistæ, and analagous to *Hippurites*, *Radiolites*, etc. He gives also two plates of illustrations.[1]

Since the original description was published, several authors have expressed doubts as to the correct reference of the fossil to the group Rudistæ, and have questioned its molluscan nature, considering it more in the light of a coral than a bivalve shell.[2] Even Mr. Woodward himself speaks of this resemblance to a coral in his opening paragraph, where he says: "Almost any person, at first sight of the specimen, would think he was looking at a coral, and it would seem like an attempt to impose on one's credulity to say it was a bivalve shell, like an oyster or a clam."

I have not been able to learn that any person has critically examined the original specimens since the paper by Mr. Woodward, above referred to, was published, or that other specimens have been collected or examined until the present time. During the winter of 1895 and 1896 Mr. Francis C. Nicholas, of New York, sent to the Museum, from Jamaica, quite a collection of this peculiar fossil, the specimens varying from four inches in length to about twenty, with diameters up to nearly a foot.

Among them there are some which show features not mentioned by Mr. Woodward or indicated on his figures, but which seem to throw additional light upon their nature, although perhaps not

[1] The Geologist, London, January, 1862, p. 372.
[2] Zittle, Traité Palæont. (French Edition), Vol. II, p. 86, 1887. Tryon, Syst. and Struct. Conch., Vol. III, p. 205. Fischer, Manuel Conch. et de Palæont. Conch., p. 1064. 1887. Linström, Operculate Corals of the Devonian Formation, Swedish Academy, Vol. VII, p. 78.

being conclusive as to their true position in the Animal Kingdom. None of these, however, show any indications of an upper valve, or any remains of any such plate, with the exception of what may possibly have been projecting tooth-like processes, remaining within the central cavity of three of the specimens. In this respect the specimen used by Mr. Woodward was far superior to any in this collection.

By an examination of the specimens in the Museum collection I have endeavored to ascertain something further as to the true zoölogical relations of these peculiar organisms, and present the following facts and observations as a result of these examinations.

The prominent feature of the genus, as shown by Mr. Woodward, is the presence of a series of rays, outside of a central cavity, extending to the circumference, but marked at close intervals by oval expansions. These he calls moniliform rays, and he says he counted sixty-five of them in the circumference of the specimen. The intervening spaces he describes as being filled with crystalline matter. He further states that the center is filled up with "a vesicular structure, as in the Silurian coral *Cystiphyllum*." Each of these moniliform rays or lines of beads originate, as shown by Mr. Woodward, in a lacuna somewhat greater in size than the other beads, and is connected with the others by a thin radial plate like the vertical ray or lamella of a coral. The beads are often distant more than their own diameter, but this radial plate connecting the different beads extends throughout the entire series.

These moniliform bodies are found to be vertical tubes, which are densely septate horizontally, with the septa all convex upward, the reverse of those in the cavities in the interradial spaces, and are distinctly double or divided in the middle by the radial plate. This feature is distinctly shown on the split surfaces, where the beads often separate from the surrounding substance and drop out entirely, or one-half may fall off and leave the other half in place. This latter feature also proves the existence of the thin radial plate which connects all the beads of a ray, or, as Mr. Woodward states it, they are "strung together by almost invisible lines." This thin radial plate begins near the center of the inner or first bead (the lacuna) of the ray, and is continuous through-

out the line to the outer margin of the disc. These moniliform tubes must have projected on the surface, and, as Mr. Woodward says, formed a series of radiating ridges with furrows between, except that instead of the "furrows between" them, the spaces were occupied by rows of quadrangular pits or depressions with transverse walls which divide them into cells, which Mr. Woodward did not observe.

These moniliform rays originate in the young organism just outside of the central cavity, and are constantly extended at the outer end by the addition of new tubes and an extension of the thin radial plate mentioned by Mr. Woodward.

The principal feature observed in the most perfect examples in our collection is in the spaces between the moniliform rays. In all of our examples, these spaces, which might be called interradial spaces, are occupied by a series of quadrangular pits or depressions with strong cross partitions between them, mentioned above, giving to the surface a sort of honey-comb structure. This is the most conspicuous feature of the organism when properly preserved, and one that does not appear to have been observed by the author of the genus, probably owing to the presence of the upper valve and to their being filled with crystalline matter to which he refers, like the sample shown on our Plate XXX. The depressions, although quadrangular on the surface, are rounded below and at bottom, and as seen from below resemble the under side of a deep septum of an Orthoceras. They vary in depth in the species *B. monilifera* from one-fourth to fully five-eighths of an inch (six to fifteen centimeters). In a vertical section of the specimen these cavities are seen to be closely septate below the surface one, so as to show as a series of deep cups one within the other, the intervening spaces being filled with calcite. (See Plate XXVII, upper figure.) Wherever a new moniliform ray is added, these cavities are doubled from that point outward, but are of smaller size than the inner ones.

This feature, *i. e.*, the radiating lines of quadrangular cavities, is shown by the specimen represented on Plates XXVII and XXVIII, to have been the true surface feature of the organism, and to have existed during life nearly as in the condition shown by the figures.

Another of the prominent features of these organisms is the character of the central cavity or visceral cup. In some of the specimens this is seen to be quite large and comparatively deep; but the rays and their lacunæ do not enter into its structure at the surface, nor do the quadrangular cell-like cavities, unless it be just at the edge. In one example it is about half as deep as wide, quite regularly concave and marked in some parts with ramifying vascular lines. When the specimens are cut longitudinally or accidentally split, the entire course of the cavity from the apex of the body to just below the upper surface is seen to be strongly, closely, and distinctly septate, just like that of a Cyathophylloid coral. (See Plates XXXI and XXXIII.) Mr. Woodward mentions that the center is filled up with a vesicular structure, as in the Silurian coral *Cystiphyllum.* In our specimens the septa extends entirely across the center of the cup, as they do in the genus *Zaphrentis* or in *Omphyma.*

In several of the specimens in our collection, showing more or less of the interior cup or visceral cavity, there are noticeable two features which are somewhat peculiar. One of these is shown distinctly in the figure on Plate XXVIII, at *c*, on the upper margin of the body cavity, encircling nearly one-half its diameter. This object is somewhat fibrous in a horizontal direction, and is of a white somewhat pearly texture. The other one nearly fills the center of the cup inside of the one just mentioned, and is vertically columnar or fibrous, appearing on its upper end much like the weathered end of a specimen of the coral *Chætetes* (see at the letter *d*). In the figure of *B. multilirata*, on Plate XXXIV, the first mentioned feature is seen to form a nearly continuous line for fully one-half the circumference of the cavity, is of a more dense and lighter colored substance than the rest, and is interrupted at two points by other bodies which represent the objects marked *t*, *t*, in Mr. Woodward's figure 5, and which he supposed to be sections of the teeth of the upper valve. These points, as seen in the section, are over two inches below the top of the specimen. In another example (of *B. multilirata*) the spaces marked *t*, *t*, on Woodward's figure, are occupied by long triangular points or processes much resembling teeth, and they are apparently fitted into triangular sockets or pocket-like cavities on the

side of the central cavity. In this specimen (see Plate XXXV) the cup is deep and rather narrow, but is partly filled by a calcareous crystalline deposit on one side; but the white pearly substance seen in many specimens of *B. monilifera* and the vertically columnar body seen in the cavity of that species, are both entirely absent from this one. The other feature, viz., the Chætites-like body, is seen in only some three or four specimens; one of these being a specimen of *B. sparcilirata*, in which it is very distinct and presents the appearance of a weathered fragment of *Stromatopora*, being formed of an interlaced network of ramifying, stolon-like branches. It is possible that this last feature in the several specimens may be objects foreign to the *Barrettia*, but it is not at all probable.

The question of the proper relations of these organisms is not clearly established by the evidence furnished by any of the specimens in the collection, notwithstanding there are many of them, and that they represent three distinct species. Neither would any one suspect from an examination of the collection that anything representing an upper valve had existed. But that such a feature was really present in the individuals used by Mr. Woodward there can be no doubt.[1]

That the objects are radial in their structure no one can question who examines the figures here presented, which are all from photographs of the objects, and consequently cannot misrepresent. There is no unsymmetrical side, like what would be seen in a body having a lateral hinge, not even as much so as in *Radiolites* or *Hippurites*, consequently the upper valve must have been held in place entirely by muscular action; but the homologies of the several features presented in the internal arrangement are hard to find in any living or known extinct coral or molluscan. When examined in transverse sections, the central cavity, below the living surface, appears to be separated from the marginal features by a distinct wall which is formed by the united edges of the plates which constitute the septa below, but none of the specimens showing the cup would lead one to expect such a

[1] I wrote to Mr. T. Rupert Jones, of London, requesting him to examine the type specimens for me, if they were still in the British Museum. He writes me that the upper valve is there "as figured" on Plate XX, fig. 2, of Woodward's article (copied on page 242 of this paper), but that "it has been slightly damaged, apparently since the drawing was made, at *x*, *x*, above *a*, on the left hand side (the spectators left hand)."

feature, any more than would the surface of the cup of a coral which would show the wall in a section.

The existence of an upper valve is a strong argument in favor of a molluscan affinity. Still we know there are bivalve or operculate corals, as *Calceola*, *Goniophyllum*, *Areopoma* and *Rhizophyllum* sufficiently attest. But none of these are sufficiently allied to *Barrettia* to form a basis for comparison, besides being so distantly separated geologically, none of them being known above the Devonian.

The increase in number of the moniliform rays being from the margin or outer rim is a distinctly radiate feature, and the increase in number of the tubes or beads in a ray taking place at the outer rim is also a distinctly radiate character. They are also seen to be cut off or obliterated at the central cavity by the latter's increased growth, as are the ray teeth of a coral to which they may be analagous. The radial plate is also seen to be composed of a double film, shown by the readiness with which it splits longitudinally, just as do the ray lamellæ of cup corals, having been formed by a folded film of the endoderm of the animal.

If these bead-like bodies were produced by anything like the expanded mantle of a mollusc during growth, they would most likely diverge upwards and increase in distance from each other, like the rays on a shell, or be added to in numbers at intervals, neither of which features occur ; but, on the contrary they are seen on the several longitudinal sections to drop out near the central cavity, which widens at the expense of numbers of these tubes. This probably explains why, in some of the larger individuals, many of the large lacunæ are not present, they having been obliterated by the widening of the central cavity. This feature is noticed in the increase and disappearance of the lines of bead-like tubes. They (the lines) appear to originate at the inner surface of the margin of the cup, and the increase in number of beads in a line takes place at this point, *i. e.*, on the inner surface of the outer wall of the cup. Owing to this fact the lines on a split surface are seen to be parallel to the outer margin after the body has attained its full size, and where there is an increase in dimensions, new ones are seen to come in on the

outer border, while those near the inner margin at the border of the central cavity are displaced or obliterated by the increase in width of the central cavity. (See Plates XXXI and XXXII.)

Of the two lacunæ which are always present and continuous (those marked *n*, and *m*, on Woodward's figure 5, Plate XXI [copied on page 242 of this article] of the work cited), the large round one forms a cylindrical horizontally septate tube, extending the entire length of the body, and is situated close to the margin of the central cavity. The septa are concave, flat or convex, at different places in its length. The other one marked *n*, on Woodward's figure 5, is narrowly compressed laterally, and extends to about two-thirds of the distance toward the margin of the body, and is also septate horizontally. (See Plate XXXII, at *b*.) Beyond its outer end the usual bead-like tubes continue, but the earlier ones on the line are absorbed by its increase in length during growth, as can be seen on the left of the figure just referred to. These two features, in all the examples examined, bear the same relations one to the other, and were supposed by Mr. Woodward to represent the inflections of the mantle on the cardinal side, to form the ridges seen on the inside of the cup on the cardinal side of *Radiolites* and *Hippurites*, or as he supposed to form a hinge. (See *n* and *m*, Figs. 6 and 7, page 242, which is a reproduction of Woodward's Plate XXI.) In our specimens these two features are close to the central cavity, and do not become separated from it at its surface, but when, from further growth, the body cavity is contracted below by the partitions thrown across from time to time, in lessening its depth, these features will in a section appear as disconnected from the interior cavity, just as does the fosset in a Cyathophyloid coral, which the long narrow organ here mentioned *very closely resembles, if it does not represent.* That they do not form part of a hinge analagous to that of a bivalve mollusc, or more particularly like that of Hippurites, is shown in their distance from the margin of the body and in being connected with that margin only by the line of bead-like tubes between.

Besides the two features just described, there are others of the rays, as they are seen in transverse sections, which are constructed differently from the generality of them. These may be seen on

page 242, at *c*, *c*, *c*, *c*, where they are more nearly solid and not as vesicular as the others, as if they had been filled up by a continuous deposit. The meaning of these I have not been able to determine, nor have I been able to trace them to their source on the surface of the specimens. But I have thought they might, with the features *a* and *b*, represent the primary rays of a coral.

It might be contended that these cells and partitions are analagous to the columnar or fibrous features of *Radiolites*, *Caprotina* and other Rudistæ, but all those features are divergent in their growth upward, whereas these in *Barrettia* are convergent or parallel, and the additions are all at the outer rim of the body and not at intermediate points and interstitially as in molluscs.

When examined in thin transverse microscopical sections, the thick wall separating the quadrangular interradial cavities or cells, in *B. monilifera*, is seen to be composed of vertical plates rather dense in substance, forming a rudely longitudinally vesicular structure, sometimes uniting in centers, like the rays of septate corals; they also formed compressed ovals or narrowly elliptical cavities, all arranged vertically. In vertical sections these plates are seen to be continuous for considerable distances, or are subject to frequent interruptions and conjunctions with each other, as is seen in longitudinal sections of cup corals. In longitudinal sections made along the moniliform ray the vertical plates are seen always a little oblique to the moniliform tubes, but entirely distinct from them; while the convex plates of the moniliform tubes are very perceptible. In a vertical section at right angles to the moniliform ray, cutting the tube transverse to its radial axis, the transverse plates or septa are seen to be raised in the center, pointing upward where they join the thin radial plate which divides them along the middle, appearing much like the plates or tabulæ which are seen in the Palæozoic corals *Syringopora*, *Lithostrotion*, etc., which form the columella of those corals.

So far as my observations extend I can find no evidence of a molluscan nature in these organisms except the presence of an upper valve. All the other features tend towards a radial affinity. The total absence of a hinge, even as much as the faintly marked

EXPLANATION OF PLATE XXVII.

Barrettia monilifera Woodward. Page 233.

Fig. 1.—View of the summit of a large weathered specimen reduced to one-half the natural size. The circular spot near *a* is the longitudinal septate tube ; *b* is the fosset-like cavity filled by a calcareous deposit ; *c* is the horizontally fibrous, pearly substance ; *d* indicates the vertically fibrous, or Chætetes-like substance of the central cavity. The quadrangular cavities of cells are seen all over except in the centre, and in the ridges between the radiating rows of these may be seen the moniliform rays of Woodward.

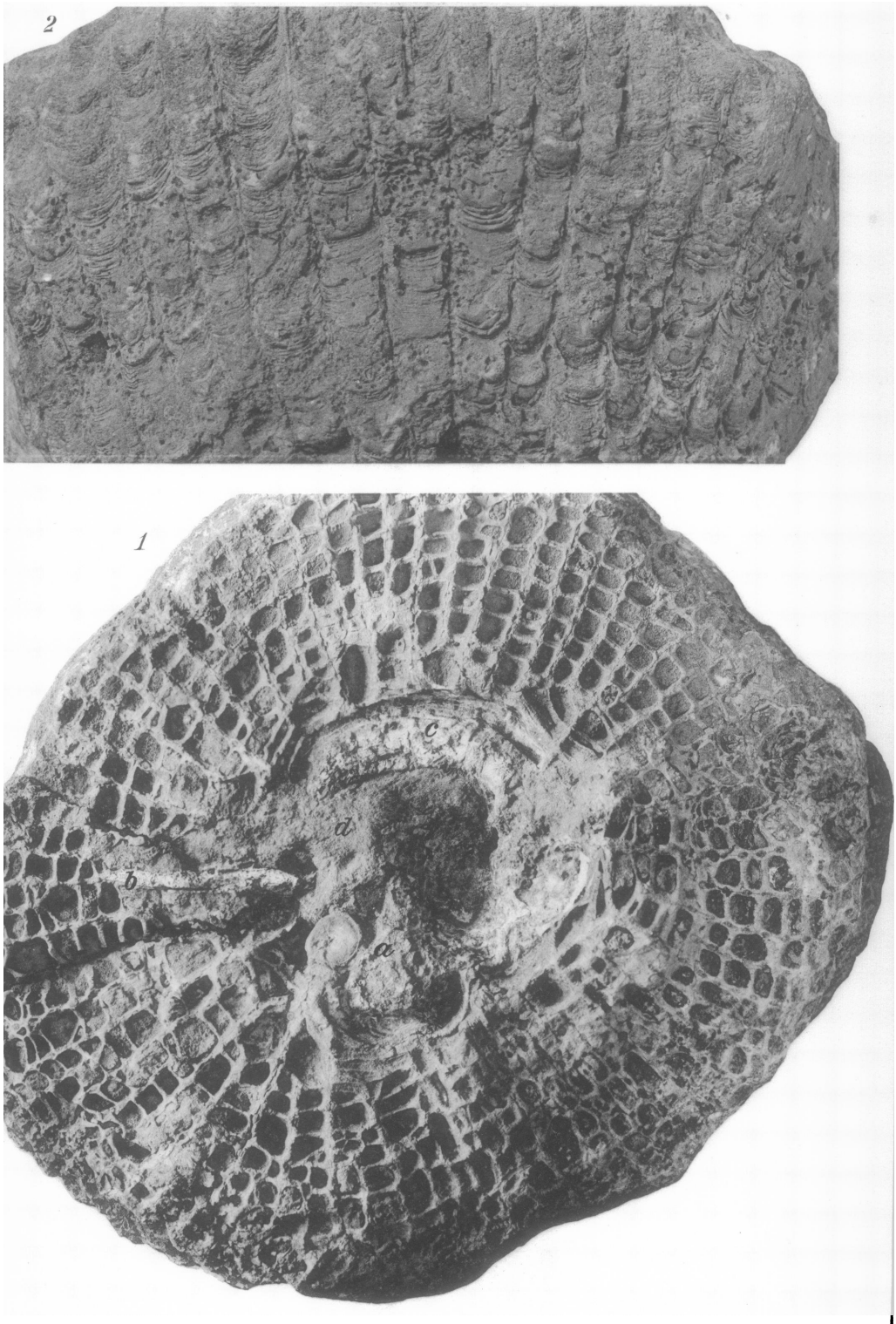
Fig. 2.—Represents a vertical weathered section of a specimen showing the septa-like lower surfaces of the quadrangular cavities with vertical rays separating them. Natural size.

BARRETTIA MONILIFERA, Woodward.

EXPLANATION OF PLATE XXVIII.

Barrettia monilifera Woodward. Page 233.

Fig. 1.—View, natural size, of a part of the weathered specimen represented half size on Plate XXVII, showing more plainly the features indicated on that figure. The lettering refers to the same parts as there. At *e*, a cavity, reniform in shape, is seen which is distinctly walled. The *moniliform* rays can be easily seen on the ridges between the lines of quadrangular cavities. Many of the cavities are filled with calc-spar.



BARRETTIA MONILIFERA, Woodward.

EXPLANATION OF PLATE XXIX.

Barrettia monilifera Woodward. Page 233.

Fig. 1.—A view, natural size, of a weathered fragment viewed on the lower surface so that the features appear reversed from what they do on figure 1 on Plate XXVII and on Plate XXVIII. Some of the moniliform tubes are seen projecting on the surfaces where the quadrangular cells are filled with crystalline limestone.

BARRETTIA MONILIFERA, Woodward.

EXPLANATION OF PLATE XXX.

Barrettia monilifera Woodward. Page 233.

The figure represents the upper end of a split specimen, where all the quadrangular cells are filled with crystalline matter so as to obliterate their outlines, similar to what Mr. Woodward's specimen must have been. The moniliform rays are seen projecting on the weathered surface. Natural size.

BARRETTIA MONILIFERA, Woodward.

EXPLANATION OF PLATE XXXI.

Barrettia monilifera Woodward. Page 233.

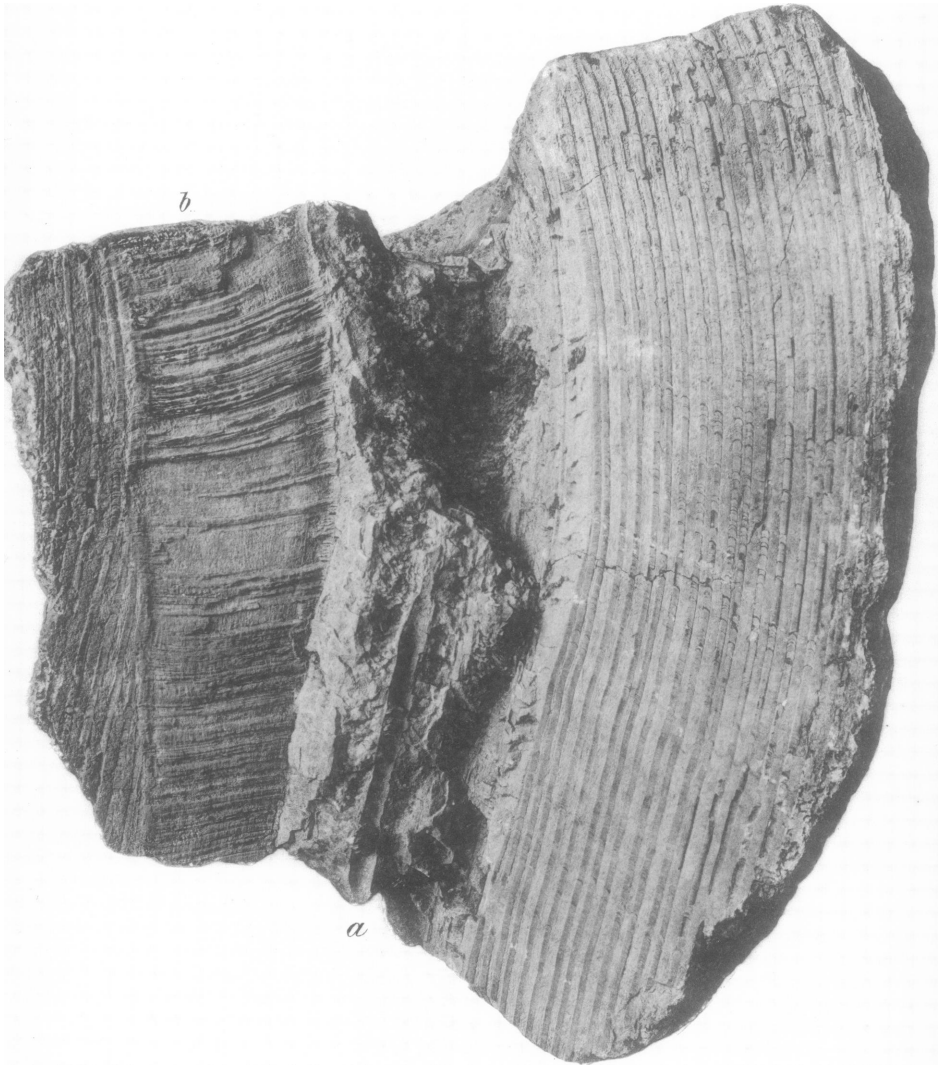
The figure represents a specimen split longitudinally and weathered, and shows the septæ of the central cavity, also the septate tube *a*, on one side of the central cavity, and on each side the sections of the moniliform bodies, most of which retain only the one-half of the tube with the septa curving upward. At the base of the figure at the right may be seen a few of these tubes retaining the front half in place, a common feature of some of these split weathered specimens.

BARRETTIA MONILIFERA, Woodward.

EXPLANATION OF PLATE XXXII.

Barrettia monilifera Woodward. Page 233.

The figure is one-half natural size of a longitudinally split specimen, retaining a little more than half of the circumference of the original body, showing part of the visceral cup at the top and the succeeding septæ below filled with crystalline matter, the imprint of the small septate tube on its broken surface at *a*. At *b* is seen the track of the fosset-like cavity with remains of its diaphrams or septa and on both sides the moniliform tubes, some of which retain both halves, while others have both parts removed leaving the tube cavity empty. The manner in which these small tubes are displaced or obliterated by the addititional growth in width of this fosset is distinctly seen on the left side.



BARRETTIA MONILIFERA, Woodward.

EXPLANATION OF PLATE XXXIII.

Barrettia multilirata Whitf. Page 244.

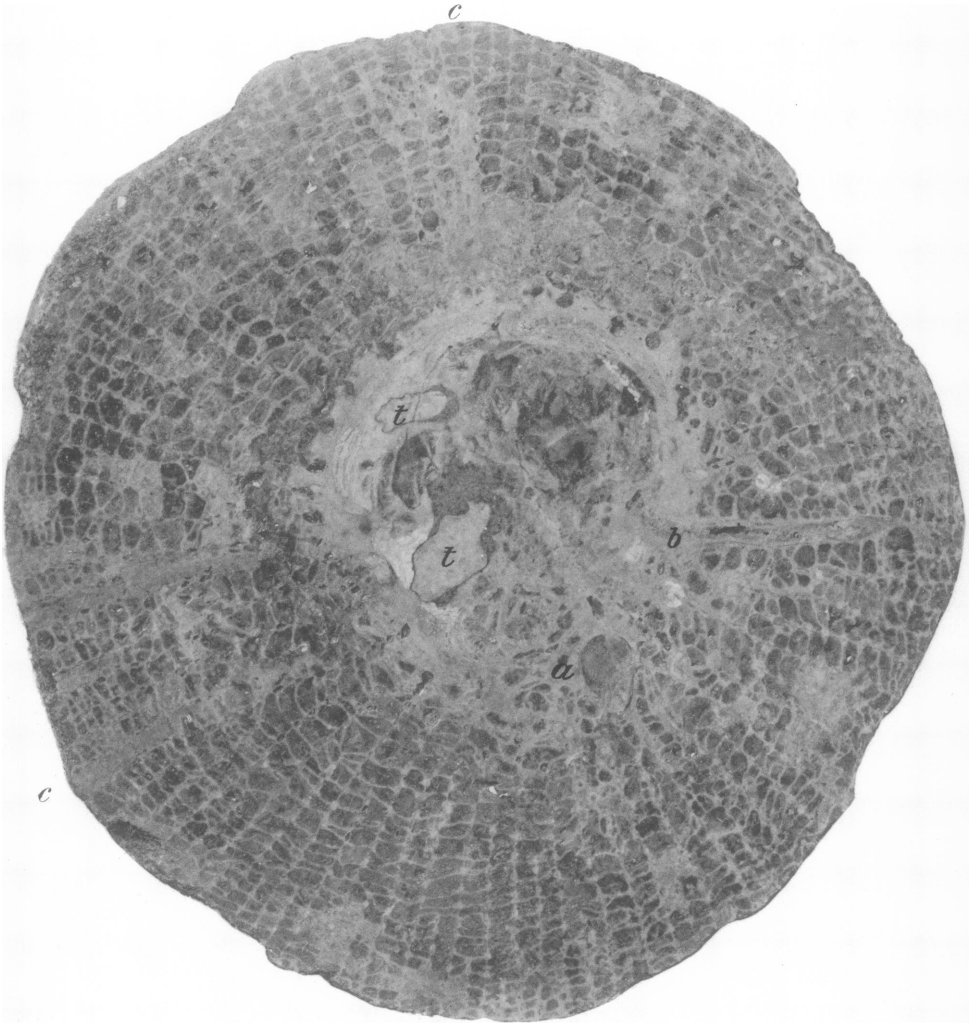
The view is of a polished longitudinal section reduced to about two-thirds of the natural size, of a specimen of this species, and shows the septa of the central cavity and also part of a section with the septa of the large septate tube *a*. On the sides may be recognized sections of the quadrangular cavities of the summit structure and fragments of the moniliform tubes. *C* probably represents the track of the horizontally fibrous body.

BARRETTIA MULTILIRATA, Whitf.

EXPLANATION OF PLATE XXXIV.

Barrettia multilirata Whitf. Page 244.

The figure is of a section, about four-fifths natural size, taken from the top of the specimen represented on Plate XXXIII, before the longitudinal section was made ; consequently it is seen from the under surface so that the features appear reversed from their natural positions. *a*, represents the longitudinal septate tube ; *b*, the fosset-like body ; *c*, *c*, *c*, three of the radial spaces filled with matter differing from that filling the others ; *t*, *t*, may represent the bodies supposed by Mr. Woodward to represent teeth of the upper valve. Around the side of the center embracing the bodies, *t*, *t*, is the pearly horizontally fibrous substance seen in *B. monilifera*. The quadrangular cells and moniliform rays are readily recognized.

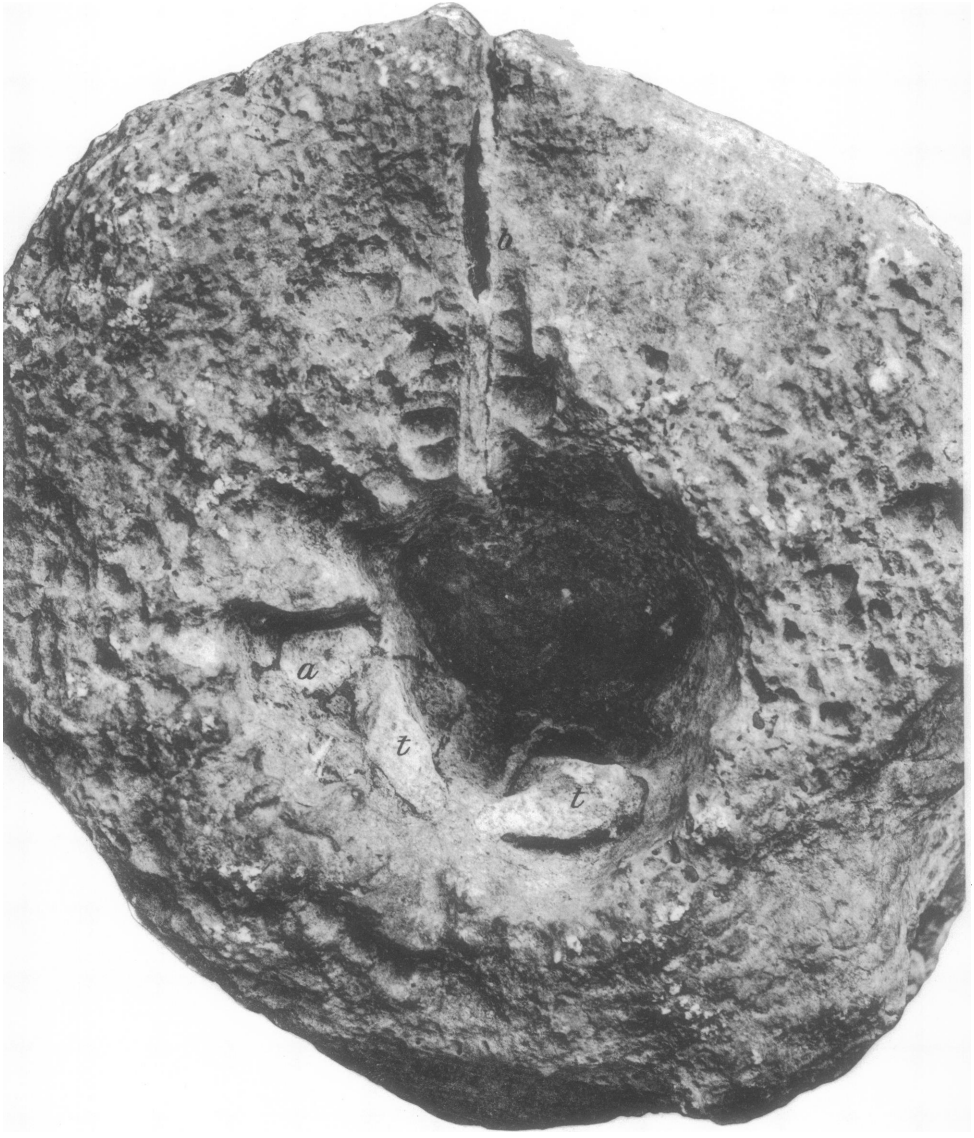


BARRETTIA MULTILIRATA, Whitf.

EXPLANATION OF PLATE XXXV.

Barrettia multilirata Whitf. Page 244.

View, natural size, of the upper weathered surface of a specimen which shows the deep central cavity. At *a*, is the end of the septate tube, at *b*, the fosset, and at *t*, *t*, the remains of the two bodies supposed to be teeth of the upper valve by Mr. Woodward. These triangular points are distinctly limited around their sides and appear to be placed in a socket-like cavity. The horizontally fibrous body cannot be found in this and some other specimens.



BARRETTIA MULTILIRATA, Whitf.

EXPLANATION OF PLATE XXXVI.

Barrettia sparcilirata Whitf. Page 245.

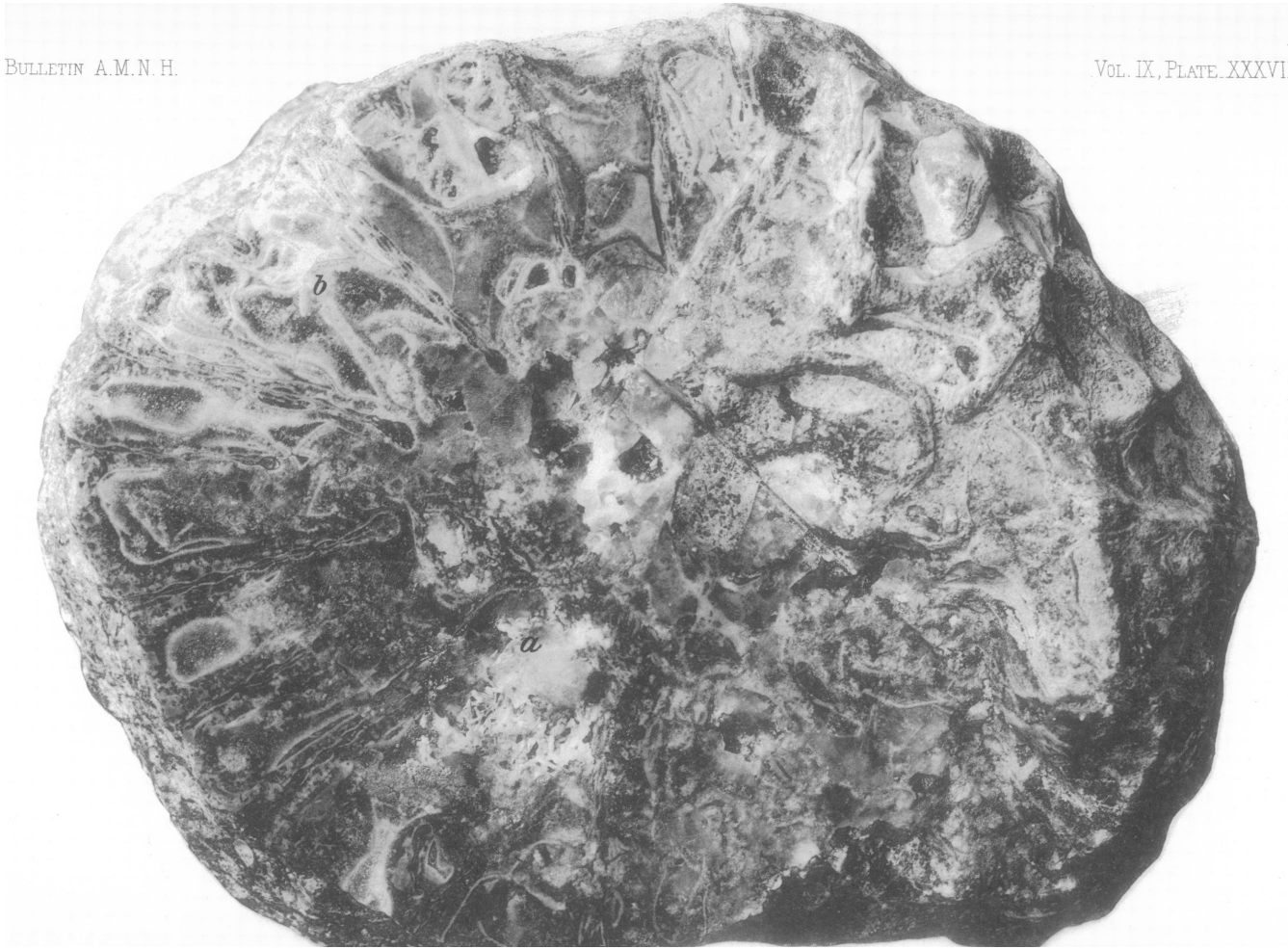
View, a little less than natural size, of a specimen of this species which is only the upper end of the organism. The surface has been weathered or worn as if rolled in a stream, but shows the structure very distinctly. In a section made across near the middle it shows the moniliform rays to be very few in number, and the quadrangular cells between them are large and very irregular as seen on the exterior.

Barrettia sparcilirata, Whitf.

EXPLANATION OF PLATE XXXVII.

Barrettia sparcilirata Whitf. Page 245.

View of a section of a second specimen of the species, in which the position of the vertical septate tube is seen at *a*, and most of the moniliform rays are easily recognized ; but the fosset-like body has not been satisfactorily recognized in either specimens of this species, but is possibly represented at *b*, broken down.


b
a

EXPLANATION OF PLATE XXXVIII.

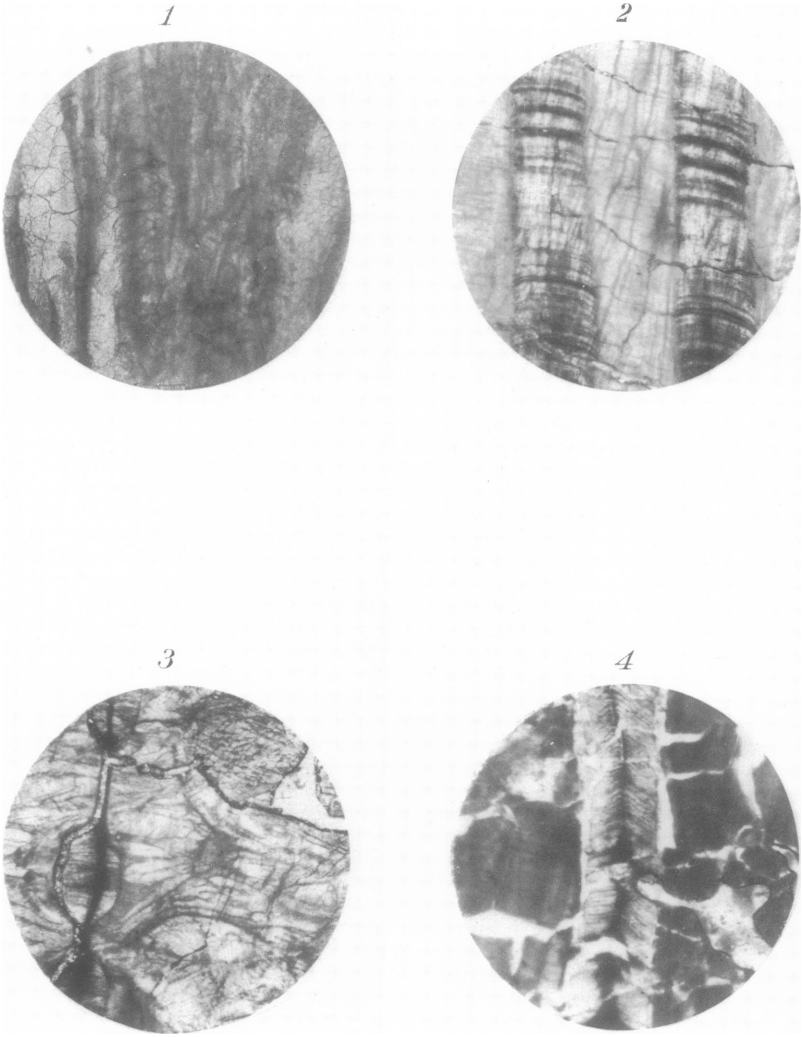
[Sections about six diameters.]

Fig. 1.—A vertical section of the transverse wall between the quadrangular cells. The vertical lines are the more solid plates. The checked area at the left of the figure is calcite. The vertical plates are seen to bifurcate upward.

Fig. 2.—A section along the ray, showing two of the moniliform beads with the numerous transverse septa curving upward. The oblique vertical lines between them are the vertical plates of the walls dividing the cells.

Fig. 3.—A horizontal section showing three monillæ. The band across the center is the transverse wall dividing the quadrangular cells, and shows the pseudo-stellate grouping of the plates.

Fig. 4.—A vertical section of one of the monillæ at right angles to the direction of the rays, and shows the columellar arrangement of the septa in the center. The specimen is badly fractured, causing the white patches.



THIN SECTIONS OF
BARRETTIA MONILIFERA, Woodward.

Fig. 1.

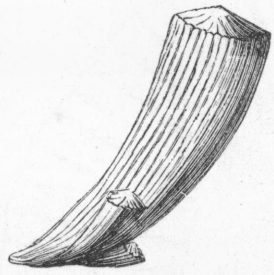


Fig. 3.

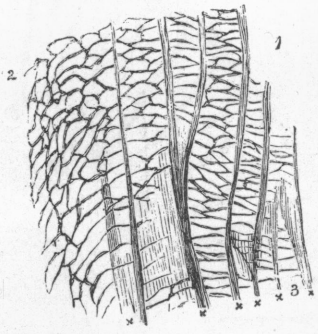


Fig. 2.

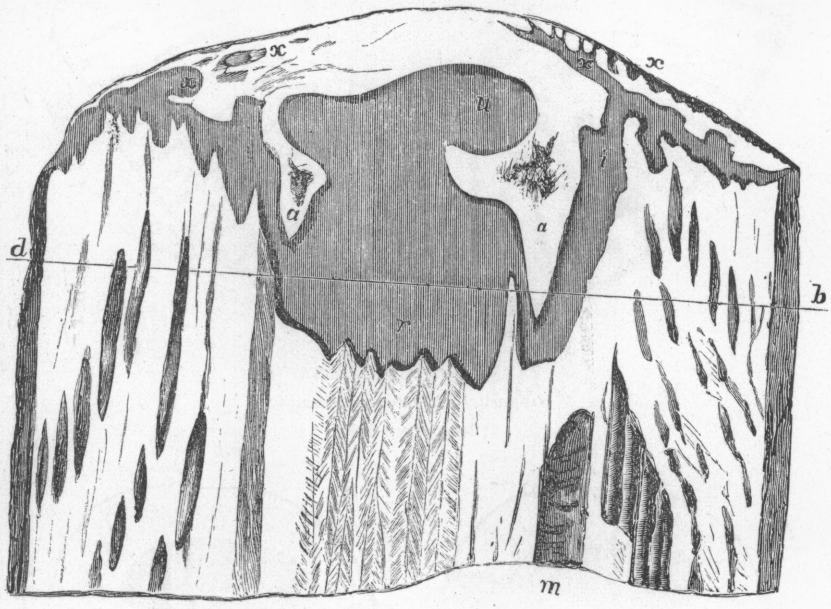
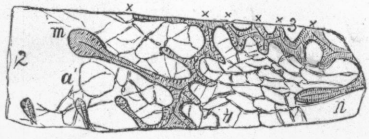


Fig. 4.



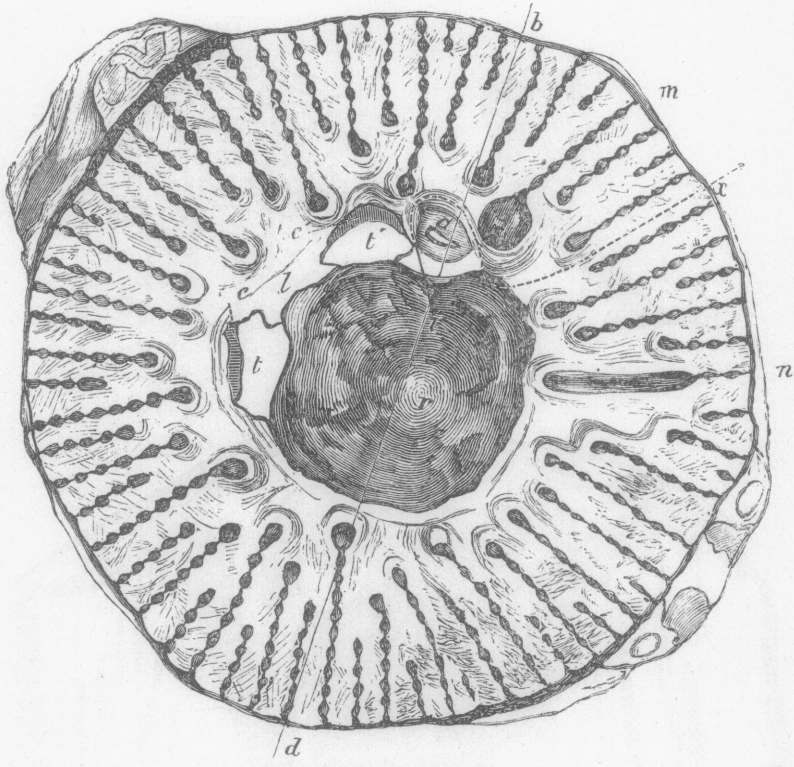
BARRETTIA MONILIFERA.

1. Reduced figure of a group of three individuals. 2. Longitudinal Section.
3. Tangential Section. 4. Transverse Section of Fig. 3..

REPRODUCTION OF WOODWARD'S PLATE XX.

(From 'The Geologist,' London, January, 1862.)

Fig. 5.

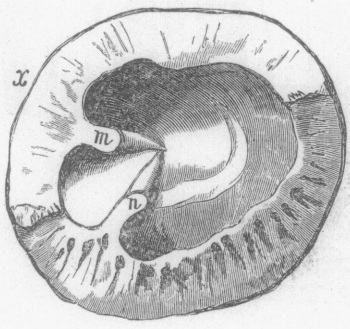


BARRETTIA MONILIFERA.

Hippurite Limestone, Jamaica.

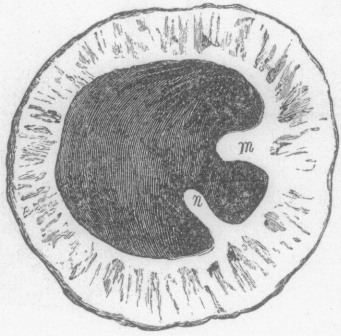
(Reduced one-fifth.)

Fig. 6.



Upper Valve.

Fig. 7.



Lower Valve.

INTERIORS OF HIPPURITE, ANGOULEME.

REPRODUCTION OF WOODWARD'S PLATE XXI.

(From 'The Geologist,' London, January, 1862.)

cardinal grooves of *Hippurites*, would be against a molluscan relationship. The growth of the ray-like features being from the margin inward is decidedly coral-like. The laterally compressed lacuna of one of the persistent rays closely resembles in all its features, as well as in its position, the fosset of a coral, and is decidedly unlike any molluscan feature; while the transversely septate feature of most of the cavities resemble peculiarities of the cup corals very closely. But the analogue of the round, persistent lacuna is not represented in any coral with which I am acquainted. Considering all these peculiarities I am much more inclined to consider them as pertaining to the Cœlenterates than to any form of the Mollusca.

More recently M. Douville has published in Memoir No. 6 of Vol. IV, Fasc. II, Geol. Soc. France, some studies of the Rudistæ, in which he has considered the genus *Barrettia* in connection with *Peronea* and *Batolites*. He seems to consider the rays of *Barrettia* as reduplications of the mantle of a mollusc, as Mr. Woodward did, and the moniliform tubes as analogous to the respiratory tubes in *Hippurites*, classing the three genera as a separate section of the Rudistæ. In *Peronea* there are a number of infoldings of the test, which, in a transverse section, have a strong resemblance to the rays in *Barrettia*, but so far as I can ascertain from his figures and description there is no structure in these infoldings resembling the moniliform bodies in the rays of *Barrettia*. In his figures of *Batolites* there are shown, in sections, features resembling these rays, penetrating the shell outside of the central cavity, which may possibly be similar in their nature, but they are in the otherwise solid outside shell, while those in *Barrettia* are entirely inside of the outer cup. No structure is assigned to those of *Batolites* like that seen in the moniliform rays of *Barrettia*. There can be no feature resembling the quadrangular interradial cells of *Barrettia* in a body like *Batolites*; on the contrary, the living surface of the valve shows the ordinary polygonal, reticulated, pitted surface, characteristic of the fibrous structure of *Caprotina* and other genera of the true Rudistidæ. All the features shown by the two genera mentioned above are such as might readily pertain to a mollusc, but those which we have shown to exist in *Barrettia* are entirely incom-

patible with the growth of a molluscan body, and are allied to those of cup corals. I think it very probable that had M. Douville seen all the features of *Barrettia*, instead of only Mr. Woodward's figures and description, he would have arrived at very different conclusions.

DESCRIPTIONS OF NEW SPECIES.

Barrettia multilirata, n. sp.

PLATES XXXIII, XXXIV AND XXXV.

Body more slender than that of *B. monilifera* Woodward, being pointed below and cylindrical above, usually slightly curved; the largest one observed having a diameter of six to six and a half inches (15 to 16 centimeters) on a specimen measuring about 14 inches in length (35½ cm.). In this specimen, about two inches from the top, at the point where the figure is cut off, or in the section photographed, there can be counted 125 rays on the outer margin, about 46 of which appear to reach the margin of the central cavity as seen in the section. Moniliform tubes rather small, but the ray material quite distinct. Interradial cavities small, appearing crowded and contracted, especially near the points where new or intercalated rays appear and toward the outer margin of the specimen. Transverse septa of the interradial cells flat or slightly concave, very irregular in their distances from each other. Septa of the moniliform tubes very numerous. Fosset-like body three-fourths as long as the distance between the margin of the central cavity and the outer border of the specimen, as seen on the section, and readily recognizable. Cylindrical tube oval in transverse section, large.

The distinction between this form and *B. monilifera* is in its more slender form, more numerous rays and more crowded interradial cells. In *B. monilifera* Mr. Woodward gives sixty-five rays in a specimen of five inches diameter; while here there are about double that number in one six inches in diameter, forty-six of which appear to reach within a little more than an inch of the center of the disc, or to what appears to have been the margin of the visceral cavity at that point.

From the Cretaceous limestone at Orange Cove, Hanover Parish, Jamaica, W. I., with *B. monilifera.*

Barrettia sparcilirata, n. sp.

PLATES XXXVI AND XXXVII.

Body cylindrical or turbinate, pointed below, and differing from the typical forms of *B. monilifera* in the fewer number of rays or divisions, but similarly constructed in other respects. In this form, an example very distinctly marked and measuring five or six inches in diameter, possesses only twenty-three rays on the outer margin ; several of these being only slightly indicated on the surface and extending inward scarcely enough to be detected on the cut surface. Some of the interradial spaces are over an inch in width on the outer surface. The septa within these spaces are concave, sometimes deeply so, at others shallow, and many of them are interrupted and somewhat irregular. The moniliform lines, as seen on the cut surface of the specimen, are quite irregular in their direction from the margin of the body cavity at the point at which the section was made (three inches from the top), the one representing the septate cylindrical tube being comparatively small and laterally compressed, instead of pear-shaped or round as in *B. monilifera*. The fosset-like body has been crushed and broken down, but seems to have been very much the same in general characters as in the other species.

A second specimen which I have referred to this species is abruptly turbinate, attaining, in a length of about eight inches, a diameter of five by seven inches, and showing evidences on the outer surface of about thirty rays at the top ; while seven or eight only can be determined at the present lower end, which is imperfect. The rays of moniliform tubes are quite distinct over most of the upper surface of this specimen, as also in the first or originating larger lacunæ. The one representing the septate tube is long, pear-shaped, but the fosset-like body cannot be determined satisfactorily. A line, however, which may represent it is seen, but at about one-fourth of the circle removed from the septate lucunæ, which is much further than in any other individual of the genus examined.

On this individual there occurs what is probably the only remains of the true external surface seen on any of the entire suite of specimens. This is probably owing to the protection afforded by the attachment of an oyster which coats this part of the body. The substance consists of a series of fine columns, arranged

longitudinally on the organism, divided by finer transverse partitions, four to six of which equal the width of one of the vertical columns.

This form has only been recognized in Cretaceous limestones at Logie Green, in the northeastern part of Clarendon Parish, Jamaica, W. I.