

Article XII.—DESCRIPTIONS OF SPECIES OF RUDI-
STÆ FROM THE CRETACEOUS ROCKS OF
JAMAICA, W. I., COLLECTED AND PRESENTED
BY MR. F. C. NICHOLAS.

By R. P. WHITFIELD.

PLATES VI-XXII.

The genus *Radiolites* Lamk. has long been known to occur in the Cretaceous rocks of Jamaica, W. I., but so far as I can ascertain none of the species found in the island have ever been described. They are particularly mentioned in the Geological Report of J. G. Sawkins, published in London in 1869; and in Appendix V to that report, Dr. Etheridge frequently refers to the forms of the Rudistidæ in the Cretaceous rocks in Jamaica, mentioning the different genera which occur, among which he places *Radiolites*, but gives no specific names, although several species occur. In the body of Prof. Sawkin's report *Radiolites* is frequently mentioned, as, for instance, on page 26, he says: "large radiolites very firmly imbedded, some indicating a length of seven feet." In almost every reference to the Cretaceous limestones of the island, the Hippuritidæ are mentioned, of which *Radiolites* appears to be the principal form, so far as can be ascertained from recent collections made there. Among the larger forms of *Radiolites*, and in fact the only very large one which I have seen, is that described below as *Radiolites nicholasi*, but I do not think it is a form that ever occurs of so great a length as six or seven feet, but is rather short and broad. Still it is the largest of any of the true Rudistidæ that I have seen from Jamaica. There is another form, *Barrettia*, described by S. P. Woodward, of London, as a form of Rudistidæ which may have reached a length of seven feet. But there is much doubt as to its true relations with the Rudistæ. In another paper, already prepared, I have discussed these relations, and illustrated several features of the genus not observed by Mr. Woodward.

Radiolites (*Lapeirousia*¹) *nicholasi*, n. sp.

PLATES VI-IX, ALL FIGURES.

Shell large and ponderous when fully grown, in some cases attaining a diameter of fifteen by eighteen inches, with a length probably somewhat greater. Lower valve rapidly and broadly spreading upward from a basal or apical attachment, becoming deeply lobed on the back or cardinal (?) side, so that the top presents a somewhat reniform outline. On the back, or unsymmetrical side, there is a broad band, resembling the ligamental band of *Spondylus*, which in some of the smaller individuals is concave, but in the larger ones is convex, and separated from the other parts of the valve by a deep, sharp groove on each side, indicating the presence on the interior of the valve of a pair of crests or ridges, the feature upon which the genus *Lapeirousia* was established, but the evidences of the ridges are difficult to obtain. On one specimen, in which I have been enabled to take the upper valve out from its place in the lower valve, there occurs one narrow projecting ridge, while in place of what might represent the other, there appears a broad plate of a secondary deposit, on the inner face of the visceral cavity, that extends nearly or quite three inches around the inside of the cavity, deposited on the inside of the inner fibrous layer, and opposed to the denticulated horizontal process of the upper valve. The one narrow projecting ridge is simply a projection of this broad plate, and lies within the smaller cavity bordering the denticulated process. On the upper surface the broad spreading lamellæ are covered by the radiating vascular furrows, and the margin of the valve on the exterior is strongly and coarsely lamellar. Visceral cavity varying from one-fourth to two-fifths of the entire diameter of the valve, but situated quite near the cardinal band on the back; while the lateral lobes of the shell protrude, leaving the cardinal band deeply imbedded, resulting from the narrowing of the spreading lamellæ, as on this side their width is only an inch, or

¹ Bayle: Explication de la carte géol. de France, vol. IV, Atlas, pl. 110 et 111 (Zittel., Paléont., Vol. II, p. 87. French ed., 1887.)

sometimes two inches ; while on the opposite side or front they may be six or ten inches in extent.

Upper valve convex, of but slightly greater diameter than the visceral cavity, so that it extends beyond its edge but little more than half an inch. On the inner face the upper valve is characterized by one deep, rather large, thickened process, projecting from the inside of the valve in front and along the left side for two-thirds of the length of the valve, as it is held with the cardinal band from one, and is divided into three tubercular prominences or ridges. On the back, toward the position of the cardinal band, a horizontal plate or process of a triangular form, connected with the body of the valve by a narrowed neck, spreads out to the broad vertical plate and cardinal ridge of the lower valve, which it reaches with the numerous denticulations which arm its end, or into which the process is divided. This form of the horizontal plate leaves a small cavity on the left side, and a much larger, deeper cavity on its right, which appear to unite between the process and the inner surface of the valve, above the process. Into the smaller cavity the projecting ridge of the lower valve enters, while the body of the plate of which it is a part extends around the back of the visceral cavity, and is apparently of a secondary deposit within the fibrous lining of the cavity, and occupies the position of the projecting process formed by the upholding of the mantle at the sides of the cardinal band.

Substance of the lower valve finely and distinctly lamellar, the lamellæ counting as many as twelve or fifteen in the space of 9 mm., and the surface of each lamella being very finely granular as well as being traversed by the vascular furrows common to this group. There is also the fine columnar or prismatic vertical structure, very distinctly seen, which pertains to this group of shells, and which presents on the surface of the lamellæ, under certain conditions, an extremely fine polygonal network of meshes.

The upper valve is circular or ovoid in outline, but somewhat truncate on the back, and in some cases shows evidence of having had low, shallow, radiating ribs. The substance is very thick and dense, the outer layer very finely laminated and thin in proportion to the inner layer, which is porcellanous.

Formations and localities.—In the Cretaceous limestone near Logie Green, Clarendon Parish, and at Green Island or Haughton Hall, Hanover Parish, Jamaica, W. I. The latter locality is that from which the peculiar form *Barrettia* is abundantly obtained, and at which the two forms are associated in the same beds. The locality from which Mr. Woodward's specimen of *Barrettia* was obtained by Mr. Lucus Barrett, F.G.S., and former Director of the Geological Survey of the British West Indies, was in Portland Parish, eastern Jamaica, at almost the other extreme of the island.

Radiolites adhærens, n. sp.

PLATES X, XI, XII.

Shell adherent, single or in clusters, closely appressed to foreign bodies and conforming to their shape in growth; three to five inches long and two or more inches in transverse diameter. Externally marked by several broad longitudinal ribs or ridges on the lower valve, which are themselves usually marked by smaller ridges, the channels between the larger ones often moderately deep and of varying width; ridges strongly rugose, from numerous transverse lines parallel to the upper margin of the valve. Upper valve extending to the margin of the lower and forming tongue-like projections at the ridges of the lower, more or less conical in shape with a nearly central apex, and also marked by numerous radiating ridges which are low and rounded. This is the feature of what is supposed to be a mature specimen; while on some young specimens which form a group of fourteen individuals of various sizes, the upper valve is small and button-like, only extending to the edge of the visceral cavity, slightly convex on the surface with a subcentral apex and rather strong radiating ribs, which curve somewhat in their direction toward the margins. The apex is situated nearest to the cardinal or hinge margin, which is, in all cases, seen on the opposite side from that by which the valve is attached to any foreign substance.

The peculiar feature of this species lies in its attachment to foreign bodies, as it often spreads over a considerable area, throwing out the broad expansions over such bodies, coating them for considerable distance and filling up the irregularities of their surfaces with the spreading lamellæ of the lower valve; while on the opposite side of the shell it will be only of moderate thickness, often of not more than a fourth of an inch, and the exterior will give no indication of the lamellose structure, except the ordinary

lines of growth. The lamellæ of the lower valve are very thin and the substance compact as compared with those of *R. nicholasi*, and the vertical lines which give the columnar structure are practically invisible except on very close inspection with a good glass. The upper valve structure is much more compact than that of the lower, and quite flaky.

This species bears considerable resemblance in its general appearance to *Radiolites squamosus* d'Orb., as figured in his Pal. Française, Cretaceous, pl. 561, only that it is so much more recumbent on the substance to which it is attached, and in the fewer and broader longitudinal ridges of the surface, which are also less rugose.

Formation and locality.—This species is from the Cretaceous at Logie Green, Jamaica, W. I.

Radiolites rudis, n. sp.

PLATE XI, FIG. I.

Shell small, the only specimen present in the collection being about three inches high, and its greatest diameter less than two inches; form irregular and very rugose, the lamellæ projecting in irregular folds which correspond to deep notches in the lip of the lower valve, the principal folds being to the right of what appears to be the hinge side of the shell, when that side is held towards one. The horizontal spreading lamellæ are very fine or thin, and vary much in their degree of extension, giving the rudely irregular outline to the lower valve. Vertical pillars of the lamellæ rather strong and distant. Upper valve as large as the border of the cup of the lower, highly round-conical in form, the margin fitting into the notches of the folds of the lower valve. The surface of the upper valve is obscured by adhering substances, but when visible is cancellated by two sets of lines, one concentric, the other radial.

This species presents somewhat the general appearance of *Radiolites* (*Sphærolites*) *leymeri* Bayle, as received in a collection from Prof. Zittel, but is somewhat more spreading, with larger vertical folds and proportionally larger upper valve.

Formation and locality.—In the Cretaceous Beds at Logie Green, Jamaica, W. I.

Radiolites cancellatus, n. sp.

PLATES XII AND XIII.

Shell rather small, the largest one referred to this species being about two and a half inches high, by two inches in its greatest transverse diameter, at the top. General form of the lower valve rather moderately spreading from the basal attachment, and slightly curved, flattened on the back or outer curvature, which apparently represents the cardinal bands of other species, and faintly marked by two indistinct longitudinal depressed lines; lateral edges of the lower valve sharply rounded and the front broadly rounded; marked by about five strong longitudinal plications. Upper valve extending to the margin of the lower, moderately convex with a nearly or quite marginal apex, low and inconspicuous; also by low rounded plications corresponding to those of the lower valve but less distinctly marked. Surface of shell marked by strong lamellose ridges of growth, transverse to the plications and strongly undulating across them; also by wire-like, raised, longitudinal lines which cancellate the entire shell except the flattened space on the outer curvature.

The flattened space on the outer side of the larger of the two specimens of this species occupies about two-thirds of the width of the lower valve, and gives it a somewhat *Calceola*-like aspect. It is very faintly marked by the two longitudinal lines which represent the "cardinal bands" of other species. On the smaller of the two the flattening is less marked, and one of the vertical lines is more strongly marked, while the curvature of the shell is not only greater than that of the larger one, but it is also twisted, and in its general form and appearance bears considerable resemblance to the figures of *Caprotina trilobata* d'Orb., Pal. Franç., Cretaceous, pl. 582. This appearance also appertains to the surface structure in its cancellations and in the appearance and form of the upper valve. I cannot, however, think that it is specifically distinct from the larger one, which is undoubtedly a true *Radiolites*.

Formation and locality.—In the Cretaceous limestone at Logie Green, Clarendon Parish, Jamaica, W. I.

Radiolites macroplicatus, n. sp.

PLATES XII AND XIII.

Shell attaining a considerable size, the largest one present in the collection having a length of a little more than six inches by a transverse diameter at the top of the cup of the lower valve of four and three-fourth inches, with the

lower extremity imperfect. Form obconical, moderately spreading upward and slightly curved. Upper valve low, conical, extending to the entire size of the lower valve; apex subcentral or much nearer to one side than the other. On the larger one mentioned, the apex is nearly one-third of the width of the valve from the side forming the back or outside of the curvature of the lower valve. Entire surface of both valves marked by coarse, angular, and very rudely lamellose, radiating or vertical plications, fifteen in number on the largest specimen, and thirteen in a much smaller one. The lamellæ are very coarse and strongly undulated in crossing the vertical ridges, producing a distinctly zigzag marking on the ridges. The fine horizontal plates or lamellæ of the microscopic structure of the lower valve number from eight to ten in the space of 3 mm., and the columnar or vertical plates or cells will average nine in the same distance.

This species belongs to an entirely distinct group of *Radiolites* from those with broad spreading lamella, like *R. crateriformis* d'Orb. and *R. nicholasi* herein described, in which the upper valves are small in comparison to the diameter of the lower, and the lower valve shows no evidence of the cardinal plates on the irregular or unsymmetrical side as does *R. nicholasi*.

Formation and locality.—In the Cretaceous limestones at Logie Green, Clarendon Parish, Jamaica, W. I.

Radiolites annulosus, n. sp.

PLATE XIV, FIG. 3.

Shell of moderate size, narrowly turbate in general form, with a moderately conical upper valve; extreme height of the shell about four and a half inches, and the greatest width less than two and a half inches. Lower valve marked with numerous regular, rather closely arranged, concentric, varix-like annulations, of which there are about seven or eight in the space of an inch; these are crossed by vertical lines which are formed by the lines constituting the columnar structure of the lower valve. Under a glass the vascular lamellæ are seen to be extremely fine and closely arranged, and when ground down the lamellæ are seen to be grouped into bands of finer and coarser sets to form the concentric varix-like annulations.

The surface of the only specimen of this species present in the collection is somewhat decomposed, especially that of the upper valve, so much so that the external features of this part are entirely destroyed, but not sufficient to give an entire mould of

the interior, still too much to serve for a lucid description of its characters. On the back of the lower valve, by cutting away the clay from under the upper one, the single infolding of the shell of the lower valve at this point is clearly seen.

Formation and locality.—In the Cretaceous limestones near Christianna, Manchester Parish, Jamaica, W. I.

Caprina jamaicensis, n. sp.

PLATE XIII, FIGS. 1 & 2, AND PLATE XV.

Shell large and ponderous, having a diameter across the top of the lower valve of eight inches. Lower valve very oblique, broadly spreading and very much curved, shortest on the hinge side; its substance quite thick and strongly marked by irregular concentric ridges or growth lines. Upper valve thin, smooth or with microscopic lines on the exterior; beak large, incurved and overhanging the cardinal side of the lower valve. Within, the shell of this valve is marked by fine, thread-like grooves radiating from the apex.

The above description is of an adult specimen, badly crushed and distorted, and having the basal portion of the lower valve broken away, and one entire side crushed in so as to nearly destroy the original contour. A small shell, having its broadest diameter one and three-fourth inches, is oval in outline on the upper valve, with the apex of that valve only slightly enrolled; but of this one the lower valve is crushed and compressed so as to obscure the original form. A second upper valve, of nearly the same size as the last, has the same general form and character, being thin and semitranslucent, with the radiating lines of the interior showing through its substance. But all the specimens, like all these large forms, are much crushed and broken, as if by some convulsive movement of the imbedding material, probably resulting from some of the earthquake movements common among the West India Islands.

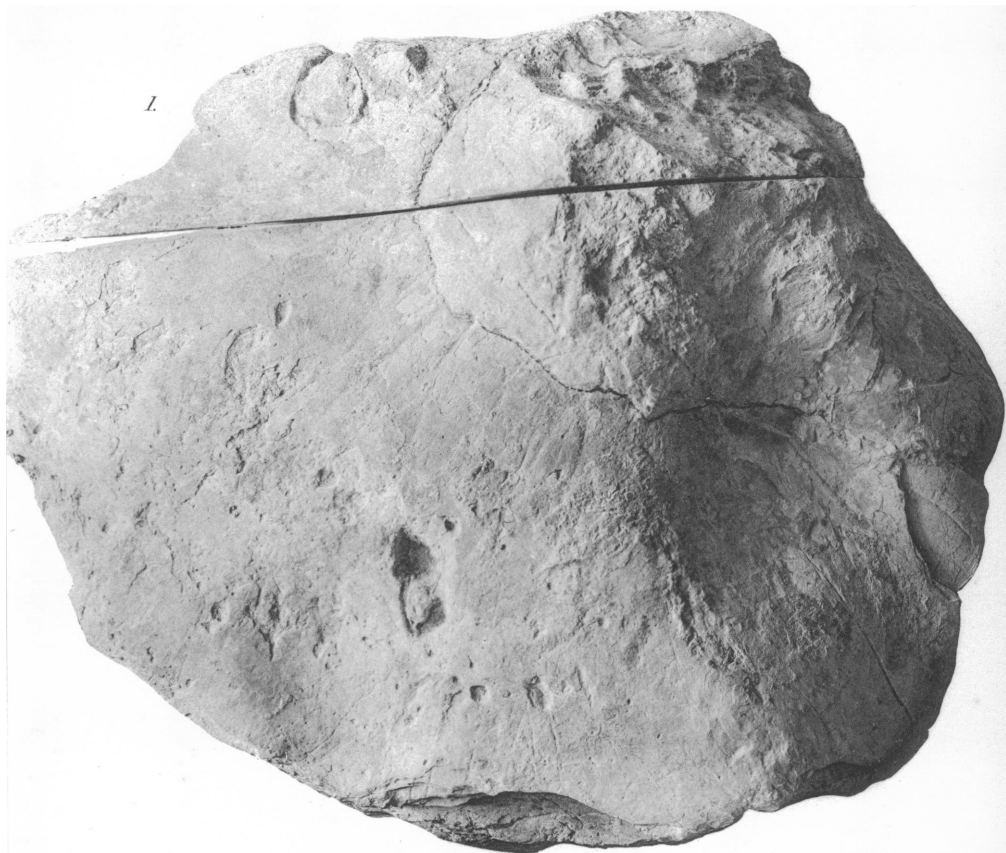
Formation and locality.—In the Cretaceous limestone at Logie Green, Clarendon Parish, Jamaica, W. I.

EXPLANATION OF PLATE VI.

Radiolites nicholasi Whitf.

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- Fig. 1.—View of the summit of a large individual retaining the upper valve in place. The specimen was cut through on the line shown to give the section on Plate VII, Fig. 1. Figure reduced to nearly one-third natural size.
- Fig. 2.—View of the surface of a fragment, reduced to one-half natural size, showing the ramifications of the vascular lines, and a section of the visceral cavity.



RADIOLITES, (LAPEIROUSIA) NICHOLASI, Whitf.

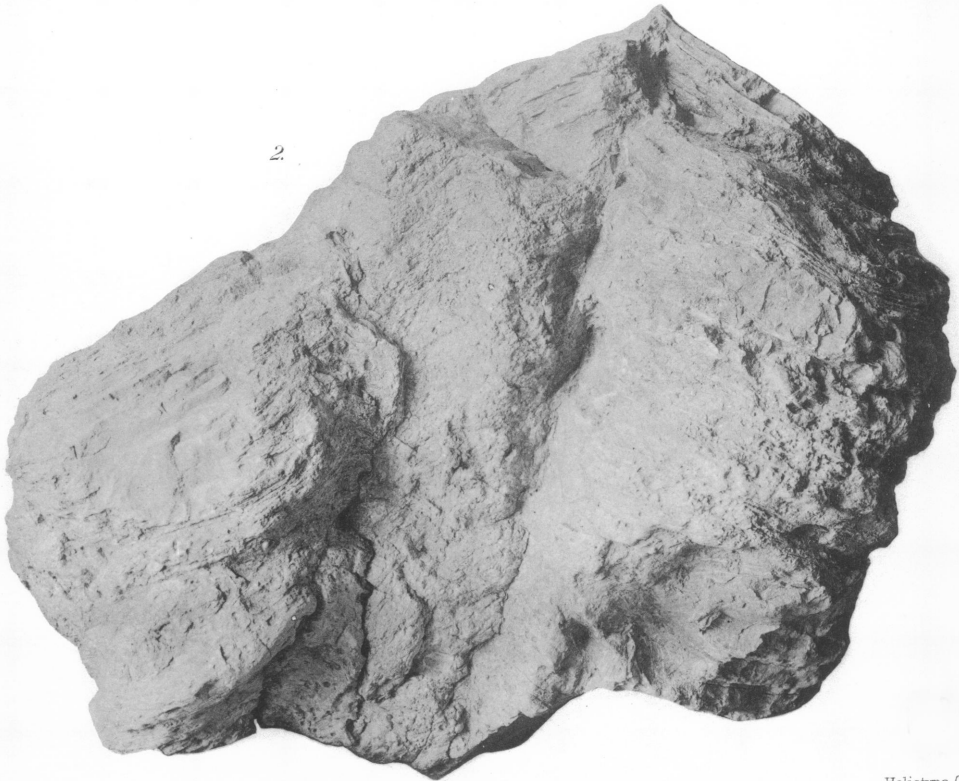
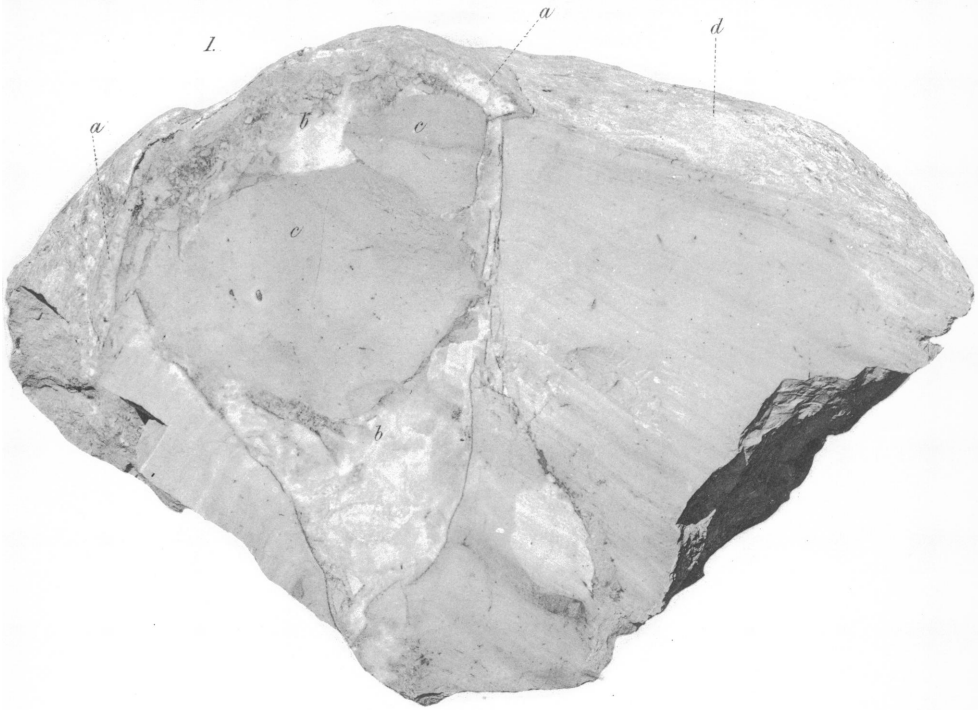
EXPLANATION OF PLATE VII.

Radiolites nicholasi Whitf.

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Fig. 1.—View of a section of the specimen shown on Plate VI, Fig. 1. *a, a*, indicates the upper valve where cut through; *b, b*, calcareous filling of the visceral cavity; *c, c*, fragments of limestone in the cavity; and *d*, the upper surface of the expanding lamella of the lower valve.

Fig. 2.—View of the back or cardinal side of an example measuring eighteen inches across. The central depressed area is that corresponding to the hinge area, or ligamental area.



RADIOLITES, (LAPEIROUSIA) NICHOLASI, Whitf.

EXPLANATION OF PLATE VIII.

Radiolites nicholasi Whitf.

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Fig. 1 —View of a specimen retaining a part of a lower valve with the upper valve in place. The latter has been cleaned out and shows the interior surface, with the walls of the visceral cavity of the lower valve on the upper side. The figure is three-quarters natural size. The view is of the inside of the upper valve which is turned upside down.



*Dorsal view of (1) *Aspidonotus* (Miroulet) White*

Halotype

EXPLANATION OF PLATE IX.

Radiolites nicholasi Whitf.

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Fig. 1.—Lateral view of the upper valve shown on Plate VIII removed from the lower valve. Figure reduced to five-sevenths natural size.

Fig. 2.—View of the inner surface of the same, showing the projecting tubercles for muscular attachment; the denticulated, projecting process on the right end is seen fitting against the inner surface of a fragment of the lower valve, at *a*, still remaining attached to the valve.



RADIOLITES, (LAPEIROUSIA) NICHOLASI, Whitf.

EXPLANATION OF PLATE X.

Radiolites adhærens Whitf.

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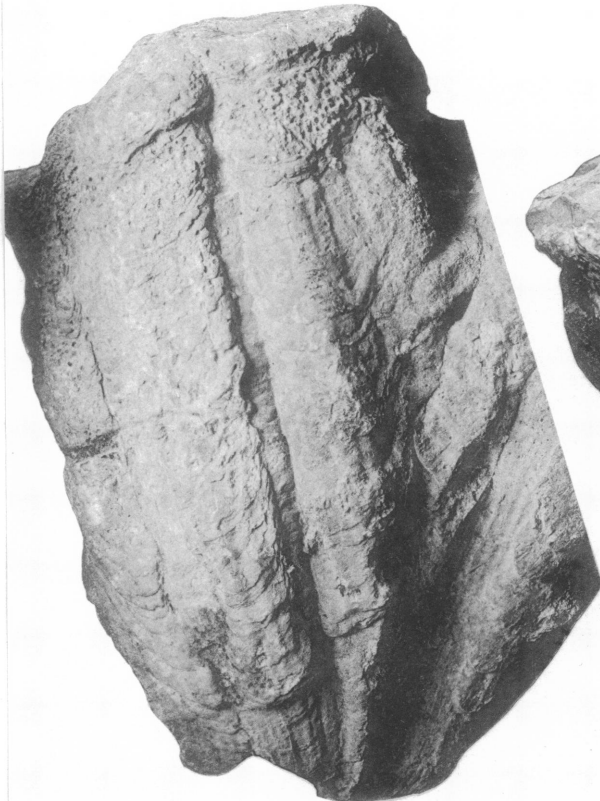
Fig. 1.—View of a specimen of *Caprinella occidentalis* with a group of small examples of *R. adhærens* attached to it. The group consists of twelve young individuals. Figure natural size.

Figs. 2 and 3.—Two views of a large specimen which had grown with others on a valve of *Caprinella occidentalis*. Figures natural size.

1.



2.



3.



RADIOLITES ADHERENS Whitf.

EXPLANATION OF PLATE XI.

Radiolites adhærens Whitf.

Page 188.

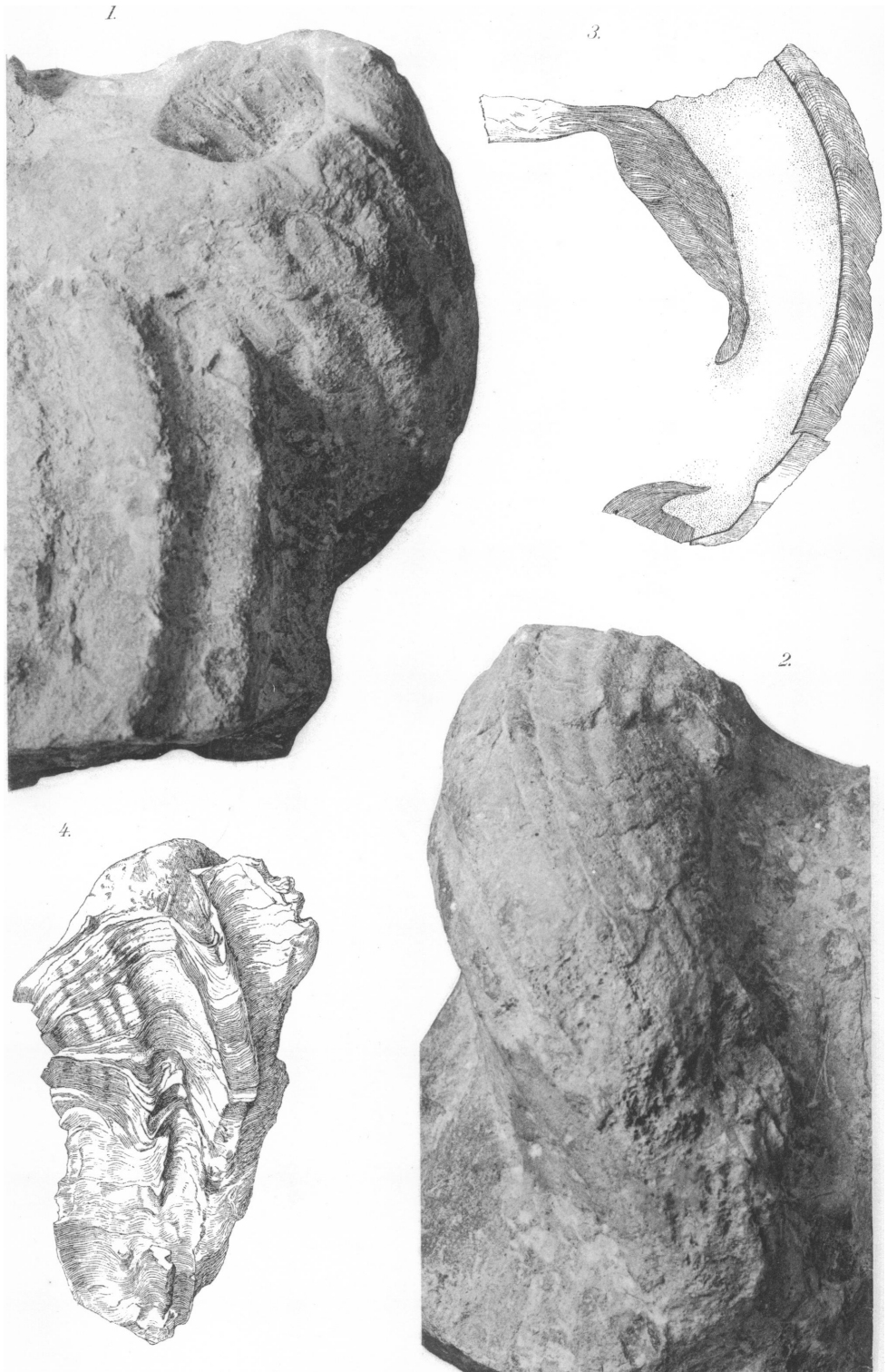
Figs. 1 and 2.—Views, natural size, of a medium-sized specimen attached to *Caprinella occidentalis*, and showing the visceral cavity seen in Fig. 1, while Fig. 2 shows the back of the specimen.

Fig. 3.—A longitudinal section, natural size, of a specimen of this species, showing the depth of the central cavity and the direction of the lamellæ.

Radiolites rudis Whitf.

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Fig. 4.—View of the specimen described, natural size.



RADIOLITES ADHERENS AND R. RUDIS, Whitf.

EXPLANATION OF PLATE XII.

Radiolites adhærens Whitf. Page 188.

Fig. 1.—Another view, somewhat different, of the specimen figured on Plate X, Fig. 1.

Radiolites macroplicatus Whitf. Page 190.

Fig. 2.—Side view, two-thirds natural size, of a large, nearly perfect individual retaining the upper valve in place.

Fig. 3.—View, natural size, of two young specimens attached to a fragment of *Caprinella occidentalis*.

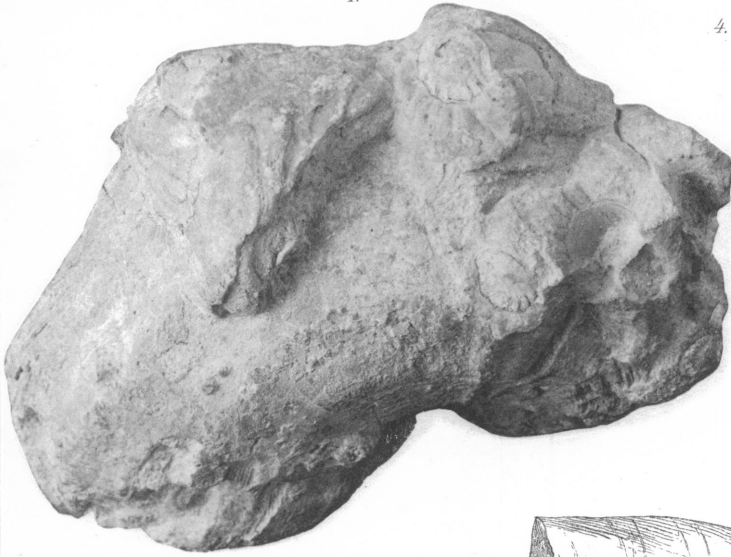
Radiolites cancellatus Whitf. Page 190.

Fig. 4.—Profile view, natural size, of the specimen figured on Plate XIII, Figs. 3-5.

Caprinella quadrangularis Whitf. Page 193.

Fig. 5.—View, natural size, of the apex of a lower valve of this species. See Plate XIV, Figs. 4 and 5, for other illustrations.

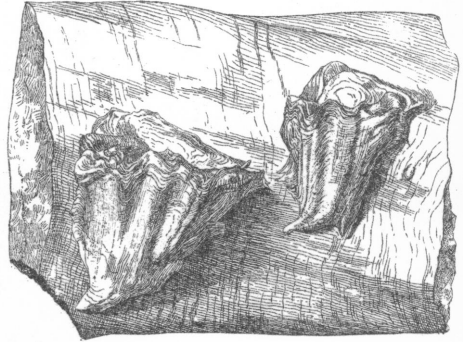
1.



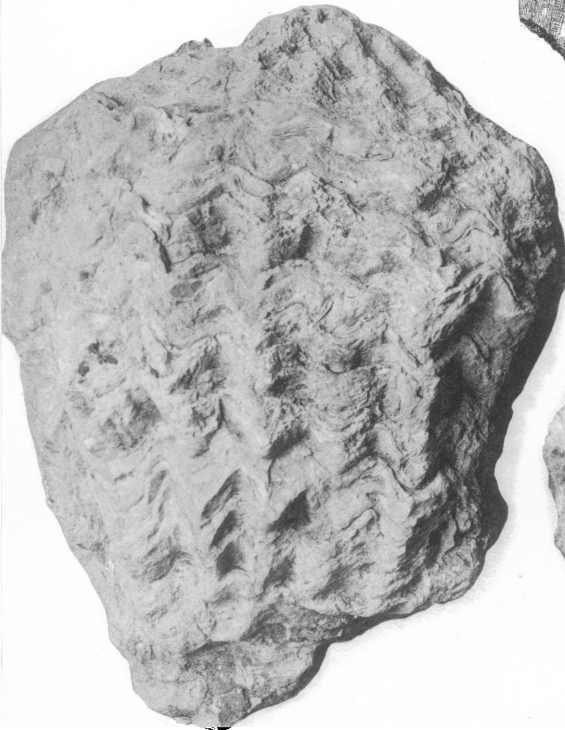
4.



3.



2.



5.



EXPLANATION OF PLATE XIII.

Caprina jamaicensis Whitf. Page 192.

Figs. 1 and 2.—Upper view showing the upper valve, and lateral view of what is thought to be a young shell of this species. Natural size.

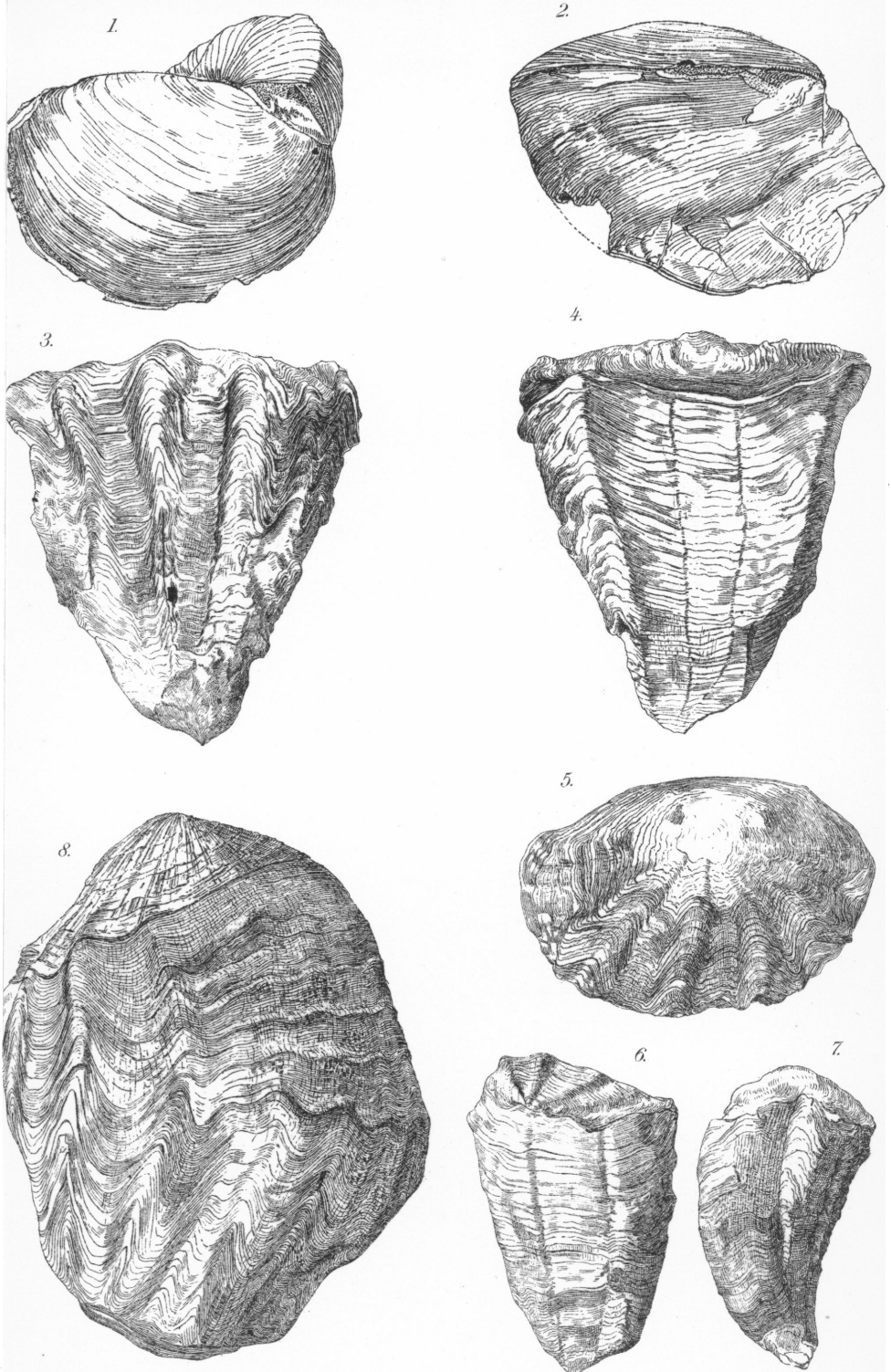
Radiolites cancellatus Whitf. Page 190.

Figs. 3, 4 and 5.—Front, back and top views of the largest, nearly perfect individual obtained.

Figs. 6 and 7.—Back, or cardinal, and lateral views of a smaller shell, referred to the same species.

Radiolites macroplicatus Whitf. Page 190.

Fig. 8.—View, natural size, of a small imperfect shell of this species, retaining only the cast of the upper valve, and showing irregularities of growth in the lower valve.



EXPLANATION OF PLATE XIV.

Radiolites macroplicatus Whitf. Page 190.

Fig. 1.—View, natural size, of a section of a small individual of this species, showing the upper valve in place, and also the lamellæ of both valves.

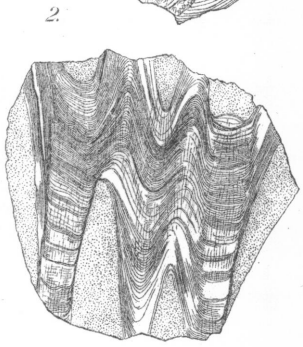
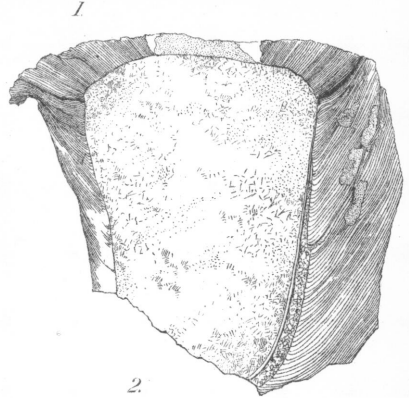
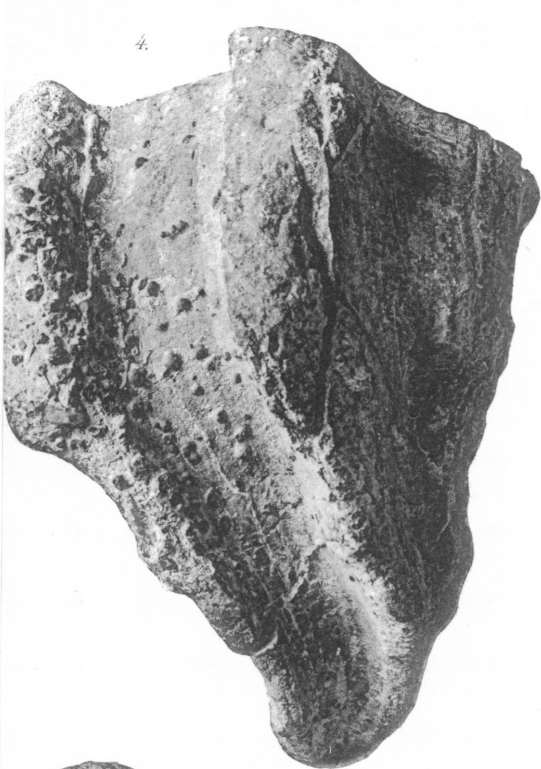
Fig. 2.—View of the back of the same specimen ground off to show the lamellæ and the vertical lines also.

Radiolites annulosus Whitf. Page 191.

Fig. 3.—Lateral view, natural size, of the specimen described. The upper valve has been nearly all removed by the solvent action of weathering, and shows the ridges of the muscular scars.

Caprinella quadrangularis Whitf. Page 193.

Figs. 4 and 5.—Back and lateral views, two-thirds natural size, of a lower valve of the species, showing the specific features. In the back view, one of the projecting flanges is broken away on the upper half. The shell is partly covered by numbers of a Nullipore, and in Fig. 5 may be seen a young shell of *R. adhærens* in section.



EXPLANATION OF PLATE XV.

Caprina jamaicensis Whitf.

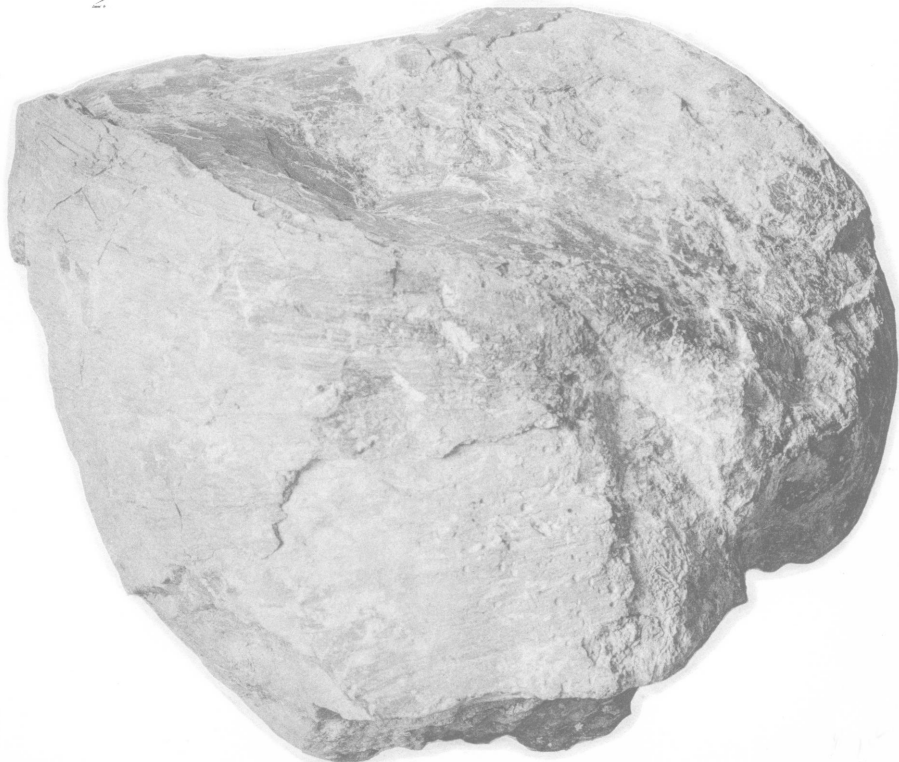
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Figs. 1 and 2.—Top view, showing the upper valve and a lateral view in which the lower valve is shown. This valve is imperfect in the lower part where it was broken from its attachment. The figures are half natural size.

1.



2.



CAPRINA JAMAICIENSIS, Whitf.

EXPLANATION OF PLATE XVI.

Caprinella occidentalis Whitf.

Page 193.

Figs. 1-4.—Views of upper valves showing various forms of coil. Fig. 1 shows the apex dextrally spiral ; Fig. 2 is symmetrically coiled and involute ; Fig. 3 has the apex slightly turned downward but not involute ; Fig. 4 is sinistrally coiled, and also shows the internal surface of the valve. These figures are all two-thirds natural size.



CAPRINELLA OCCIDENTALIS, Whitf.

Heliotype Co., Boston.

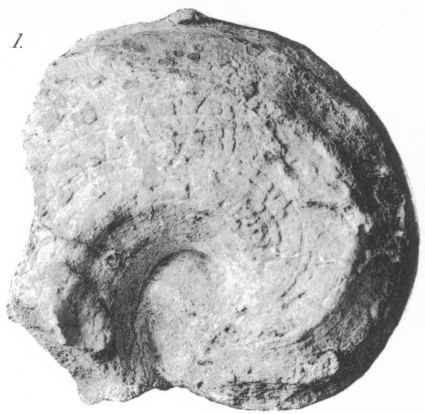
EXPLANATION OF PLATE XVII.

Caprinella occidentalis Whitf.

Page 193.

Fig. 1.—Side view of an upper valve showing a closely-involuted apex.
Reduced one-third.

Figs. 2-4.—Views of three lower valves presenting different forms. Figs.
2 and 4 are two-thirds natural size, and Fig. 3 is natural
size.



CAPRINELLA OCCIDENTALIS, Whitf.

Heliotype Co., Boston.

EXPLANATION OF PLATE XVIII.

Caprinula gigantea Whitf.

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Fig. 1.—Lateral view of what is supposed to be a fragment of an upper valve, reduced one-third in size. A large part of the back of the shell has been broken off, probably one-half the original width, exposing the inner surface of the large central cavities. The top of the specimen shows the openings and pits like those on the lower valve shown on Plate XX, Fig. 1.



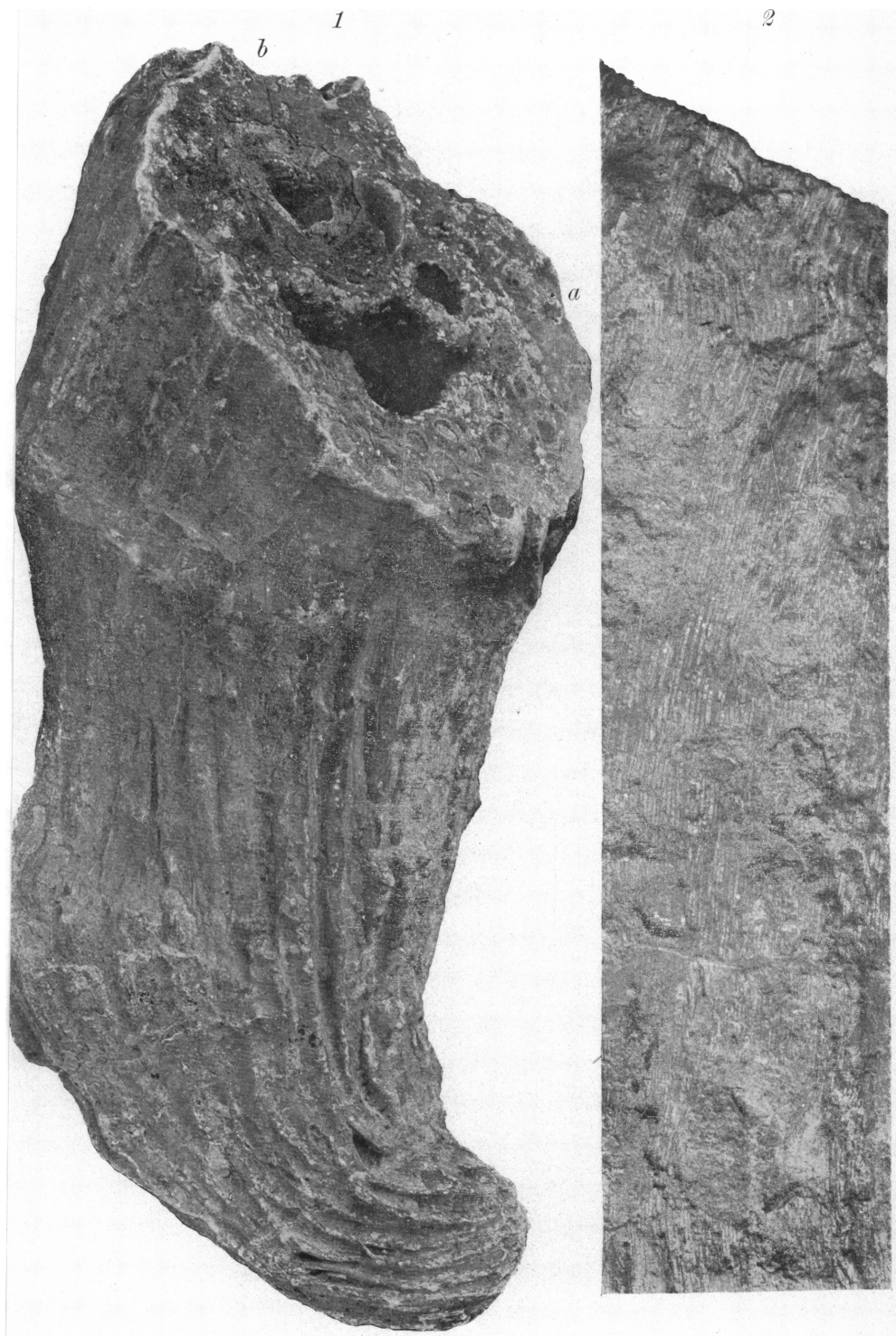
EXPLANATION OF PLATE XIX.

Caprinula gigantea Whitf.

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Fig. 1.—View, two-thirds natural size, of the apical portion of a lower valve which has been split longitudinally, retaining only the inner half of the shell. On the broken surface at the top it shows, at *b*, the large septate cavity, and at *a*, several of the longitudinal tubes which open upon the inner surface of the living chamber of the shell.

Fig. 2.—View, natural size, of a portion of the inner split surface of the specimen, the end of which is shown on Plate XXI, to show the capillary tubes which traverse the entire length of the valve.



EXPLANATION OF PLATE XX.

Caprinula gigantea Whitf.

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Fig. 1.—Shows the back of the same specimen figured on Plate XIX, reduced to the same extent, and illustrating the large cavities of the central portion of the valve. In the outer one there is the filling of one of the smaller tubes that penetrate the marginal portion of the valve.



EXPLANATION OF PLATE XXI.

Caprinula gigantea Whitf.

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Fig. 1.—View of a broken end of part of a lower valve, natural size, showing the large septate tube or chamber which traverses its length, and at *a, a*, two of the smaller tubes. Around the outer margin can be seen the small tubes spoken of in the description. All the intermediate substance is finely fibrous, and a strip of lower surface of this specimen is shown on Fig. 2, Plate XIX, natural size. The specimen has been split longitudinally near the middle and weathered so as to show this structure very finely.



EXPLANATION OF PLATE XXII.

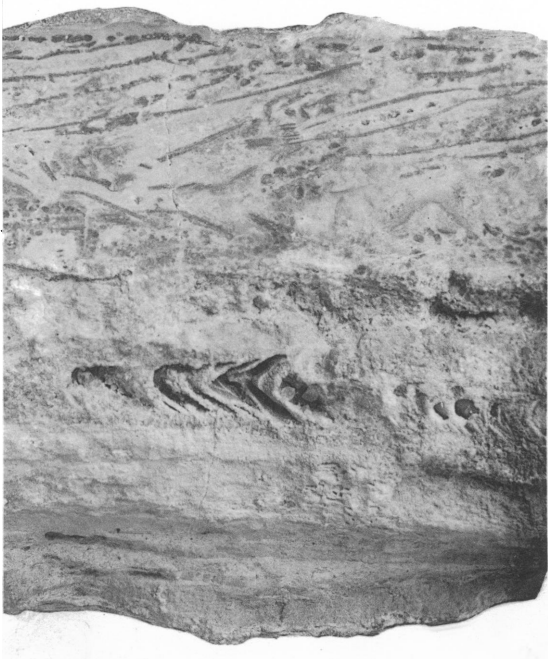
Caprinula gigantea Whitf.

Page 194.

Fig. 1.—View of a fragment, natural size, of a lower valve showing the surface of the interior imperfectly. The top of the figure shows the edge of the valve at *a*; at *b*, is seen the surface of one of the large vertical chambers, and over the rest of the surface many of the orifices of the smaller vertical tubes are shown, while the ends of the fibrous capillary structure may be recognized in the finely pitted surface caused by their concave ends.

Fig. 2.—View of a part of a specimen split longitudinally and weathered, showing the septa in one of the large central cavities. Along the lower edge of the figure is seen one of the smaller septate cavities.

Fig. 3.—View of a part of a split specimen, showing the septa of a large cavity and also those of one of the smaller ones, the two having the same relations to each other as those in Fig. 2 above it. These figures are all from photographs, natural size.



Caprinella quadrangularis, n. sp.

PLATES XII AND XIV.

Shell known only by the lower valve, which, in all the cases seen, is rudely quadrangular and twisted, so as to present about one-fourth of a turn in the length of a shell. Valve rapidly expanded from the apex, which was the point of attachment, and marked by numerous longitudinal ribs or costæ, which vary in size from 1 mm. in width to three or more centimeters, some of them often becoming broad, projecting, flange-like expansions, which produce the quadrangular outline when seen in a transverse section. The intermediate ribs may become obsolete and leave comparatively smooth spaces on the exterior of the cup. Upper valve and interior unknown.

This species is readily distinguished by the greater size of the longitudinal capillary tubes, of which the outer part of the shell is composed, as they are often fully one, and not uncommonly 2 mm. in diameter, whereas those of the other species are generally not much more than half of one mm. in diameter.

Formation and locality.—In the Cretaceous limestones at Christianna, Manchester Parish, Jamaica, W. I.

Caprinella occidentalis, n. sp.

PLATES XVI AND XVII.

Shell of moderate size and very inequivalve, the lower valve long, straight, slightly enrolled, twisted or loosely spiral like a corkscrew, smooth, ribbed, or slightly channeled on the exterior surface, and gradually expanding from the apex outward. Upper valve coiled and generally more or less involute, often closely so and nearly symmetrical, the exterior surface being nearly smooth or with spiral ridges extending from the apex to the border of the valve; the ridges, from five to ten in number, are elevated and distinct, rounded or sub-obsolete.

Interiorly the substance of both valves is made up of fine longitudinal tubes, which are divided transversely at distances about equal to their own diameter by horizontal septa, very like those of the palæozoic coral *Favosites*, giving to the weathered shell a strongly fibrous structure. A large central cavity traverses the entire length of the lower valve subcentrally, which is strongly and distantly septate by very oblique, curved septa. The upper valve is also traversed by a central cavity in which the septa are very irregular, very much more oblique, and generally much more delicate in texture than those of the lower; some of them appear

to extend into the central cavity as free lamellæ before cutting off the cavity from the space below.

The internal surface of the valves shows the ends of the capillary tubes, or rather the surface of the transverse diaphragms or septa, and the tubes seem to be pretty generally hexagonal in form, although varying in size. The surface of the upper valve presents the large, rather deep oblique central cavity, a large, somewhat flabellate muscular scar with a broad shallow depression to the right of it, also flabellate, as well as a large, abrupt, irregular marginal depression. The detail of the interior of the surface of the lower valve has not been observed in full, but it appears somewhat similar to that of the upper.

The fibrous appearance dependent on the existence of the capillary tubes depends to a considerable extent on the presence of the outer layer of these tubes, which if septate at all, are only distantly so, and they are also much wider in a radial direction of the body than in a concentric direction, so that in a transverse section of a shell the tubes of a marginal range are elongate-oval radially; while the others in the outer layer are polygonal and of various sizes, as well as pretty closely septate.

Formation and locality.—In the Cretaceous limestones at Logie Green, Clarendon Parish, and near Christianna and elsewhere in Manchester Parish, Jamaica, W. I.

Caprinula gigantea, n. sp.

PLATES XVIII, XIX, XX, XXI AND XXII.

The genus *Caprinula* of D'Orbigny is represented in the collection by a large number of fragments of a gigantic species, which must have been several feet in length, judging from the size of some of the larger fragments, one of which indicates a diameter of twelve inches (30 cm.), if the shell was elliptical in a transverse section, but if it was round it must have been at least sixteen inches (about 40 cm.) in diameter. The specimens are curved apparently in a plane. Some of the apical portions where the length, measuring along the outer curvature, will be about twenty inches, represent about one-half of one revolution. The shells are strongly ribbed longitudinally on these sharply-curved individuals, which would indicate them to be the upper or smaller valves according to the generic description given by D'Orbigny, while the larger ones are straighter,

sometimes almost straight, with a comparatively smooth exterior, or with a few longitudinal ribs on the inner curvature, and also distant, broad, indistinct annulations marking the shell.

Interiorly the shell of the lower or straighter valve is traversed by a large subcentral cavity which is rudely septate, sometimes quite distantly so, and very oblique; at other times somewhat regularly and approximately septate, the septa less oblique. In one specimen there are two smaller cavities with funnel-shaped septa arranged at variable distances of a fourth of an inch or less, and not open at the points, so as to connect with each other. Besides these there are longitudinal tubes of various sizes, traversing the entire length of the shell and opening on the surface of the visceral cavity of the valve, so that the living surface of the shell is occupied by these openings from just within the border of the shell to within a short distance of the central cavities. In one part of one individual there are six ranges of these tubes visible side by side radially, varying from an eighth of an inch in diameter to half an inch, some round, some oval, and others irregular in shape; on other parts of the same specimen there are only one, two or three ranges, one within the other, but all very irregularly placed. In D'Orbigny's figure of the generic type, *Caprinula boissyi*, he shows four ranges of tubes, each varying in size from minute ones near the outer edge to very large ones bordering the visceral cavity. In our specimen they are entirely without order, either as to size or arrangement in their relations to the outside or inside of the thickness of the shell. All the intermediate substance of the shell is composed of minute capillary tubes, as in *Caprinella*, except that the tubes, although quite small, are only distantly septate, sometimes a centimeter distant and occasionally only half a millimeter apart. Only fragments of the natural surface of the visceral cavity have been observed; on these the longitudinal tubes are seen to open upon the surface as round or oval holes, having a raised rim, the intermediate portion being depressed slightly, and the entire surface covered by small pits representing the ends of the capillary tubes, which gives to the surface a beautifully punctate structure.

This species seems to be exceedingly abundant, as there were large numbers of the fragments obtained, but none of much more

than ten or twelve inches in length, except two of the rapidly-curved specimens, which may possibly represent the upper valves, and even these have been broken and split lengthwise so that the entire diameter, except near the apex, is not present. Only a single small fragment shows the entire diameter of what is supposed to be the lower valve, so that only a partial description can be given. It is altogether probable that this species is the one referred to in several places in J. G. Sawkin's *Geology of Jamaica*, 1869, and in the appendix of that report, as a Hippurite, which occurs of six or seven feet in length.

Formation and locality.—In the Cretaceous limestones at Logie Green, Clarendon Parish, Jamaica, W. I.

DEVELOPMENT OF THE YOUNG RADIOLITES.

In the collection are numbers of young specimens of *Radiolites* measuring from 3 mm. upward, which are attached to some of the other specimens by the whole width of one surface, but are too small to possess the specific features necessary to refer them to their kinds. Some of these would appear from their rapid expansion in width to pertain to *R. macroplicatus*, while others are quite slender. Most of them agree in being quite angular on their outer surfaces, and when the core which has filled the visceral cavity can be obtained, it appears to be generally hexagonal. The lower valve shows the minute apex to be coiled to the left in all the cases noticed, and to consist of only one coil, or in some cases of only half a coil, and looking much like the first coil of a *Spirorbis*, except that the coil is dextral.

At this period of growth the upper valve is frequently in place and situated, with the apex sublateral, generally to the right and near the attached side. The surface is convex and concentrically and radiately marked.

One specimen, which is rather more than a centimeter long, has a slightly greater width at the top, the lower valve is somewhat triangular in transverse section, and has the commencement of two strong angular plications, partially developed, showing on each valve. This I have supposed might be the young of *R. macroplicatus*.