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A Revision of Whitfield's Type Specimens of the Rudist Mollusks from the Cretaceous of Jamaica, British West Indies

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In two papers published by the American Museum in 1897, Whitfield described a number of Jamaican Cretaceous Rudistae that had been collected by F. C. Nicholas in the two preceding years. There had previously been a number of references to the presence of "hippurites" in the island (Sawkins, 1869, pp. 26, 41, 47, etc.), but only one rudist species had been described (Woodward, 1862), so Whitfield had an almost clear field, and his monograph gave the first descriptions of most of the common and some of the rarer species.

The present writer's interest in these fossils arose as a result of his study of some hundreds of specimens collected by the field officers of the Jamaican Geological Survey during the past four years, and an examination of those preserved in the museum of the Institute of Jamaica. During a visit to New York in the summer of 1954 he devoted about a fortnight to a study of Whitfield's types in the American Museum of Natural History. Subsequently he visited the United States National Museum, Washington, where a large collection of rudists and other Cretaceous fossils from Jamaica, collected by C. A. Matley and determined by L. W. Stephenson (MS.) was examined. Still later the Jamaican rudists collected and described by C. T. Trechmann (1922, 1924) were studied in the British Museum (Natural History), as well as S. P. Woodward's type specimens of *Barrettia* (1862), and other Jamaican rudists collected by Lucas Barrett between 1859 and 1864. In these museums rudists from

other areas, including Cuba, Haiti, Puerto Rico, the Virgin Islands, Mexico, Texas, south Europe, England, and elsewhere, were examined.

Following these studies a brief review of Whitfield's types seemed desirable.

Durania nicholasi (Whitfield)

Radiolites (*Lapeirousia*) *nicholasi* WHITFIELD, 1897a, pp. 186-188, pls. 6-9.

Lapeirousia nicholasi TRECHMANN, 1924, pp. 405-406.

Durania nicholasi KUHN, 1932, p. 108.

The genus *Lapeirousia* was established by Bayle in 1878, the genotype being *L. jouanneti* (des Moulins). Among its principal characters are two vertical ridges, or pseudo-pillars, on the wall of the body cavity in the fixed valve and corresponding oscules in the free valve. Whitfield thought that the occurrence of two deep sharp grooves on the exterior of the fixed valve of *R. nicholasi* indicated the presence in the interior of the valve of a pair of crests or ridges, though he admitted that "the evidences of the ridges are difficult to obtain." He thought he had obtained such evidence in the specimen, including a free upper valve and a portion of the lower valve, illustrated in his plates 8 and 9, concerning which he wrote (p. 186) that "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 . . . deposited on the inside of the inner fibrous layer [of the lower valve], and opposed to the denticulated horizontal process of the upper valve. The one narrow projecting ridge is simply a projection of this broad plate."

The plate and ridge are seen on the left in plate 8 and plate 9, figure 1, and on the right in plate 9, figure 2, where the plate is labeled *a* and described in the legend as "a fragment of the lower valve . . . still remaining attached to the [upper] valve," the only indication that the plate and ridge are not actually attached to the lower valve.

An examination of the specimen leaves no doubt that the plate and ridge are not a fragment of the lower valve but an integral part of the free or upper valve; indeed a portion of the lower valve may be seen adhering to the plate's outer face (pl. 8, lower left, pl. 9, fig. 1, upper left, fig. 2, upper right corner). The plate is a sliding process, a modified "tooth," and there is a similar but smaller "tooth" on the opposite side of the free valve. Both these "teeth" fit closely against the smooth inner layer of the fixed valve, so that they are free to slide vertically up and down.

There appears, therefore, to be no evidence of the presence of pseudo-pillars in Whitfield's specimens or in any of the numerous other repre-

sentatives of this species that have been examined. Only two free valves have been seen, those illustrated by Whitfield (pls. 6-9), and a careful examination of both of his figures and of the actual types failed to reveal any trace of oscules. The species must therefore be removed from the genus *Lapeirousia*.

With its broad, flat, close-set, horizontal funnel plates, crossed by well-spaced branching vascular grooves, and its polygonal cell pattern, the species shows affinity with such forms as *Durania mortoni* (Mantell) from the Cambridge Greensand (upper Albian) and the lower and middle Chalk (Cenomanian-Turonian) of England, *D. austinensis* (Roemer) of the Austin Chalk (lower Senonian) of Texas, and *D. curasavica* (Martin) of the Seroe Teintje Limestone (? lower Senonian) of Curaçao. MacGillavry was clearly mistaken in attributing *D. nicholasi* to *Bournonia* (1937, p. 41).

HORIZON AND LOCALITIES: In Jamaica *Durania nicholasi* occurs in association with *Barrettia* at Haughton Hall, near Green Island, Hanover Parish, and at Stapleton, near Newman's Hall, St. James Parish, in beds believed to be Turonian; it is also found in the lower part of a higher rudist limestone at Logie Green, Upper Clarendon, in beds probably of Senonian age.

"Radiolites" adhaerens Whitfield

Radiolites adhaerens WHITFIELD, 1897a, pp. 188-189, pls. 10-12.
Biradiolites adhaerens TRECHMANN, 1924, pp. 400-401.

This species is one of the most common in the *Titanosarcolites* Limestone (Maestrichtian) of Jamaica. The specimens described and illustrated by Whitfield fail to show certain characters of the siphonal bands which in better-preserved individuals become occluded and are associated with oscules in the free valve. This species will probably have to be transferred to a new genus.

"Radiolites" adhaerens has been reported from Guatemala by MacGillavry (1934, pp. 235-237).

"Radiolites" rudis Whitfield

Radiolites rudis WHITFIELD, 1897a, p. 189, pl. 11, fig. 4.

This seems to be a well-defined species, but it must be a rarity, as no other specimens have been found by the Jamaican Geological Survey. There are none in the Matley or Trechmann collections, and it has not been reported from other Caribbean countries. Douvillé, in a criticism of Whitfield's two papers (1898, p. 122), thought that it could well be a

Biradiolites, but it appears to have no close relationship to the species described by Trechmann (1924, p. 402) under the name *Biradiolites rudissimus*.

Bournonia cancellata (Whitfield)

Radiolites cancellatus WHITFIELD, 1897a, p. 190, pls. 12, 13.

Biradiolites cancellatus TRECHMANN, 1924, p. 403, pl. 24.

Biradiolites subcancellatus TRECHMANN, 1924, pp. 403-404, pl. 26.

This is a common fossil in the more shaley parts of the *Titanosarcotites* Limestone (Maestrichtian). Whitfield's drawings are not inaccurate, but some of them, especially plate 13, figure 3, may give an impression that the upfolds of the funnel plates form strong longitudinal costae, and the downfolds flat-bottomed grooves, when in fact the whole surface of his specimens is weathered comparatively smooth. There are generally at least seven plications, not five as stated by Whitfield, which do indeed form quite prominent costae in unweathered specimens, but it is the downfolds that form the ridges, and the upfolds the grooves. Trechmann's *Biradiolites subcancellatus* seems to be a shorter and more stumpy individual of the same species.

According to Douvillé (1898, p. 122) *R. cancellatus* shows the two bands characteristic of the group of *Biradiolites chaperi*, but otherwise little resemblance is to be seen. Most specimens of *R. cancellatus* are flattened on the anterior side, and were evidently recumbent. Trechmann's type specimens of *Biradiolites cancellatus* and *B. subcancellatus* have been sectioned, and both show two longitudinal grooves ("fossettes glissières") in the interior of the body cavity for the reception of the teeth of the free valve. These features are characteristic of *Bournonia bournoni* des Moulins, the type species of its genus. Cuban specimens of *R. cancellatus* were referred to *Bournonia* by MacGillavry (1937, p. 39) on the grounds that there is no rib, but only a groove, between the siphonal bands, and it seems reasonable to transfer the species to this genus.

Sawvagesia macroplicata (Whitfield)

Radiolites macroplicatus WHITFIELD, 1897a, pp. 190-191, pl. 13, fig. 8, pl. 14, figs. 1-2, not pl. 12, figs. 2-3.

Not *Radiolites macroplicatus* THIADENS, 1936, pp. 1013-1014.

Whitfield appears to have included three distinct species under the name *Radiolites macroplicatus* without designating a holotype. The specimen shown in plate 13, figure 8, is therefore selected as lectotype, and it is believed that the sectioned specimens shown in plate 14, figures 1 and

2, belong to the same species. He seems to have been mistaken in describing plate 14, figure 1, as a section "showing the upper valve in place and also the lamellae of both valves." The portion regarded as the upper valve represents displaced parts of the lower valve. The upper valve consists, not of lamellae or funnel plates like those of the lower valve, but of a cortical layer separated from the inner layer by a middle layer which consists of vertical plates radiating from a central umbo. The most noteworthy characteristic of the species is the excessive plication of the funnel plates of the fixed valve, the amplitude of the folds, exceeding 20 mm. in places, though it must have been more before erosion of the surface. The broken and weathered lower end of the lectotype shows a ligamental infold which, combined with a polygonal cell pattern, puts the species into the genus *Sauvagesia*.

The larger specimen illustrated in plate 12, figure 2, also has a ligamental crest and a polygonal cell pattern, but the plication of its funnel plates is much less, so it must be regarded as a distinct species of *Sauvagesia*. The siphonal bands are not well marked in either of these species.

The two young shells shown in plate 12, figure 3, appear to be immature *Biradiolites*. They show no ligamental crests, and their funnel plates are not strongly plicated except at the well-marked siphonal bands, where they are sharply upfolded.

All these species are probably Maestrichtian in age.

Douvillé (1898, pp. 122–123) was clearly mistaken in his view that *Sauvagesia macroplicata* belongs to the same group as *Bournonia cancellata*.

Thiadens (1936, pp. 1013–1014) described some Cuban rudists as *Radiolites macroplicatus*, but as these had a radial cell pattern they cannot belong to Whitfield's species.

Radiolites annulosus Whitfield

Radiolites annulosus WHITFIELD, 1897a, pp. 191–192, pl. 14.

Not *Biradiolites semiannulosus* TRECHMANN, 1924, pp. 401–402, pl. 25.

The holotype is the only specimen known at present. Where Whitfield has "cut away the clay" a ligamental infolding is visible, projecting about 5 mm. into the body cavity, and this can be traced down the outside of the shell to the apex by a slight narrow downfold of the funnel plates. The varices, each of which consists of about eight to 10 funnel plates, run around the shell almost without inflections, but two broad shallow upfolds occur on the ventral side, separated by a slightly sharper downfold. Whitfield's figure shows the anterior side, with the ligament on the left margin and the downfold on the right, so one of the broad upfolds can

be seen. The cell pattern is not obvious, but it seems to be radial and rectangular. The free valve has a middle layer consisting of vertical radial plates.

As Douvillé (1898, p. 123) observed, this has the character of a specimen the funnel plates ("lames externes") of which have been much eroded. The present thickness of the shell is only about 1 mm. on the dorsal side and 2–3 mm. on the ventral, and its thickness and the appearance of its surface before weathering cannot be guessed. It appears to be a true *Radiolites*, *sensu stricto*.

Biradiolites semiannulosus Trechmann has no relationship to *Radiolites annulosus* Whitfield, its affinities being rather with "*Radiolites*" *adhaerens*.

Douvillé was certainly wrong in his view (1898, p. 123) that all the forms so far described except the first (*Durania nicholasi*) seem very little different one from another.

Plagioptychus jamaicensis (Whitfield)

Caprina jamaicensis WHITFIELD, 1897a, p. 192, pl. 15, not pl. 13, figs. 1–2.

Not *Plagioptychus jamaicensis* TRECHMANN, 1924, pp. 407–408, pl. 25, fig. 4.

Under *Caprina jamaicensis* Whitfield included two specimens which seem to belong to different species. His main description applies to the large specimen shown on plate 15, which must therefore be chosen as the lectotype. As Douvillé observed (1898, p. 123) the external form is that of a *Plagioptychus*, and an examination of the type confirms this impression, as the shell has the thin brown outer layer, of horny appearance, so characteristic of this genus, beneath which the free valve shows the typical canals, separated by bifurcating plates, radiating from an umbo on the dorsal side. This is a rare species, but the Jamaican Geological Survey has one specimen from the *Titanosarcolithes* (Maestrichtian) Limestone.

The smaller specimen illustrated in plate 13, figures 1 and 2, and described by Whitfield as a young *C. jamaicensis* has unfortunately been mislaid, but it probably belongs to another species of *Plagioptychus*, of which the Jamaican Geological Survey has collected several specimens.

Trechmann's *Plagioptychus jamaicensis* seems to belong to yet another species, about the same size as the last-mentioned form, but having a much more arched free valve, with an overhanging umbo, and a rather different hinge structure.

Antillocaprina quadrangularis (Whitfield)

Caprinella quadrangularis WHITFIELD, 1897a, p. 193, pls. 12, 14.

Douvillé (1898, p. 123) was critical of this species, which he claimed had been established on a single lower valve of which the internal characters were unknown. Actually Whitfield illustrated two lower valves and described the capillary tubes. No representatives of this form are in the Matley and Trechmann collections and none have been found by the Jamaican Geological Survey. However, Trechmann has recently collected two specimens, one consisting of a somewhat crushed lower valve, with the upper valve in place, and the other an isolated upper valve. These upper valves are well arched but not coiled, roughly quadrangular in outline, with the umbo in one corner, from which a strong rounded ridge, between two grooves, runs diagonally to the opposite corner; two broad lateral ridges extend to the remaining corners. The species seem to belong to Trechmann's genus *Antillocaprina* (see below).

Antillocaprina occidentalis (Whitfield)

Caprinella occidentalis WHITFIELD, 1897a, pp. 193-194, pls. 16, 17.

Antillocaprina occidentalis TRECHMANN, 1924, p. 407, pl. 25, figs. 1-3.

This is a common fossil in the *Titanosarcolites* Limestone (Maestrichtian) of Jamaica, but few specimens have been found as well preserved as those described by Whitfield, many of which have the cortex intact. It is not clear, however, on what evidence he based his descriptions of the septa in the central cavity, as none of his specimens show them, the body cavity, where exposed, being opened up by solution and thickly lined with secondary calcite.

Douvillé (1898, p. 123) thought that this form recalled the structure of *Coralliochama*, but a careful study of the types failed to disclose much resemblance. Trechmann (1924, p. 407) created the new genus *Antillocaprina* for this species, in which the whole of the middle layer of both valves, between the inner and outer layers, is occupied by a mass of small, with occasionally a few large, tubules, oval or polygonal in cross section, which invade the hinge teeth and the areas of muscle attachment.

Titanosarcolites giganteus (Whitfield)

Caprinula gigantea WHITFIELD, 1897a, pp. 194-196, pls. 18-22.

Titanosarcolites giganteus TRECHMANN, 1924, pp. 397-400, fig. 1, pl. 23, figs. 1-2.

This is the most characteristic fossil of the main rudist limestone of Jamaica, which is believed to be Maestrichtian. It is said to attain a maximum length of 6 or 7 feet, and Trechmann actually collected and presented to the British Museum a specimen 5 feet, 4 inches long, which appears to have lost the apices of both valves. Whitfield's material is

exceptionally well preserved, several specimens showing the cortex or the actual surface of the body cavity virtually unweathered. The shell has a smooth cortical layer, with rather inconspicuous transverse growth lines, which cross all ridges and furrows at right angles. The longitudinal tubular canals and the capillaries are visible only on weathered or broken surfaces.

The tubular canals are not present on all sides of the body cavity, but only on the dorsal and one of the lateral flanks of each valve. These canaliculate sides of the shell are marked by numerous rounded costae, averaging about 10 mm. wide, separated by rounded grooves; the other sides of the valves show a few broad, roundly concave flutings, generally 40 to 60 mm. wide, separated by subangular ridges. These characters are well shown in the specimen figured in Whitfield's plate 19, figure 1, and plate 20, though he is mistaken in describing it as "split longitudinally," for plate 20 shows the actual cortex of the valve, with its flutings, which being external cannot be correctly described as "large cavities of the central portion of the valve." The cylindrical object described as "the filling of one of the smaller tubes" is actually a foreign body adhering to the outside of the cortical layer, in the bottom of one of the broad flutings, from which it is separated by rock material 1-2 mm. thick. Several of Whitfield's specimens have been sectioned, and these show that the capillaries are mostly polygonal, forming a network, but those in the outermost row on the fluted sides are oval in cross section, with their long axes perpendicular to the outer surface; on the costate side the polygonal mosaic generally continues to the edge.

Because the two valves are very much alike in shape, size, and structure, the correct orientation of the shell is difficult to determine. Whitfield described the valves shown in his plates as "upper" or "lower," but there can be no reasonable doubt that *T. giganteus* was a recumbent form, so these terms are inappropriate. Presumably "upper" may be interpreted as meaning the free or left valve, and "lower" as the fixed or right valve. If he is correct in regarding the valve shown in plate 18 as free, and that in plate 19, figure 1, and plate 20 as fixed, and if the umbones curve dorsally as in other pelecypods, then the costate side is posterior and the fluted side is anterior.

This conclusion is confirmed by an examination of one of Trechmann's (1924) types in the British Museum, figured in his plate 23, figure 2. Here there can be no doubt as to which side is dorsal, as its hinge teeth are preserved, and it is certainly the free valve as it has two teeth. The shell does curve dorsally. The figure shows tubular canals on the dorsal side but not to which flank they extend. An examination of the type

makes it clear that they are on the posterior flank, while the anterior has four or five flutings which are narrow because it is a young individual. A polished section cut from Trechmann's large specimen, illustrated in his text figure (1924, p. 399), shows that the tubular canals are on the side facing the observer, which is therefore posterior. The valves are correctly allocated to right and left, but the shell is shown with the dorsum below.

Unfortunately neither Whitfield nor Trechmann is consistent in interpreting the orientation of his types. If the specimen shown in Whitfield's plate 21 is examined it is found to be a left valve, not a right or "lower" valve as stated in the legend. The figure shows the distal end of the fragment, as is proved by the concavities of the septa. In Trechmann's plate 23, figure 1, the two valves are wrongly labeled; it is the tubular, i.e., the posterior, side that we see, and the dorsum is below. In fact the orientation is identical with that of the text figure on page 399, with the right valve on the viewer's left, and the left valve on his right.

The criteria for the orientation of shells of *T. giganteus* can now be summarized as follows:

The hinge teeth are on the dorsal side of the body cavity, one in the right valve, two in the left.

Both valves taper distally and curve dorsally.

The septa in the body cavities of each valve present their concave faces towards the other valve.

The tubular canals are more or less confined to the dorsal and posterior sides, which are costate.

Transversely oval capillaries line the anterior and ventral margins; these sides are fluted.

It is probable that *T. giganteus* lay on its anterior side, for the majority of specimens seen in the field lie with this side embedded in the rock and the costate side exposed, though a few may be found lying on the posterior side. Possibly the latter were overturned by waves or currents after death.

Barrettia gigas, new name

Barrettia monilifera WHITFIELD, 1897b, pp. 233-244, pls. 27-32.

Barrettia cf. *monilifera* TRECHMANN, 1922, pp. 510-511, pls. 19, 20.

Not *Barrettia monilifera* WOODWARD, 1862, pp. 372-377, pls. 20, 21.

On first seeing Whitfield's types in the American Museum of Natural History labeled *Barrettia monilifera* Woodward, the writer had no doubt that they were correctly named, for they were identical with many specimens with which he was familiar in the collections of the Jamaican Geological Survey and the Institute of Jamaica, which had been regarded by all

who had studied them as typical examples of Woodward's species. Most of these came from what is probably the same locality as that of Whitfield's types, Haughton Hall, near Green Island village in Hanover Parish.

Later, when he saw in the United States National Museum 14 specimens from St. Croix in the Virgin Islands similarly named, he thought that these had been misidentified, and belonged to a new species. All were relatively small and slender, the diameter varying from 75 to 140 mm., and the shells appeared to have had an elongated, curved, cornute form, with a length probably about thrice the maximum diameter, though as all were broken no exact estimate was possible. Adult specimens from Haughton Hall are commonly straight cylindrical, and about 300 mm. in diameter by at least 300 mm. high.

When at last he saw Woodward's types, from Back River, Portland Parish, Jamaica, in the British Museum, he was compelled to revise his views again, for like most students of these organisms he had relied on Whitfield's rather than on Woodward's description of *B. monilifera*. Woodward's specimens resemble those from St. Croix rather than those from Haughton Hall. Of the shells illustrated in Woodward's rather idealized drawing (1862, pl. 20, fig. 1, reproduced in Whitfield, 1879b, p. 241) the larger is 100 mm. in diameter at the big end and was about 400 mm. long before the loss of its apex. The smaller is about 80 mm. in diameter by over 160 mm. long. Both are curved cornute and taper regularly and evenly. The specimen shown in Woodward's plate 20, figure 2, and plate 21, figure 5 (Whitfield, 1897b, p. 242) is about 125 mm. in diameter, and according to Woodward (p. 373) it was probably originally 18 inches or 2 feet (450-600 mm.) in length.

Whitfield's types are obviously closely related to Woodward's *Barrettia monilifera*, but they are well differentiated in size and form and are easily distinguishable from it; no intermediate varieties are known and they have a different geographical range. It appears therefore that they should be regarded as a different species, for which the name *Barrettia gigas* is proposed, the holotype being the specimen illustrated in Whitfield's plate 27, figure 1, and plate 28 (A.M.N.H. No. 9665/1). All Whitfield's types called *Barrettia monilifera* and all Trechmann's called *B. cf. monilifera* belong to the new species.

In youth *B. gigas* was broadly turbinata, and young individuals, such as occur especially in St. Anns Great River Valley, may have a diameter nearly twice their height; for example, one collected by Zans is about 50 mm. in height by 100 mm. in diameter. A young adult from Stapleton near Newmans Hall, St. James Parish, is about 200 mm. in height by 300 in diameter. On attaining this breadth the shell continues

its upward growth but becomes cylindrical, sometimes with a slight curvature, and usually grows to a height of about 300–400 mm., though Trechmann (1922, p. 511) records one $2\frac{1}{2}$ feet (750 mm.) long. As might be expected in view of its greater diameter *B. gigas* has a larger number of moniliform rays than *B. monilifera*. Woodward's type of the latter species, with a diameter of about 125 mm., has 65 rays. The holotype of *B. gigas*, with a diameter of 250 mm., has about 78; one of Trechmann's specimens, with a diameter of 300 mm., has 90, and among other specimens in the British Museum the following were noted: diameter 290 mm., rays 102; diameter 250 mm., rays 84; diameter 193 mm., rays 81; diameter 86 mm., rays 45. The last two are immature individuals. The moniliform rays are similar in development to those of *B. monilifera*.

Whitfield mentions (p. 236) two peculiar features seen in some specimens, a white horizontally fibrous substance encircling one side of the body cavity, and a vertically columnar or fibrous body, resembling the coral *Chaetetes*, filling the center of the cup. The former appears to be a thickening of the inner shell layer, perhaps to give strength for muscle attachments, and the latter, which is seen in very few specimens, is probably a foreign body.

Whitfield's view (1897b, p. 243) that *Barrettia* pertained to the coelenterates was strongly opposed by Douvillé (1898, p. 124). It is unnecessary to enter into this argument, as probably all paleontologists are today agreed as to the molluscan affinities of this genus.

GEOGRAPHICAL RANGE: So far as is known at present, *Barrettia gigas* occurs only in Jamaica, in a limestone exposed in St. Anns Great River Valley, at Whitechapel Spring and Stapleton, St. James, and at Haughton Hall, Green Island, Hanover. *Barrettia monilifera* occurs in Back River Valley, Portland. Specimens of *Barrettia* from Haiti and St. Croix, Virgin Islands, in the United States National Museum, and from Puerto Rico in the American Museum of Natural History also appear to be true *B. monilifera* Woodward, so the range of this species is from eastern Jamaica to the Virgin Islands, a distance of about 800 miles.

Two facts which may, or may not, be significant are to be noted: (1) The known occurrences of *B. monilifera* from Jamaica to St. Croix all lie east of a major tectonic line, a great belt of folding and faulting, which runs diagonally northwest to southeast across Jamaica, cutting off the much folded Blue Mountain area in the east from the rest of the island; the known occurrences of *B. gigas* all lie west of this line. *Barrettia gigas* was probably adapted to life in shallow water, subject to wave action; *B. monilifera*, to deeper water conditions. Possibly the tectonic line already existed in upper Cretaceous time, separating a northeastern deep-

water, from a southwestern shallow-water area. (2) All specimens of *B. monilifera* that have been seen show a similar mode of preservation, giving a black and white effect in polished sections, the cortex and moniliform rays being nearly black, and the rest of the shell nearly white; while all specimens of *B. gigas* are a buff color, the moniliform rays being a darker buff or brown.

It would be interesting to know whether the forms reported under the name of *B. monilifera* from Cuba, which would lie northeast of a continuation of the tectonic line, and those from Guatemala and south Mexico, which would lie southwest of it, really belong to this species or to the new species *B. gigas*, and what is their mode of preservation. A specimen from Cuba figured by Douvillé (1927, p. 129, pl. 7, fig. 2), with 56 rays and a diameter of 118 mm., has the appearance of a true *B. monilifera*. He noted that all representatives of this species from San Juan de los Yesos and L'Arroyo Hondo in Cuba were white in color, though his photograph shows the moniliform rays and cortex to be nearly black. It would appear likely therefore that the Cuban specimens are *B. monilifera*. Mullerried stated (1934) that the larger individuals of *B. "monilifera"* found in Chiapas, Mexico, attained 1 meter in height and 33 cm. in diameter. Such monsters would almost certainly be *B. gigas*.

HORIZON: It seems probable that *B. gigas* and *B. monilifera* were contemporaneous. They are closely related and both occur in association with *B. multilirata*. In a forthcoming paper evidence will be brought forward that the *Barrettia* Limestone of Jamaica is of Turonian age.

Barrettia multilirata Whitfield

Barrettia multilirata WHITFIELD, 1897b, p. 244, pls. 33-35.

Barrettia cf. *multilirata* TRECHMANN, 1922, pp. 511-512, pls. 18-20.

This species and the species next discussed appeared to Douvillé (1898, p. 125) to be simple varieties of *B. monilifera*, and MacGillavry (1937, p. 126) also doubted if they were specifically distinct. Having examined all of Whitfield's and Trechmann's types, some of the latter retaining their free valves, as well as a number of other specimens in the collections of the Jamaican Geological Survey and the Institute of Jamaica, the writer has no hesitation in affirming that *B. multilirata* is specifically distinct from *B. monilifera*, *B. gigas*, and "*B.*" *sparcilirata*. Some authors perhaps attach too much importance to the number of rays in an individual specimen, without giving sufficient attention to its diameter. While it is possible that some large specimens of *B. gigas* have nearly as many rays as some specimens of *B. multilirata* half their breadth, it may be taken as a general rule that, for any given diameter, the latter species will have

nearly if not quite twice as many rays as either *B. gigas* or *B. monilifera*. The moniliform tubes and the interradiial cells are correspondingly reduced in size, but the cylindrical septate tube (marked *a* in Whitfield's pls. 34 and 35) is unexpectedly large, exceeding 10 mm. in diameter. It may be noted that the septate tube labeled *a* in plate 33 is not the "cylindrical tube," which has domed septa, but the inner end of the so-called "fosset," which has nearly horizontal septa. It is now generally believed that these two bodies correspond with the pillars in the hippurites.

LOCALITY AND HORIZON: There is some uncertainty as to the provenance of Whitfield's specimens of *Barrettia multilirata* and *B. gigas*. In his long discussion of *B. "monilifera"* (1897b, pp. 233-244) there is no mention of its locality, but the source of *B. multilirata* is given as "the Cretaceous limestone at Orange Cove, Hanover Parish, Jamaica, W. I., with *B. monilifera*" (1897b, p. 244). In his earlier paper one of the localities for "*Lapeirousia nicholasi*" was given as "Green Island or Haughton Hall, Hanover Parish, Jamaica, W. I. The latter locality is that from which . . . *Barrettia* is abundantly obtained" (1897a, p. 188). It would appear that these are intended to be two descriptions of one and the same locality, but in fact Haughton Hall, which is adjacent to Green Island village, is about 8 miles southwest of Orange Cove; both places are in Hanover Parish.

Some confusion is understandable, for there is a place called Haughton Court near Orange Cove, and there is a bay called Orange Bay only 2 miles from Haughton Hall. Trechmann in 1922 (p. 504) found a peasant who had watched Nicholas when he was collecting for Whitfield 27 years earlier. This man conducted him to the spot, which proved to be on Haughton Hall estate, where specimens of *B. multilirata*, *B. gigas*, and *Durania nicholasi*, with exactly the same preservation as Whitfield's types, occur in some abundance. Up to the present no outcrop of Cretaceous limestone has been found at Orange Cove or Haughton Court, so it is probable that the source of Whitfield's specimens of *Barrettia* was Haughton Hall.

Barrettia multilirata has not been found elsewhere in Jamaica but it has been reported from Cuba, and a specimen from Haiti in the United States National Museum appears to belong to this species. In both these islands it is associated with *B. monilifera*. The horizon is thought to be Turonian.

Praebarrettia sparcilirata (Whitfield)

Barrettia sparcilirata WHITFIELD, 1897b, pp. 245-246, pls. 36-37.

Barrettia sparcilirata TRECHMANN, 1922, p. 512.

Praebarrettia sparcilirata TRECHMANN, 1924, pp. 395-396, pl. 23, figs. 3-4.

The generic name *Praebarrettia* was created by Trechmann for this species. The present writer accepts the name with reluctance, as, though he agrees that it is generically distinct from *Barrettia*, *sensu stricto*, he does not accept Trechmann's view that *P. sparcilirata* occupies an intermediate position between *Pironaea* and *Barrettia*. He believes it to be not a primitive ancestor but a degenerate descendant of *Barrettia*; in any case in Jamaica its horizon appears to be about 2500 feet higher.

As noted above Douvillé (1898, p. 125) at first regarded this species as a mere variety of *B. monilifera*, though later he seems to have recognized its specific distinction (1927, pp. 128–129). More recently M. G. Rutten (1936, pp. 135–136) has again thrown doubt upon it. Boissevain and MacGillavry (1932, p. 1308) and Thiadens (1936, p. 1013) considered that Trechmann was not justified in creating a new genus for this species, though later MacGillavry recanted (1937, pp. 119–124). Some of the uncertainty is due to a general failure to recognize that *Praebarrettia* is more recent than *Barrettia*, some perhaps to confusion between the primitive *Pironaea* and the decadent *Praebarrettia*. Certain specimens from Cuba, in the United States National Museum, labeled *Praebarrettia sparcilirata* var. *cubensis* Palmer, have more resemblance to *Pironaea polystylus* (Pirona), from Maniago, Friaul, Italy, than to the Jamaican specimens of *Praebarrettia sparcilirata* in the Whitfield and Trechmann collections. Here again it appears that too much attention has been paid to the number of rays and not enough to their structure.

In the writer's opinion Whitfield was justified in recognizing *sparcilirata* as a different species from *monilifera*, and Trechmann was justified in regarding it as a distinct genus, though his choice of name was unfortunate.

HORIZON AND LOCALITY: *Praebarrettia sparcilirata* occurs at Logie Green, Upper Clarendon, in the *Titanosarcolithes* Limestone of Senonian age. In Cuba *P. sparcilirata* is commonly associated with *T. giganteus*.

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