

ON TWO SPECIES OF TITANOSARCOLITES (RUDISTIDS) FROM ST. JAMES' PARISH, NW JAMAICA

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ABSTRACT

Van der Wal, R. J. F. (1978). On two species of *Titanosarcolites* (Rudistids) from St. James' Parish, NW Jamaica. In: H. J. Mac Gillavry & D. J. Beets (eds): The 8th Caribbean Geological Conference (Willemstad, 1977). Geol. Mijnbouw, 57, p. 339-346.

Specimens of *Titanosarcolites* from St. James' Parish, NW Jamaica, are described. It is shown that in *Titanosarcolites* new tubes are formed by a process of subdivision of older tubes. The presence of the ligament in the right valve of *Titanosarcolites giganteus* is established.

The internal structures of *Titanosarcolites alatus* (Chubb, 1967, 1971) are described; the species may be intermediate between *Antillocaprina* and *Titanosarcolites giganteus*.

The genus *Titanosarcolites* was already known from the Barrettia Limestone of Sunderland.

INTRODUCTION

The specimens studied form part of the material collected in 1967 on Jamaica by Professor H. J. Mac Gillavry^{1,2}, Dr. H. van Dommelen¹ and Dr. J. P. Krijnen³. This study is restricted to that part of the collection which was sampled in the Sunderland, Calton Hill and Maldon inliers, St. James' Parish, NW Jamaica. A columnar section has been published by KRIJNEN (1972) and VAN DOMMELEN (1971).

In this paper the following conventional abbreviations and symbols for shells are used:

RV : right valve
 LV : left valve
 CV : body cavity

A_{II}, A_{II}' : anterior tooth and its alveole
 P_{IV}, P_{IV}' : posterior tooth and its alveole
 3, 3' : single tooth of the right valve and its alveole
 ma, mp : anterior and posterior myophore
 L : ligament

The generic name *Titanosarcolites* was proposed by TRECHMANN (1924) for the species described by WHITFIELD (1897) as *Caprinula gigantea*. Extensive descriptions based on the type species are given by MAC GILLAVRY (1937) and CHUBB (1971). *Titanosarcolites* is subequivalve, both valves tapering towards the umbo. The gigantic shell was recumbent on its anterior side. Both valves are curved in one plane, the concave side of the curve being dorsal. The valves are described as having numerous longitudinal rounded costae on the dorsal and anterior sides; these costae are separated by narrow grooves. In reality, however, *Titanosarcolites giganteus* only has very flat costae on its anterior side or this side is completely smooth (this has already been described by MAC GILLAVRY, 1937). Prominent costae may be present at the dorsal side (Fig. 1). The posterior and ventral sides have angular ridges or flanges with intervening broad flutings.

The main mass of the shell consists of many fine and tabulated polygonal 'canals', which also invade the hinge elements

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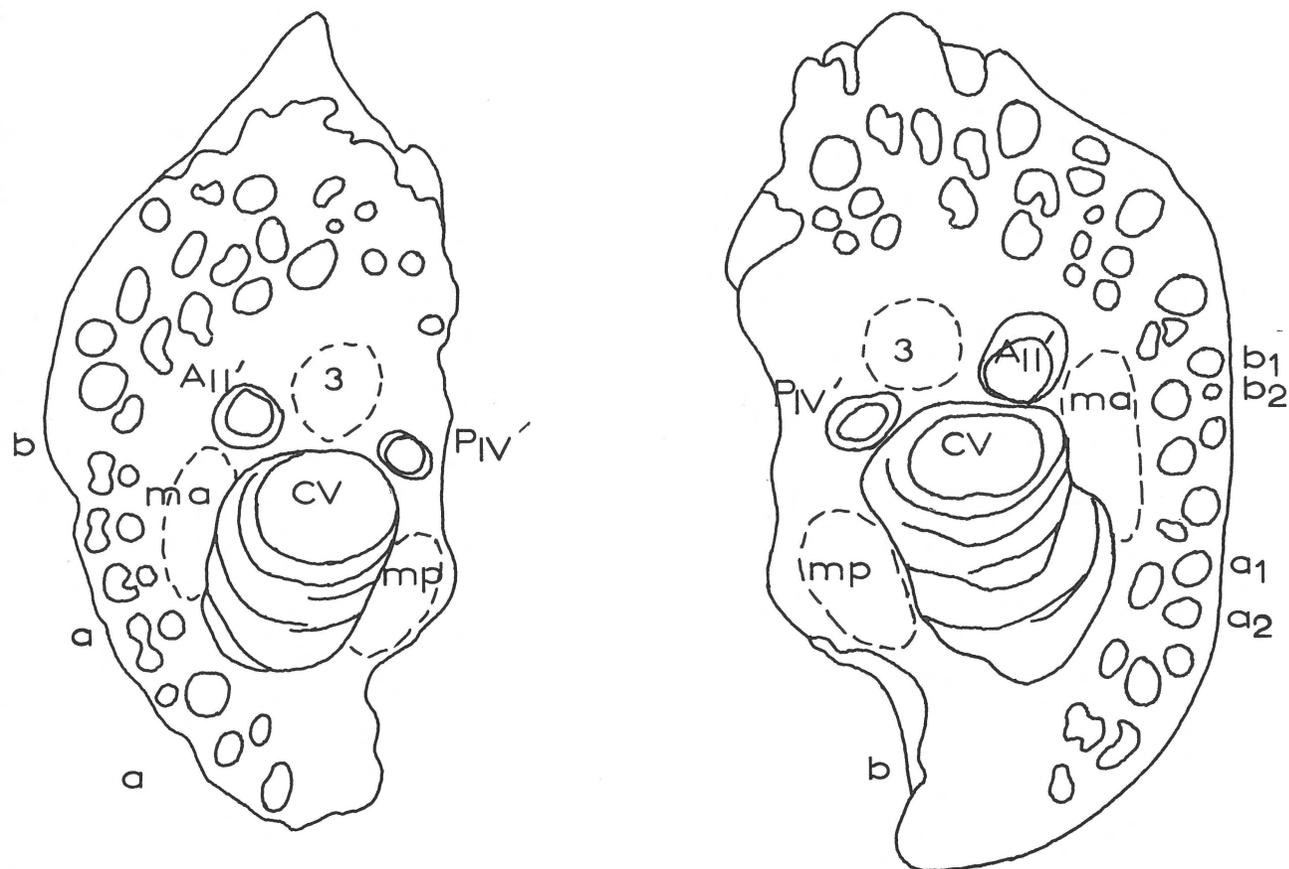


Fig. 1

Titanosarcolites giganteus (Whitfield), J. 3584, RGM. 190.405, Maldon Series; Maldon school yard. Two transverse sections of the RV, the left one being nearer to the umbo. Subdivision of the anterior tubes is shown: the tubes indicated by a and b can be correlated in the sections. The teeth are rounded to oval. The anterior side is smooth, while some dorsal costae can be observed. Natural size.

and the myophoric areas. The chief characteristic of *Titanosarcolites* is the presence among the canals of many large tubes with rounded, oval or irregularly shaped cross-section, the diameter of which may be up to ten times that of the polygonal canals. The tubes are non-tabulate and confined to the costate sides. They have been described by MAC GILLAVRY (1937) as 'enclosures of the world outside into the animal's shell'. They are considered by CHUBB (1971) and MAC GILLAVRY (1937) to be formed in the way suggested by TRECHMANN (1924): 'by a repeated growing over as the shell increases in size, in a roof-like manner of the outer ribs'. It is difficult to see, however, how this could be accomplished, since the animal is lying with this side of its shell upon the sediment.

CHUBB (1971) distinguishes two species of *Titanosarcolites*: *T. giganteus* (Whitfield) and *T. alatus* Chubb. The material at my disposal consists of many fragmentary specimens of *T. giganteus* and several fragments which I consider to represent *T. alatus*. None of the specimens of *T. giganteus* studied contained the commissure.

The interior of the shell of *T. alatus* described by Chubb was

recrystallized, so he could not find any trace of the hinge structure. At least some of the specimens that I consider to belong to *T. alatus* have well preserved internal structures.

Titanosarcolites giganteus (Whitfield)

Caprinula gigantea Whitfield, 1897a, p. 194-196, pls. 18-22.

Titanosarcolites giganteus (Whitfield), Trechmann, 1924b, pars, p. 397-400, text fig. 1; pl. 23, fig. 1.

Titanosarcolites giganteus (Whitfield), Chubb 1955a, p. 7-9; 1955b, p. 178-185; 1956c, p. 8.

Titanosarcolites giganteus (Whitfield), Chubb 1971, p. 177-178, pl. 31, figs. 1, 3; pl. 32, figs. 1, 2; pl. 33, figs. 1, 2.

Titanosarcolites giganteus (Whitfield), Mac Gillavry, 1937, pars, p. 85-92, pl. 2, figs. 1-5.

The cross-section of the shell of *Titanosarcolites giganteus* is oval to half-moon shaped, the longer diameter directed dorso-ventrally.

The polygonal canals in this species are all thick-walled, the diameter may be 0.5 to 1.0 mm.

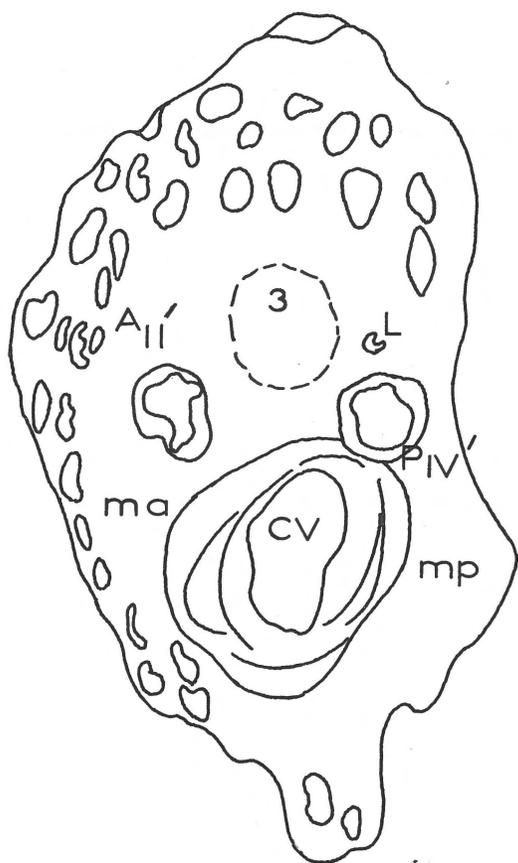


Fig. 2
Titanosarcolites giganteus (Whitfield), J. 3579, RGM. 190.386, Vaughansfield Limestone; found loose on the road to Maldon, Transverse sections of the RV, Showing the rounded teeth and dorsally of P_{IV} ' the comma-shaped ligamental hollow. Natural size.

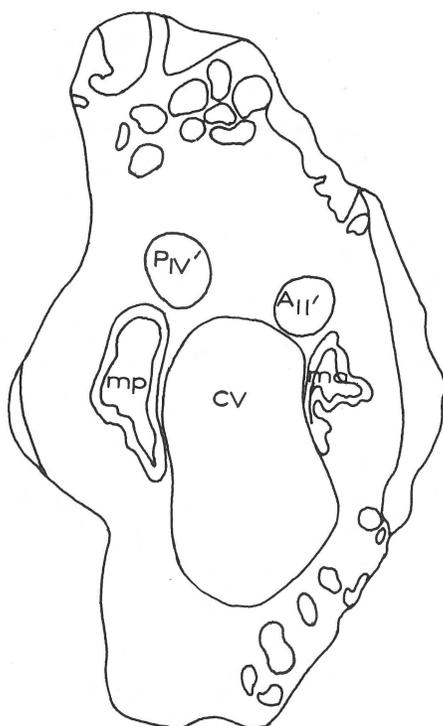


Fig. 3
Titanosarcolites giganteus (Whitfield) from Catadupa, drawn after Chubb's Plate 32, Fig. 2. Transverse section of the RV, showing the commissural aspect. Two alveoles, into which more or less tooth-like myophoric structures fit, are to be seen.

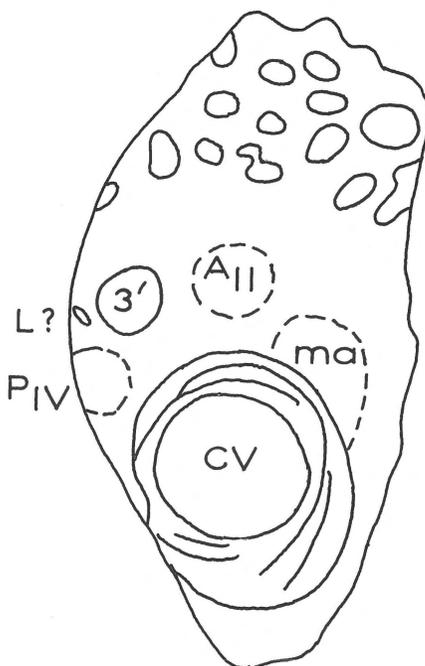


Fig. 4
Titanosarcolites giganteus (Whitfield), J. 3508, RGM. 190.373, Maldon Series; found loose on side road of road Point - Flamstead near contact Yellow Limestone/Cretaceous. Transverse section of the LV, showing dorsally to P_{IV} the oval structure, which might indicate the existence of the ligament in the LV. x 1.6.

The teeth are rounded to oval (Figs.1-3). The two teeth in the left valve and the single tooth in the right valve fit into alveoles in the opposite valve; these alveoles are filled with concave tabulae in the distal parts. Canals are frequently visible in the teeth. The cross-section of the posterior tooth P_{IV} appears to be rounded in contrast with the peculiar pinched cross-section of that tooth in *T. alatus* and *Antillocaprina*. Mac Gillavry's tentative interpretation of the posterior tooth of a specimen from Jamaica figured by Whitfield (Whitfield Plate 21; Mac Gillavry Plate 2, Fig. 6; reproduced here as figure 10 showing my interpretation) would seem to be in error. The muscle attachment seems to have been superficial. Tooth-like myophores, fitting into alveoles of the RV are not present. The myophoric areas are often distinguished by a markedly different arrangement of the canals. Chubb's Plate 32, Fig. 2 (1971), a photograph of a section of the RV of *T. giganteus* cut near the commissure, shows two alveoles into which myophoric structures fit (Fig. 3). In my specimens I have not observed this feature. This could indicate that the muscle attachment is superficial in younger stages of *T. giganteus* and that raised

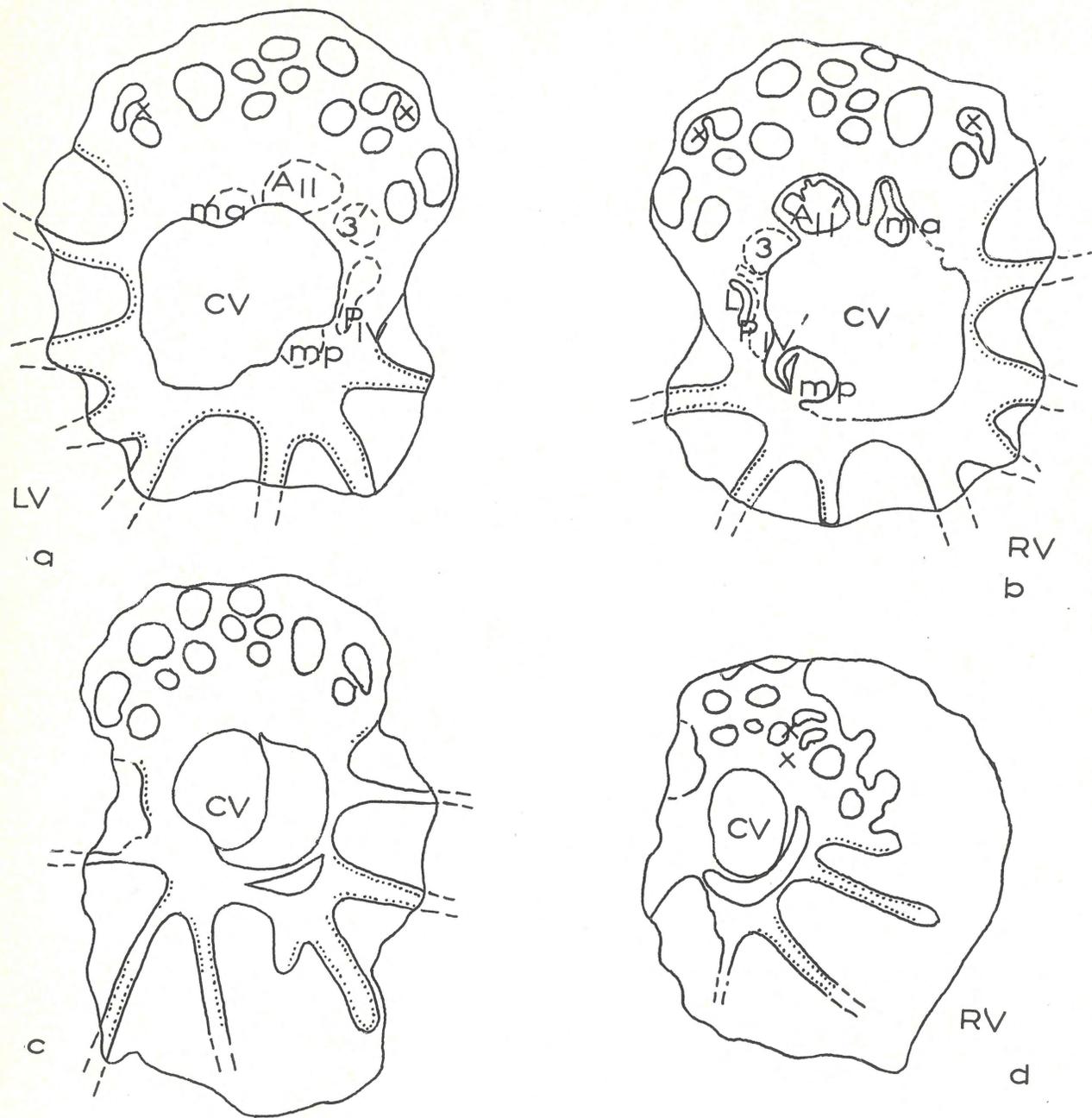


Fig. 5
Titanosarcolites alatus Chubb, J. 3480, RGM. 190.210, Calton Hill Series; side road of the road from Point. a and b are transverse sections showing the commissural aspect of the LV and the RV respectively. The peculiar shape of P_{IV}' and the location of the ligament in the hollow of P_{IV}' are to be seen. Ma and mp are tooth-like myophores, fitting into alveoles of the RV; ma is elongated. The lamina that separates the alveoles of ma and mp in the RV from the CV, is not seen. c is a transverse section of the LV nearer the umbo and d is a similar section of the RV. x indicates a subdividing tube. Oval capillary canals, following the periphery of the flanges and flutings, are indicated by a dotted line. Natural size.

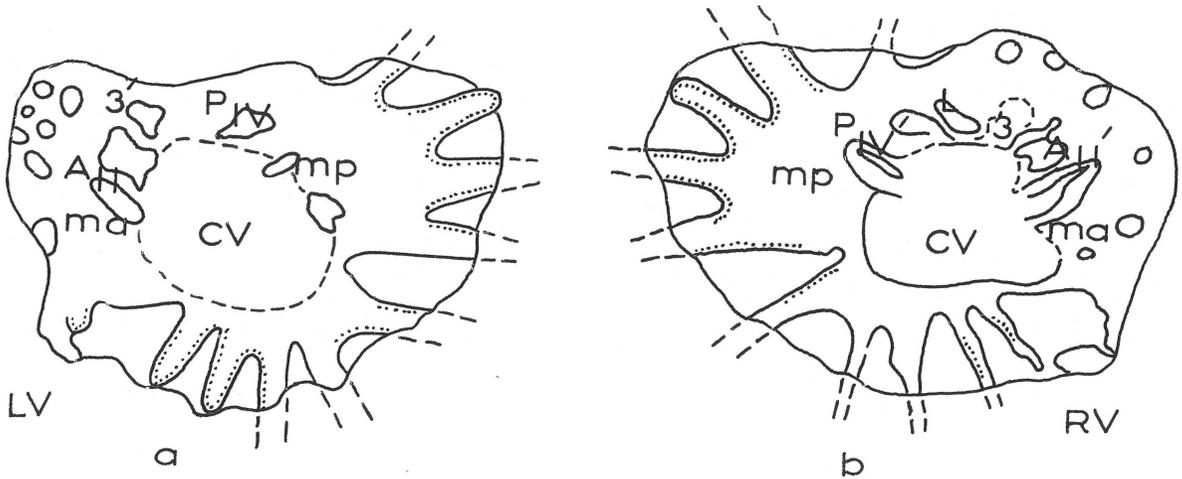


Fig. 6
Titanosarcolithes alatus Chubb, J. 3502, RGM. 190.334, Maldon Series; side road of road Point – Flamstead near contact Yellow Limestone/Cretaceous. Transverse sections of the LV and RV, showing the commissural aspect. Note the peculiar shape of P_{IV}' and the location of the ligament in the concave hollow of P_{IV}' . The myophores are tooth-like. The lamina that separates the alveoles of *ma* and *mp* from the *CV* is absent. Oval capillary canals along the periphery of the flanges are indicated a dotted line. Natural size.

myophoric apophyses exist in the adult stage. This supposition is supported by the observation, that in Chubb's figure there are no tabulae in the *CV*, while in my specimens they are always abundantly present. This would mean that in all my specimens the adult stage is missing.

A ligamental hollow is found in the juvenile stages of the *RV* of some specimens dorsally of the P_{IV}' alveole. The cross-section of this hollow is comma-shaped as in *Antilocaprina*. No ligamental material has been found. This hollow is only present in the younger stages of the *RV*: in sections made from the umbo towards the commissure it is present in the distal sections, but disappears rather abruptly, and no trace of it is found further on. No trace of the ligament is found in the *LV* with the possible exception of one specimen. In one section of this specimen a structure with an oval cross-section occurs dorsally to P_{IV}' which could be an indication of the existence of *L* in the *LV* (Fig. 4).

The tubes of *Titanosarcolithes* have always been considered to be formed by roofing over in the manner described above (TRECHMANN, 1924). However, in the material studied by me I have only rarely observed that dorsal costae, which are usually much more prominent than the anterior ones, close over the intervening groove to form a tube. On the other hand I have observed in one or two cases that dorsal costae, going from umbo to commissure, approach each other without closing over the intervening groove, but that nearer to the commissure they separate again leaving the groove open. The anterior side of many specimens is smooth without costae, although tubes are formed internally at this side. In a large number of specimens I have on the contrary observed, that a tube subdivides into two new ones by the appearance of a ridge or

constriction in the tube (Fig. 1). This process can be followed by comparing successive cross-sections. This possibility has already been considered by MAC GILLAVRY (1937, p. 89) in order to explain some irregularly shaped tubes which are constricted internally by a ridge. Mac Gillavry, however, prefers the explanation that two tubes fuse to form one. In almost all specimens I have found such irregularly shaped tubes and observed that these tubes are subdividing into two new ones.

Titanosarcolithes alatus Chubb

Titanosarcolithes giganteus Trechmann, 1924b, pars, p. 400, pl. 23, fig. 2.

Titanosarcolithes giganteus Mac Gillavry, 1937, pars, p. 85-92, pl. 2, figs. 1-5; pl. 9, fig. 1.

Titanosarcolithes alatus Chubb, 1967, p. 26.

Titanosarcolithes alatus Chubb, 1971, p. 178, pl. 31, fig. 2; pl. 32, fig. 3.

Titanosarcolithes alatus has been described by CHUBB (1971) as a medium to large-sized species. According to him the chief characteristics are the projecting flanges on the posterior and ventral sides of the shell. These flanges, which are much more numerous than those of *Titanosarcolithes giganteus*, have flat, parallel sides and are rounded at the tip.

The shells from St. James' Parish have a more rounded cross-section than those of *T. giganteus*. They all possess projecting flanges on the posterior, ventral and antero-ventral sides (Fig. 5 and 6). A single row of canals with oval cross-section perpendicular to the surface follows the entire periphery of the flanges and of the intervening flutings (indicated by a dotted line in the figures). The main mass of the shell consists of very thin-walled capillary polygonal canals, the diameter of



Fig. 7
Titanosarcolites alatus Chubb from Ingenio Grande, Camaguey Province, Cuba. Drawn after Mac Gillavry's Plate 2, Fig. 4 (1937) (Ca 81). It shows the tooth-like mp and the comma-shaped ligament. Bases of flanges are present. Natural size.

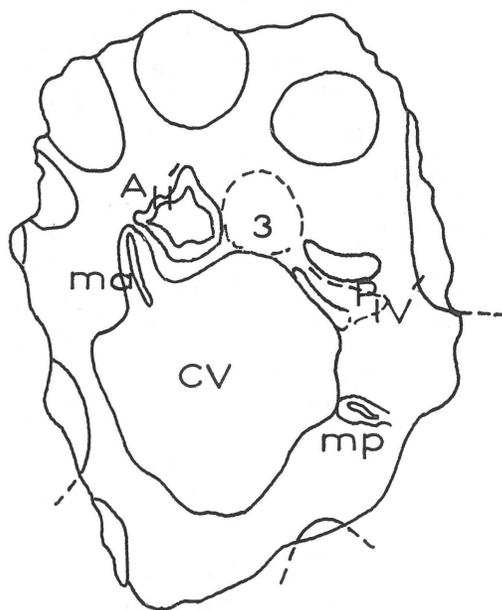


Fig. 8
Titanosarcolites alatus Chubb, J. 3480, RGM. 190.203, Calton Hill Series; side road of the road from Point. Transverse section of the RV, showing the commissural aspect. The hinge structures and the myophores are like those in Fig. 6b. Note the very large tubes dorsally to the teeth. x 1.6.

which may be up to 2.5 mm. Tubes occur on the dorsal and antero-dorsal sides. The mechanism of subdivision of tubes, as described before, can be observed in many cases. Overgrowing of grooves by costae has not been established.

The cardinal apparatus resembles that of *Antillocaprina*. A_{II} and 3 are more or less rounded, fitting into alveoles of the opposing valve. P_{IV} has the same peculiar cross-section as that of *Antillocaprina*. A ligamental hollow is only found in the RV. It is situated on the concave dorsal side of P_{IV} and has the same characteristic comma-shaped cross-section as in *Antillocaprina* (Fig. 2). Again no ligamental substance has been found.

The adductor muscles appear to have been attached to raised myophoric apophyses in the LV, which fit into alveoles in the RV. The myophores are rather small, sometimes with a more or less flat cross-section with the longer axis perpendicular to the CV. In sections of the RV near the commissure the ma and mp are not separated from the CV by a lamina. The CV itself is relatively large compared to the CV of *T. giganteus* and contains fewer tabulae.

Although this cannot be established with certainty, I have the impression, that the valves of *T. alatus* are unequal in size and shape. Specimens with parts of both valves preserved, show a straight RV and a curved, somewhat smaller LV.

The specimens of *T. alatus* described here do not fully correspond with Chubb's Plate 31, Fig. 2: in his specimen the flanges are restricted to the posterior and ventral sides; the tubes, however, are distributed in a belt from the dorsal to the anterior side, whereas they are restricted on the dorsal side in my specimens (compare my Figs. 5 and 6). My specimens appear to show a closer resemblance to Chubb's Plate 32, Fig. 3, the specimen found by Trechmann and described by him as

T. giganteus. This specimen has tubes only on the dorsal side, flanges are lacking, but this may be due to erosion. Points of difference between this specimen and mine are the shape of P_{IV} and the buttress to the left of the CV, considered by Trechmann as "a base of a process for muscle attachment" (TRECHMANN, 1924, Plate XXIII, Fig. 2). Chubb's figures may represent specimens of two different species, but until there is more information available concerning Chubb's specimens I do not think the specimens from St. James' Parish should be separated from *T. alatus*.

CHUBB (1971) doubted whether the Cuban specimens of *Titanosarcolites* described by MAC GILLAVRY (1937) belong to *T. giganteus*. MAC GILLAVRY (1937) himself already noted the heterogeneity of the Cuban material. I have the impression that at least part of it is *T. alatus* as described in this article. The specimen figured on his Plate 2, Figs. 1-4 (refigured as my Fig. 7) possesses the bases of many flanges posteriorly and ventrally. Moreover the shape of mp and its position in relation to the CV correspond with the shape and position of mp in my figure.

It is remarkable that MAC GILLAVRY (1937) describes the polygonal capillaries in the Cuban specimens as being thick-walled, a feature I have only observed in *T. giganteus*. The capillaries of *T. alatus* are very thin-walled. MAC GILLAVRY (1937) recognized the close relationship between *Antillocaprina* and *Titanosarcolites*. As the hinge

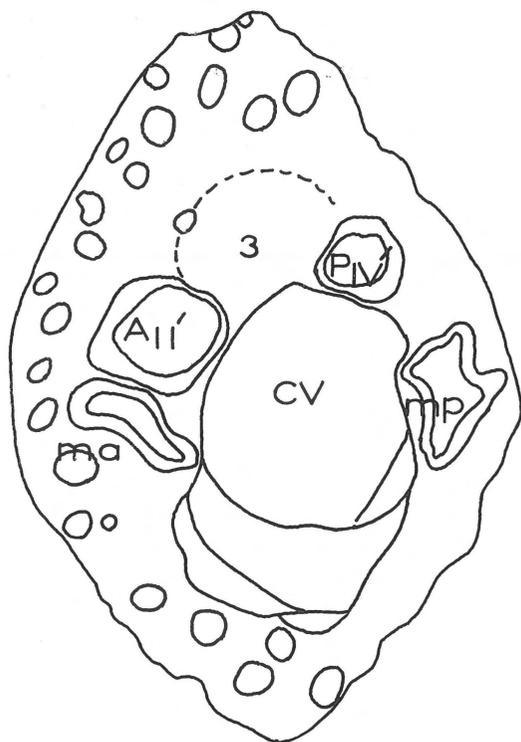


Fig. 9
Titanosarcilites spec., J. 3444, RGM. 190.089, Praebarrettia Bed; road from Springfield to Kensington, some 500 m from Welcome Hall. Transverse section of the RV. The myophores are clearly tooth-like. The teeth are rounded to almost square. x 0.9.

structure upon which he based this relationship is that of *T. alatus* this species could probably represent an intermediate stage in the evolution from *Antillocaprina* to *T. giganteus*. Stratigraphically *T. alatus* and *T. giganteus* appear to have been nearly contemporaneous throughout the section. The first specimens of *Titanosarcilites* are found in the Barrettia Limestone (Sunderland Inlier); it is not possible to make out whether these specimens belong to *T. alatus*, *T. giganteus* or to another species. Only the uppermost part of the section (Vaughansfield Limestone) yielded no specimens of *T. alatus*.

Aberrant forms

Three specimens in the collection have relatively few and large tubes. I believe that they belong to *T. alatus*, as the hinge structure and the myophores are in all respects like those of *T. alatus* (Fig. 8).

One specimen of *Titanosarcilites* evidently possesses tooth-like myophores (Fig. 9). The shell differs from *T. alatus* in the shape of P_{IV} and the size of the hinge structure in relation to the CV; L is also lacking. It differs from *T. giganteus* in that the teeth are rounded to almost square in cross-section and very close to the CV; moreover the ma and mp are large in cross-section and tooth-like, fitting into alveoles.



Fig. 10
Titanosarcilites giganteus (Whitfield) from Logie Green, Jamaica. Drawn after Mac Gillavry's Plate 2, Fig. 6 (1937), which is a drawing after Whitfield's Plate 21 (1897). Note the resemblance to Fig. 1, a specimen of *Titanosarcilites giganteus*. The teeth are rounded.

CONCLUSIONS

- (1) A ligamental hollow seems to be present in principle in the RV of *T. giganteus*, at least in the young stages. The presence of L in the LV cannot be established beyond doubt.
- (2) Division of tubes appears to be the most important mechanism for the formation of new tubes in *Titanosarcilites*. Overgrowing of intervening grooves by costae, if it occurs at all, only plays a minor role.
- (3) The hinge structure and the muscle attachment of *T. alatus* have been determined. The hinge structure displays a close relationship to the hinge structure of *Antillocaprina*, the corresponding shape and location of P_{IV} and L are especially striking.
- (4) *T. alatus* may be an intermediate stage in the evolution of *Antillocaprina* to *T. giganteus*.
- (5) At least some of the Cuban specimens of *Titanosarcilites* described by MAC GILLAVRY (1937) belong to *T. alatus*.

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