

Report of a field meeting to the area around Browns Town, parish of St. Ann, north-central Jamaica, 21st February, 1998

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INTRODUCTION

IT IS an enigma of Jamaican geology that the stratigraphic unit with the greatest areal extent, covering over half the island's surface and with an estimated thickness of 2,750 m (Robinson, 1994, pp. 119, 121), is a sedimentary rock with an unexpectedly poorly known macrofauna. Studies of major invertebrate groups in Jamaica have tended to concentrate on those rocks that are either older or younger, although there are some notable exceptions. It is also noticeable that, over the years, field meetings of the Geological Society of Jamaica have tended to avoid these rocks. We refer, of course, to the mid Cenozoic White Limestone Group, which was first documented over 170 years ago (=white limestone formation of De la Beche, 1827). In an effort to partially redress this imbalance, a field meeting was organised with the aim of concentrating on one of the more fossiliferous units within the White Limestone Group, namely the Browns Town Formation. This trip was centred on the type area of this formation, and aimed to demonstrate a range of limestone lithologies and, particularly, their included faunas.

The Tertiary limestones of Jamaica are biostratigraphically zoned principally on the basis of their included fauna of foraminifers (Hose and Versey, 1957). The various formations of the White Limestone Group (mid Middle Eocene to low Upper Miocene) have been defined on the basis of both lithological and biostratigraphical evidence. These units were deposited in a range of shallow to deeper water palaeoenvironments (Robinson, 1994, p. 119), and are purer and usually more indurated than the various lithofacies of the underlying Yellow Limestone Group.

The Upper Oligocene Browns Town Formation is a shallow-water unit of the White Limestone succession and has a relatively wide areal extent (McFarlane, 1977a; Eva and McFarlane, 1985). The macrofauna of the Browns Town Formation consists principally of echinoids (sea eggs), benthic molluscs and scleractinian corals. Faunal lists for these groups may be found in Dixon (1995), and Dixon and Donovan (1994, 1998) (echinoids); Jung (1972) and McFarlane (1977b) (benthic molluscs); and Wallace (1969), Frost (1972) and McFarlane (1977b) (scleractinians). The larger benthic foraminifers of this unit are discussed by Hose and Versey (1957), McFarlane (1977b), and Robinson and Wright (1993).

This report is based very loosely on part of the field guide of Donovan *et al.* (1995, pp. 40-43). However, more complete information on the palaeontology of the Browns Town Formation is included herein. Grid references used herein refer to the 1:50,000 topographic (metric edition) maps: #3, 'Falmouth-Browns Town', and #7, 'Albert Town-Alexandria'. The relevant 1:50,000 geological sheet was compiled by Bateson (1974). The last recorded field meeting of the Society to this area was over 30 years ago (Lee, 1966; no relation to the owner's of Stop 1), and it was a happy coincidence that his daughter, Wendy, and grandson were able to attend the most recent excursion to this area. Note that the Browns Town area is otherwise famous for its impressive karstic topography (see, for example, Day, 1976). At the time of this field meeting, S.K.D. was a staff member in the Department of Geography and Geology, UWI, Mona.

STOP 1. LEE'S MARL CRUSHING PLANT

The party left the De la Beche Building, UWI, at 8.25 a.m. in five vehicles. The route was west from Kingston on the main A1 road. This turns northwest at the roundabout after Spanish Town. At Moneague the left fork (A1) was followed, towards and through Claremont. At Green Park the turning to Bamboo was taken (B11) and on towards Browns Town. Stop 1 was on the left about 1½ km before Browns Town (NGR 125 936; Fig. 1). We were met here by two further participants, raising the total number of members and friends (including leaders) to 23. Amongst a number of young fossil collectors on the trip, Hannah Donovan, aged 2 months and 10 days, may hold claim to being the youngest participant on a field meeting by the Society!

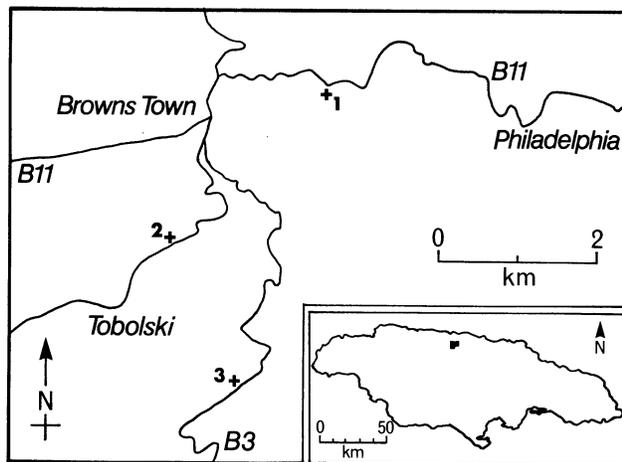


Figure 1. Outline map of the Browns Town area, parish of St. Ann, showing the principal roads. Key: +=stop made on this excursion; 1=Lee's Marl Crushing Plant; 2=disused bauxite pit, Tobolski road; 3=Friendship. Inset map of Jamaica shows region shown on main map (shaded). Redrawn after Donovan et al. (1995, figs 4, 15).

Mr. Lee's Marl Crushing Plant (LMCP) is not currently in operation, unlike that of Mr. Edwards on the opposite side of the valley. In consequence, the more or less weathered faces of LMCP enhance the appearance of at least some fossils *in situ* and prevent the observer from being dazzled by reflection from the very white limestone. Even so, a cap and dark glasses are useful items of field equipment for this, or any, site in the White Limestone Group.

Bedded limestones are exposed on one side of the quarry floor at LMCP, opposite a line of limestone spoil tips. It also has a long, well-exposed face at the back of a limestone bench about 5-6 m above the quarry floor (Fig. 2a). This face is over 100 m in length and 15-20 m high, trending northnorthwest-southsoutheast and curving round to a face that is approximately east-west at the

southern end; there is a sloping gully at the north end of the quarry that enables access to higher horizons. The succession consists of white, grey-weathering beds of biosparitic limestone interbedded with softer, more biomicritic bands in which joints are more clearly developed. Beds dip gently in a northerly direction, are laterally continuous, but are commonly somewhat friable, probably due to pervasive jointing. Calcite spar derived from veins is found loose on the quarry floor.

The predominant fossils are large benthic foraminifers, associated with echinoids (Dixon and Donovan, 1998), calcareous bivalves (particularly oysters, scallops and tubes of *Kuphus*), large and small asteroid ossicles (Professor D.B. Blake, research in progress), sirenian ribs (Appendix 1) and rare bryozoans (Appendix 2). In contrast, aragonitic fossils such as gastropods are rare or absent, although there are some colonial scleractinian corals preserved as calcite casts.

The commonest echinoid is the sand dollar *Clypeaster oxybaphon* Jackson, whose broad test, flattened except at the strongly rounded and inflated ambitus, is distinctive even in cliff section. This is most commonly preserved parallel to bedding, but may also occur in a perpendicular orientation, suggesting possible allochthonous deposition rather than preservation as a life assemblage; this deduction may be supported by the common occurrence of bivalves (mainly scallops) as disarticulated valves. Despite being a large and obvious species that is an important Oligocene (perhaps Upper Oligocene) to Miocene indicator in the Antillean region (W.A. Gordon, 1963; Donovan and Portell, 1996), *C. oxybaphon* was not reported from Jamaica until recently (Dixon and Donovan, 1994, 1998). Many fragments of this species were collected by members of the party. A second species, *Clypeaster batheri* Lambert, is also present, albeit less commonly, and is easily distinguished in lacking an inflated ambitus. A partial test of this species was collected by Mr. D.J. Blissett. A tantalizing fragment of what may be a large, but unidentifiable, spatangoid was collected by H.L.D.

The commonest benthic foraminifer is *Lepidocyclina* sp. or spp. Certain fossils, including *C. oxybaphon* and *Lepidocyclina*, are concentrated in particular horizons; the former are more apparent in the higher, accessible parts of the succession. Many fine specimens of *Lepidocyclina* and rarer nummulitids were collected in the lower face adjacent to the bench. Hitherto, sirenian ribs have been found weathering out at the southern end of the quarry above the level of the bench, that is, the lower part of the section (Appendix 1), but no new specimens were added on this occasion. Scleractinians were best collected from the field adjacent to the quarry at the north end (Fig. 2b) which yielded three species on this occasion.

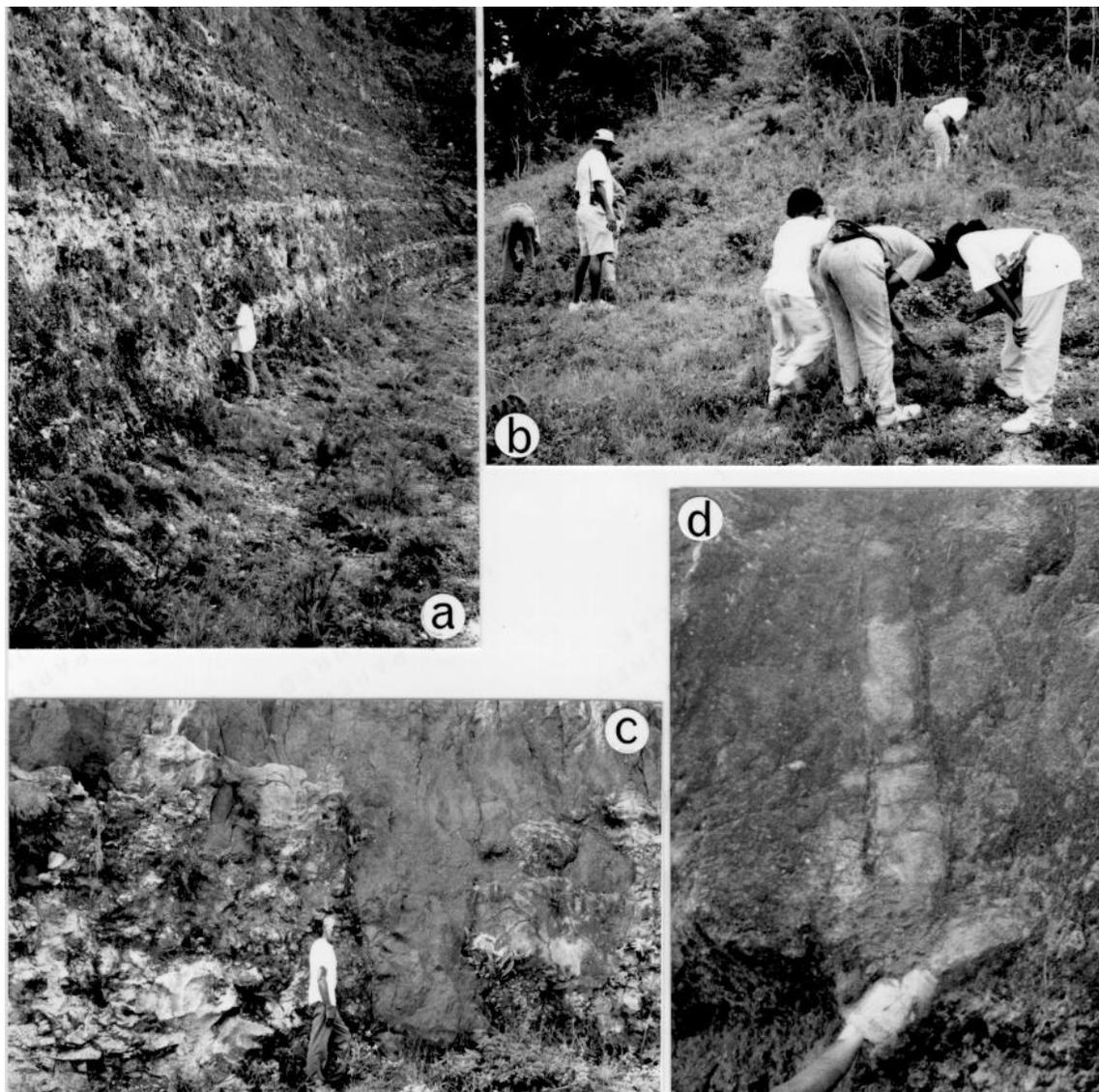


Figure 2. a, b. Stop 1, Lee's Marl Crushing Plant. a. Bedded, fossiliferous limestones in the main face of the quarry, looking southsoutheast. Photograph taken on a 'dry run' prior to the meeting (Mr. C. Donovan for scale). b. Participants collecting fossils from float in the field adjacent to the quarry at the north end. c, d. Stop 2, road to Tobolski. c. Hal Dixon is happy to act as scale for this particularly well-developed bauxite pipe. d. *Kuphus* sp. in life position, at least in the upper part of the figure; finger for scale.

Lunch was taken in Browns Town, west from Stop 1. The middle of town was reached by turning left at the T-junction by the Esso petrol station.

STOP 2. BAUXITE PIPES, ROAD TO TOBOLSKI

Only one participant was lost (but soon rediscovered) during lunch. From Browns Town, we then took the B3 road south towards Alexandria, passing St. Hilda's School, type locality for the heart urchin *Eupatagus hildae* Hawkins, 1927, the first echinoid to be described

from the Browns Town Formation. On the outskirts of Browns Town, we turned southwest towards Tobolski. About halfway between Browns Town and Tobolski is a large, disused, but reclaimed (for cattle grazing), bauxite pit to the left of the road. We stopped at the next road junction, by the south end of the 'uncompleted' road in this pit (NGR 107 916; Fig. 1). This site is illustrated on the back cover of Donovan *et al.* (1995).

The exposures on the right, just before this point, allow close inspection of solution pipes in the limestones of the Browns Town Formation, which have a sharp contact between the bauxite and the strongly karstified

surface of the limestone. This surface shows considerable relief and one pipe is over 1.3 m in diameter (Fig. 2c). The limestones here differ from those at Stop 1 in lacking obvious bedding and perhaps being more bioclastic, although complete fossils are rarer and less varied. The fauna includes articulated bivalves (seen in section), moulds of gastropods and scleractinian corals, benthic foraminifers (particularly *Lepidocyclina*), disarticulated asteroid ossicles, spines of cidaroid echinoids, fragments of echinoid tests (spatangoid?) and other bioclastic debris. As often happens when geologists visit such localities, there was animated discussion concerning the origins of Jamaican bauxite and its relationship to the underlying limestones.

The most notable and prominent faunal elements are common, vertical, *in situ* tubes attributed to the teredinid bivalve *Kuphus* sp. (Fig. 2d); less commonly, these are preserved in other attitudes, including horizontal. At Stop 2, they mainly occur in the higher part of the limestone exposure, from about 'head level' upwards. Two tubes in close association, which may form part of the same individual, suggest a minimum length of over 70 cm, although no specimen was obviously complete; individual fragments are up to about 15 cm in length. Rare specimens preserve the top of the tube with the twin openings for the siphons (Mr. C. Donovan, pers. comm.). Tubes of *Kuphus* sp. are commonly found in life position in shallow-water, Jamaican limestones of Oligocene and Miocene age. These were attributed to *Kuphus* aff. *polythalamia* (Linné) by Jung (1972, table 3), although the suspicion must exist that more than one taxon is present; they also occur as reworked fossils in younger deposits. The palaeoecology of these peculiar 'tube-dwelling' bivalves has been discussed by Savazzi (1994, pp. 72-75). A specimen collected by Dr. S.F. Mitchell preserves the internal mould of an infaunal bivalve and a *Kuphus* tube in close association, which is at least suggestive that the one may have secreted the other. However, both specimens were preserved parallel to bedding, perhaps indicating merely a fortuitous current accumulation.

STOP 3. FRIENDSHIP

The party returned towards Browns Town, but turned right at the junction with the B3 (Top Road), travelling south towards Alexandria. The Friendship pit is about 5 km south of Browns Town (NGR 115 892; Fig. 1). This is a worked-out bauxite mine which has largely been infilled and reclaimed as cattle land. This locality is, presumably, stratigraphically lower than Stop 1, assuming no repetition by faulting. Parking was by the partially-completed bus shelter and, with care, we climbed around or under the barbed wire fence. The

exposure is on the other side of the cattle field, on the bench.

The limestone is a biosparite, more massively bedded than at Stop 1. An excavated bench has yielded over 60 moderately to well-preserved tests of irregular echinoids, particularly the tall species *Clypeaster* cf. *julii* Roman, which is easily differentiated from the low *C. batheri*, which is also present. H.L.D. showed those present a limestone boulder containing at least eight tests of *C. cf. julii*. Other common fossils include colonial scleractinian corals, bivalves and gastropods. The best fossils were to be collected from loose blocks. The mouldic preservation of those animals that had an originally aragonitic skeleton is conspicuous; unlike Stop 1, where scleractinians are commonly replaced by calcite, here they are also preserved as moulds. Scleractinians are particularly common on the slope above the bench; some have been bored by bivalves and preserve the trace fossil *Gastrochaenolites* (Mr. D. J. Blissett, pers. comm.). Previously, a single shark's tooth was found loose on the bench by Dr. Eamon Doyle (ex-U.W.I.) and H.L.D. has separated further fish teeth from bulk samples, but, despite the interest of the group in finding fossil vertebrates, none were located. There are also some cavities in the limestone, undoubtedly of Quaternary age, infilled with lithified terra rosa, and containing limestone pebbles and terrestrial gastropods. These are seen most commonly as loose blocks near the low face at the back of the bench.

The party returned to Kingston after 4.00 p.m., following a refreshment stop at the bar on the main road opposite Stop 3. A vote of thanks on behalf of the Society was given by Mr. Donovan Blissett. Even with some delays on the roads, all vehicles were home by about 8.00 p.m.

ACKNOWLEDGEMENTS — We thank the many geologists who have worked with us in the Browns Town area over the years. Special thanks go to the Lee family for allowing us unrestricted access to LMCP since 1991, and to Donovan Blissett and Ian Brown for their enthusiastic efforts in organising the transport for this meeting.

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APPENDIX 1. Oligocene Sirenia of the Caribbean Region, by Daryl P. Domning

The late Oligocene rocks of the Browns Town Formation have so far produced only fragments of the thick, dense ribs so characteristic of the mammalian order Sirenia (sea cows; manatees and dugongs). However, during the Oligocene the wider Caribbean region was inhabited by diverse members of the sirenian family Dugongidae, representing at least two subfamilies and several genera. Many of these genera and species have only been discovered in the last half-century, and some are still unnamed and undescribed. Any or all members of this incompletely-understood adaptive radiation might conceivably turn up in Jamaica, so Jamaican workers should remain alert to the possibility and desirability of discovering diagnostic specimens (preferably parts of skulls).

The dugongid subfamily Halitheriinae is represented by fossils from the southeastern U.S.A. and from Puerto Rico. Most of these scrappy remains have traditionally been referred to the well-known European genus *Halitherium*; for example, *Halitherium? antillense* Matthew, 1916 (Puerto Rico) and *H. alleni* Simpson, 1932 (South Carolina). Although the validity of these species remains uncertain, they do seem to represent *Halitherium* or a very similar creature. However, at least some of the late Oligocene fossils from South Carolina seem referable to *Metaxytherium*, a genus derived from *Halitherium*, that became widely distributed in the Miocene and Pliocene. Members of the *Halitherium-Metaxytherium* lineage had rather strongly down-turned snouts and small tusks, and seem to have been generalized consumers of seagrass blades and of the rhizomes of smaller seagrass species.

Puerto Rico has also produced a skull of a more distinctive Oligocene sea cow, *Caribosiren turneri* Reinhart, 1959, which was a specialized bottom-feeder with an extremely down-turned snout that altogether lacked tusks (see also MacPhee and Wyss, 1990). Still another apparent halitheriine is known only from two skull fragments, from the late Oligocene of South Carolina, which exhibit a curiously broad frontal bone (Domning, unpublished research).

A second dugongid subfamily, the Dugonginae, has been detected in the Caribbean fossil record only recently, but this region appears to be where this group first arose and diversified. Its most primitive known member is *Crenatosiren olseni* (Reinhart, 1976), from the late Oligocene of Florida and

the Carolinas (Domning, 1997). However, it inhabited that area contemporaneously with at least one other and much more derived dugongine, *Dioplotherium manigaulti* Cope, 1883 (see Domning, 1989a, b). Since still other, even more highly derived, dugongine lineages appear in the early Miocene and thereafter (for example, in the U.S.A., Yucatan and Brazil), it is likely that at least some of them already existed in the Oligocene as well.

Dugongines as a group tended to evolve large, often blade-like tusks that were presumably used to dig up the nutritious rhizomes of the largest seagrasses, such as *Thalassia*. By disrupting beds of these 'climax' species of seagrasses, it is likely that these animals acted as 'keystone species', pushing seagrass communities away from climax stages, and thus increasing their species diversity and biological productivity. This, in turn, would have opened up ecological niches for a more diverse array of herbivores, which helps to explain the coexistence of so many different sirenians in the same general region.

The sirenian family Trichechidae, including today's manatees, was evidently in existence during the Oligocene and was probably present in South America at that time. Although no Oligocene fossils of this family have yet been found in the New World, they may eventually turn up somewhere in the Caribbean.

The sirenian specimens from the Browns Town area have mostly been found at Lee's Marl Crushing Plant (Stop 1 herein); one comes from an infilled bauxite pit at Friendship (Stop 3). They consist of several small fragments of dense ribs, the largest about 20 mm x 30 mm in diameter and 70 mm long. Specimens like these are common in Tertiary marine rocks in many parts of the world and serve to demonstrate the presence of sirenians in local faunas (for example, in the Oligocene of Mississippi, Cuba and possibly Mexico; see Domning, 1996, for references), but by themselves they are not determinable to species or genus.

The known diversity of fossil sirenians, especially in the Caribbean region, is rapidly increasing. Jamaica, located in the centre of this region, lay in the midst of sirenian evolutionary history as well and its rocks doubtless have much more of that history to reveal to the attentive collector.

APPENDIX 2. The Bryozoan *Lacerna* Jullien in the Oligocene of Jamaica, by Paul D. Taylor.

SYSTEMATIC PALAEOLOGY

Phylum Bryozoa
Class Gymnolaemata
Order Cheilostomata
Family Lacernidae Jullien
Genus *Lacerna* Jullien, 1888

Type species. *Lacerna hosteensis* Jullien, 1888, from the Recent.

Lacerna sp.
Figure 3

Material, locality and horizon. One specimen in the collection of The Natural History Museum, London, NHM BZ 4172, from

Lee's Marl Crushing Plant, about 1½ km before Browns Town on the main B11 road from Bamboo, parish of St. Ann, Jamaica (NGR 125 936; Fig. 1). Browns Town Formation, White Limestone Group; Upper Oligocene.

Description. Colony encrusting, sheet-like (Fig. 3a). Autozooids rounded rhomboidal in outline shape, arranged in quincunx. Frontal wall smooth, centrally imperforate, with marginal subcircular areolar pores arranged in one or two rows. Orifice with a narrow sinus and about six orificial spine bases (Fig. 3b). Adventitious avicularia variably present, sometimes paired, located laterally of the orifice, directed proximo-laterally, with a complete pivotal bar. Ovicells not seen.

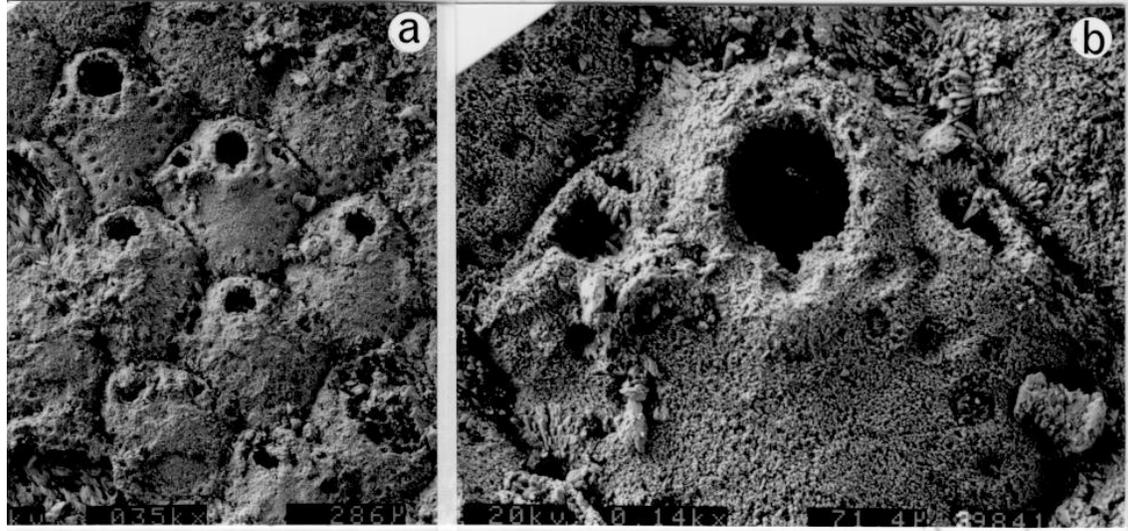


Figure 3. *Lacerna* sp., NHM BZ 4172, from the Upper Oligocene Browns Town Formation of Jamaica. **a.** Detail of colony showing quincunx arrangement of autozooids; scale bar represents $1.5 \times 286 \mu\text{m}$. **b.** Orifice of an autozoid flanked by avicularia; scale bar represents $1.5 \times 71.4 \mu\text{m}$.

Remarks. *Lacerna* is an ascophoran cheilostome bryozoan with about 20 extant species distributed from pole to equator. According to Canu and Bassler (1920, p. 345), this genus ranges back to the Eocene, although all fossil species are in need of re-evaluation using modern taxonomic concepts. Notably, Canu and Bassler (1920) placed some species with avicularia in the genus, although avicularia are lacking in the type species (revised by López Gappa, 1977). Species having these small, mandibulate polymorphs, which probably serve a defensive function, were explicitly excluded from *Lacerna* by D.P. Gordon (1984). The bryozoan from Lee's Marl Crushing Plant has adventitious avicularia on some, but not all, autozooids (feeding zooids) (Fig. 3b) and would therefore not belong in *Lacerna sensu stricto* according to D.P. Gordon's

revised diagnosis. D.P. Gordon (1984) transferred some avicularia-bearing species to *Buffonellodes*, but in this genus the avicularium is located just beneath (proximal of) the orifice in contrast to the Jamaican species, in which the avicularia are positioned laterally of the orifice. In the absence of a suitable alternative genus, the Jamaican bryozoan is provisionally referred to as *Lacerna* sp.

Lacerna sp. from the Browns Town Formation is moderately well-preserved and the colony can be classified within the membraniporiform category of bryozoan growth forms. Membraniporiform colonies live in a wide range of depths in well-oxygenated marine environments where shells or other hard substrata are available for encrustation.