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Invertebrate palaeontology of Wait-a-Bit Cave, Jamaica: a brief review

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Abstract: Caves may be important sites for fossil collectors. Specimens younger than the cave may form part of the sediment fill; fossils older than the cave may be identified in the sedimentary rocks forming the walls. Both forms of occurrence are known from the bountiful caves in the Cenozoic limestones of Jamaica. The Wait-a-Bit Cave, parish of Trelawny, is a notable example of the latter. The cave penetrates the Eocene Stettin Formation, Yellow Limestone Group. Echinoids and larger benthic foraminifers are well-known from this site; molluscs await detailed systematic investigation; one notable occurrence of the boring *Entobia* is the only trace fossil known; and groups such as bryozoans, scleractinian corals and decapod crustaceans are unknown, yet likely to be present. The undescribed elements of the invertebrate fauna of this cave await adequate investigation and would form an ideal study for a postgraduate degree.

Keywords: Borings; echinoids; foraminifera; geomorphology; molluscs; Stettin Formation; Yellow Limestone Group.

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Introduction

The palaeontologist looks for fossils in caves both in the sedimentary fill and in the surrounding bedrock. Fossils that form part of the sedimentary record filling a cave include the shells and bones of organisms that either lived (and died) there (e.g., Rudwick, 1972, Fig. 3.8; Stringer *et al*., 2000; O'Connor and Lord, 2013) and/or those that were washed in as victims of floods or other allochthonous skeletal remains (Andrews *et al*., 1999; Donovan and Veltkamp, 1994, Fig.7; Donovan, 2017). Such deposits might be rich in fossil remains and provide a selective sample of a terrestrial biota that otherwise would remain unknown (e.g., Paul and Donovan, 2006; Baalbergen and Donovan, 2013).

A different source of fossil specimens, older than those of the cave fill, come from the walls of a cave enclosed by a sedimentary rock, commonly limestone. This must be older than the sedimentary sequence within the cave and is likely better lithified. Caves are commonly a karst feature in soluble rocks, so fossils may be partially etched out of the walls and easily recognized (e.g., Donovan, 2015). The excellent exposure provided by the walls of a cave may permit sedimentary sections to be measured and the palaeoecology to be investigated.

Jamaica has faunas identified from both situations. The island's cave studies benefit from Fincham (1997), an encyclopaedic gazetteer of the island's caverns and cave surveys. He referred to the through-cave discussed herein as Lichfield Cave, but I maintain the name that I used in earlier papers, Wait-a-Bit Cave (Fig.1). The limestones of the walls of this cave are highly fossiliferous, as reviewed below, and they invite further study (see 'Discussion').

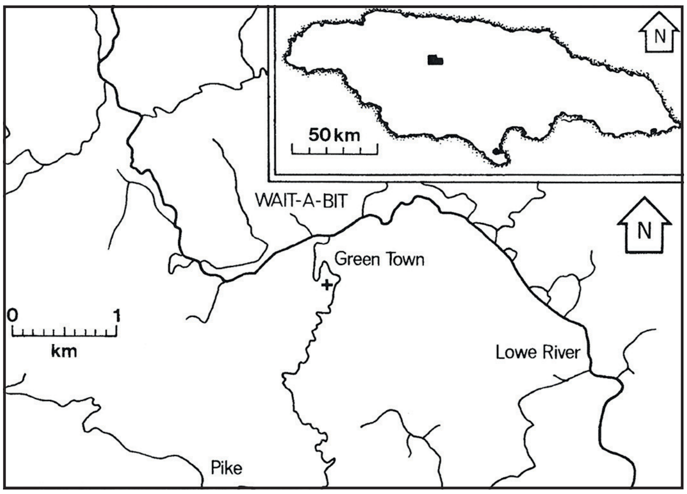

Figure 1: *Locality map of the Wait-a-Bit area, parish of Trelawny, Jamaica.*
Key: *thick line = main Christiana to Albert Town road (A5); thinner lines = minor roads;* **+** *= location of Wait-a-Bit Cave.*
Inset *is an outline map of Jamaica showing the approximate position of the main map (black rectangle).*
[After Miller and Donovan, 1996a, text-fig. 1.]

Locality and horizon

The following account is adapted from Miller and Donovan (1996a, b) and Donovan (2002). Wait-a-Bit Cave (or Lichfield Cave; Fincham, 1997, p.227) (NGR 951 769), south of Green Town, parish of Trelawny (Fig.1), is an archetypal rectangular passage, downstream of which is a 15m-high cliff with a prominent overhang more than 10m deep and 8–8.5m high (Fig.2). The cave also has a secondary upper side entrance (C–C′) about 6–7m above the level of the stream, forming a short, steeply sloping passage down to the 'main' cave meander, which shows a range of stream conduit, geomorphological features. The cave and the surrounding area include a well-exposed succession within the Stettin Formation (Porter and Robinson, 1974), which has yielded a diverse Eocene fauna.

Wait-a-Bit Cave is a small through-cave with a short, single-conduit, sinuous passage about 20–25m long, up to 5m high and 5–10m wide (Fig.2). The entrance consists of a small, sub-horizontal rift at the base of a 15m-high cliff. The cave exit (near to section E–E′) is a far larger. The cave passage shape is controlled by approximately horizontal limestone beds. The passage is marked by vertical walls in nodular, rubbly, impure limestone, while the ceiling consists of a sub-horizontal bedding plane within more massive limestone (= units 1 and 2, respectively; see below).

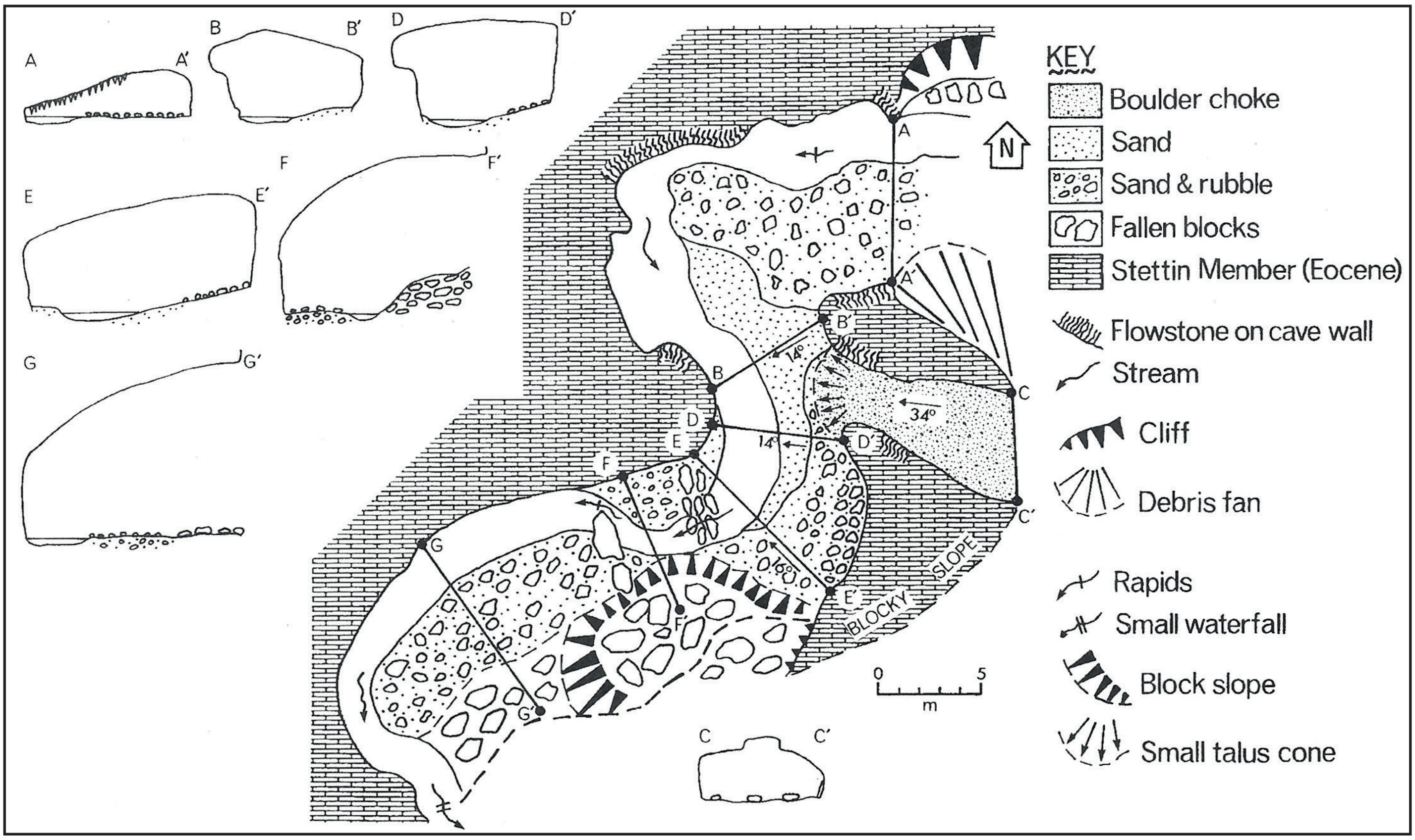

Figure 2: *Cave survey and selected passage cross-sections (A–A' to G–G') of Wait-a-Bit Cave, parish of Trelawny, Jamaica. [After Miller and Donovan, 1996a, text-fig.2.]*
The thick dashed line to the west of E', and south of F' and G', marks the edge of the limestone overhang from the northwest (see Miller and Donovan, 1996a, pl.2, figs 2, 3).

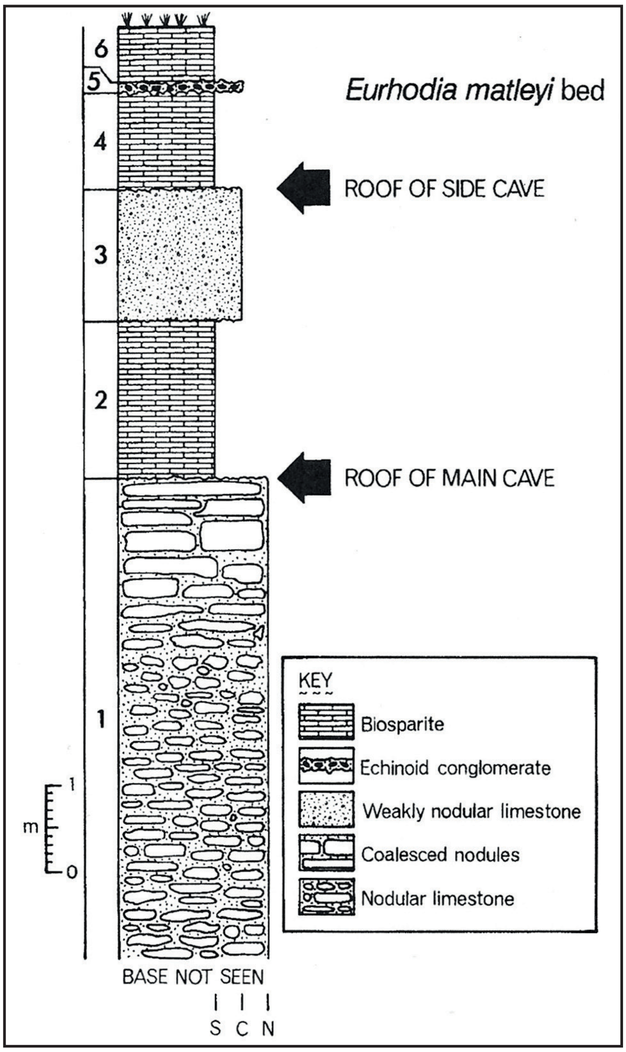

Figure 3*: Strip log of measured section through the Stettin Formation, Yellow Limestone Group, at Wait-a-Bit Cave, showing the principal limestone horizons present. [After Miller and Donovan, 1996a, text-fig. 3.]*
Unit 2 forms the roof of the main cave;
Unit 4 forms the roof of the side cave (Fig.2).
Key*: **S** = sparite; **C** = pebble conglomerate or weakly developed nodular limestone; **N** = well-developed nodular limestone with cobble- to boulder-sized clasts.*

The cave entrance (A–A′) is a relatively small, horizontal rift about 8m wide which is supported by near-vertical walls. The remainder of the cave passage (B–B′ to E–E′) is predominantly rectangular with a sub-horizontal roof supported by near-vertical walls. The rectangular cave exit, near section E–E′, is much wider. Downstream of section E–E', the cave passage gives way to a vertical wall about 4.7–5.0m high, above which is a pronounced overhang (sections F–F′ and G–G′; Fig.2) rising to about 8.5m and over 10m wide. The roof is relatively unstable with many fresh exposures due to collapse. The upper side entrance forms a similar, but steeper, sloping, rectangular-shaped passage which connects with the main conduit between sections B–B′ and D–D′. The main process causing collapse at Wait-a-Bit Cave is probably mechanical erosion and undercutting by the free-swinging, meandering stream. Roof and wall breakdown also explains why the exit passage is larger than the entrance, an unusual situation for a river cave, and suggests mechanical erosion and entrenchment is the main process of cave formation. Speleothems festoon some of the cave walls in the form of straw- and slightly larger stalactites, and flowstone and dripstone pendants, curtains and buttresses.

The lithological succession at Wait-a-Bit Cave is illustrated in Figure 3. Unit 1 consists of large limestone nodules up to 400+ by 180mm in maximum dimension. These nodules are elongated parallel to bedding and discontinuous, separated by partings of grey, slightly silty clay that has been compacted between and around them. The unit shows differential cementation, probably because of pressure solution. Nodules are loose, and numerous rock falls have occurred. Prominent macrofossils include spatangoid echinoids, bivalves, gastropods, rare nautiloids and sirenian ribs.

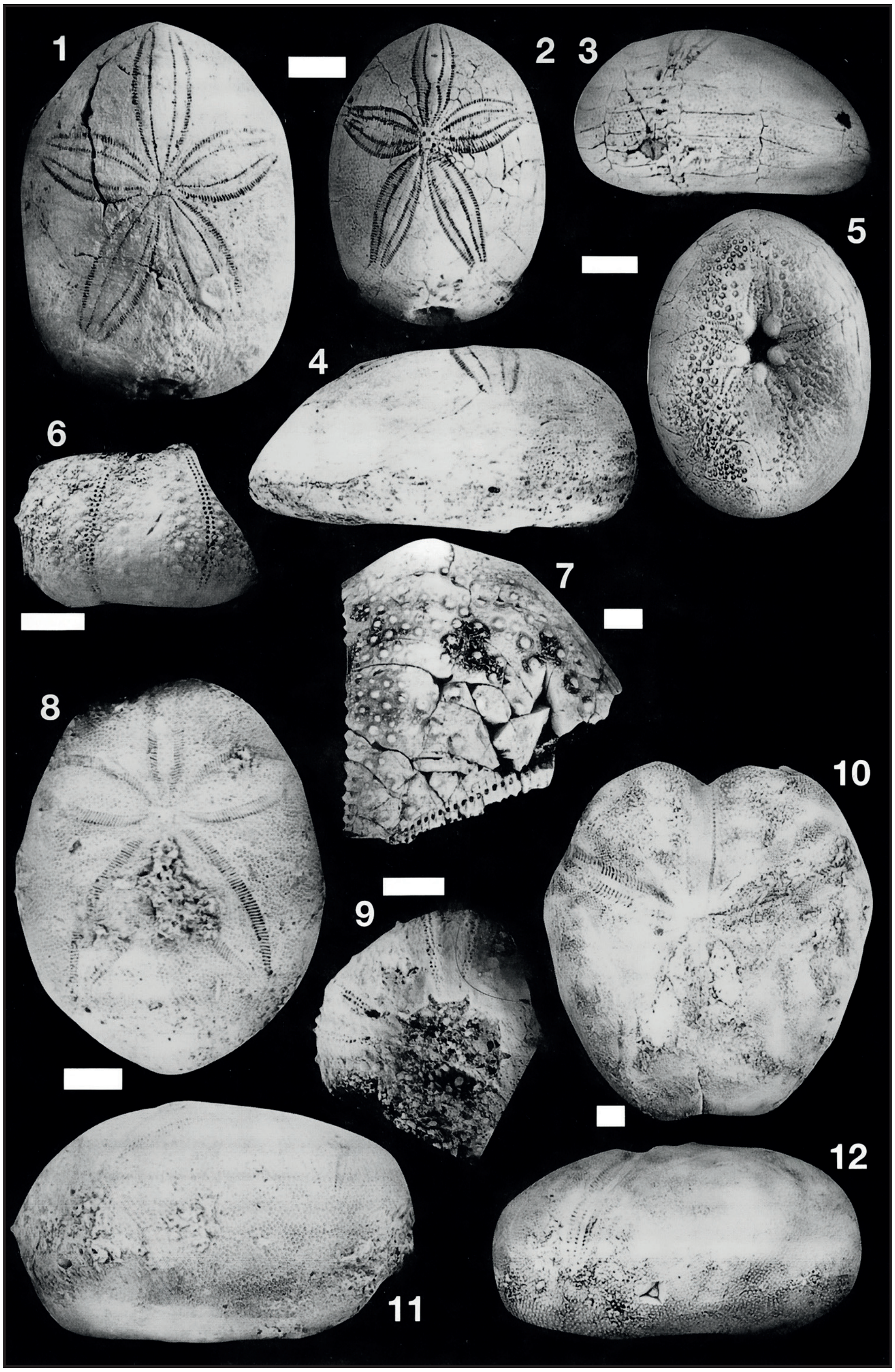

Figure 4:
Eocene echinoids of Wait-a-Bit Cave, parish of Trelawny, Jamaica.

All specimens in the Natural History Museum, London (prefix NHMUK).

(1–5) Eurhodia matleyi *(Hawkins, 1927).*
(1, 4) *NHMUK EE 5194.*
(1) *Apical view.*
(4) *Lateral view (anterior to right).*

(2, 3, 5) *NHMUK EE 5193.*
(2) *Apical view; note the growth deformity, a constriction in the petal of ambulacrum III.*
(3) *Lateral view (anterior to left).*
(5) *Oral view.*

(6, 9) Stenechinus regularis *Arnold and Clark, 1927, NHMUK EE 5203.*
(6) *Lateral view.*
(9) *Oral view.*

(7) Plagiobrissus*? sp., NHMUK EE 5201, apical view of test fragment, anterior towards top of figure.*

(8, 11) Echinolampas clevei *Cotteau, 1875, NHMUK EE 5202.*
(8) *Apical view.*
(11) *Lateral view, anterior to right.*

(10, 12) Schizaster hexagonalis *Arnold and Clark, 1927, NHMUK EE 5198.*
(10) *Apical view.*
(12) *Lateral view (anterior to left).*

All scale bars represent 5mm.

[After Miller and Donovan, 1996a, pl.3.)

The roof of the main cave is formed by the base of unit 2 (Fig.3), cut by major joints, but essentially continuous. This unit comprises a well-indurated, straw- to brown-coloured biosparite that is rich in macrofossil fragments and microfossils.

Units 2, 4 and 6 are lithologically similar, with unit 4 constituting the main roof of the side cave (Fig.3). Unit 3 presents a similar lithology to that of unit 2, but is less well indurated and also weakly nodular. Unit 5 is an unusual echinoid coquina, which contains numerous complete tests of the cassiduloid *Eurhodia matleyi* (Hawkins, 1927) (Figs 4.1–4.5). This bed displays particularly undulose contacts with the adjacent units, varying in thickness between 50mm and 120mm. *Eurhodia* is also prsent within units 2 and 4.

The Stettin Formation represents a transgressive. carbonate platform deposit typically containing a fauna of Early Eocene larger benthic foraminifers (Robinson, 1988; Robinson and Wright, 1993, p. 285; Robinson and Mitchell, 1999).

The nodular carbonates of unit 1 are inferred to have been deposited as lime-rich muds and silts, carbonate nodules having formed during diagenesis.

Order Pedinoida	
	Stenechinus regularis Arnold and Clark, 1927 (Figs 4.6 and 4.9)
Order Phymosomatoida	
	Phymosoma? sp.
Order Cassiduloida	
	Eurhodia matleyi (Hawkins, 1927) (Figs 4.1 – 4.55)
	Echinolampas clevei Cotteau, 1875 (Figs 4.8 and 4.11)
Order Clypeasteroida	
	neolaganid gen. et sp. indet.
Order Spatangoida	
	Plagiobrissus loveni (Cotteau, 1875)
	Plagiobrissus? sp. (Fig. 4.7)
	Schizaster hexagonalis Arnold and Clark, 1927 (Figs 4.10 and 4.12)

Table 1: *Echinoids of the Eocene Stettin Formation, Wait-a-Bit Cave, parish of Trelawny, Jamaica. [After Miller and Donovan, 1996a.]*

***Figure 5:** Nautiloid* Hercoglossa *sp. from Wait-a-Bit Cave, Jamaica, Florida Museum of Natural History UF 67001. [After Donovan* et al*., 1995, fig. 1.1). Specimen c.118mm maximum dimension.*

The included fauna, such as burrowing bivalves and the heart urchin *Schizaster hexagonalis* Arnold and Clark, 1927 (Figs 4.10; 4.12), support this interpretation. *Campanile trevorjacksoni* Portell and Donovan, 2008, was probably a shallow-water algal feeder (Jung, 1987, p.895) and sirenians feed on sea grass (Domning, 1981).The inference that sea grass was present suggests that this unit was deposited in relatively shallow water, less than 50m and probably no more than 25–30m. Units 2–6, comprised mainly of calcarenites, have a different echinoid fauna, dominantly *E. matleyi* and neolaganid sand dollars. *Eurhodia matleyi* is thought to have burrowed in or, more probably, lived epifaunally upon relatively coarse-grained sands, a habit similar to that of other cassiduloids (Smith, 1984, p.47). Carter *et al*. (1989) considered that neolaganids broadly similar to the Wait-a-Bit species varied from epifaunal to infaunal in grainstone substrates. Unit 5, the *E. matleyi* coquina, suggests that these beds were deposited at least above storm wave base, with what were presumably live tests of this species having been concentrated by an energetic event.

Class Cephalopoda	
	Hercoglossa sp. (Fig.5)
Class Bivalvia	
	Cardium (*Trachycardium*) sp. of Trechmann (1923, p.363)
	burrowing bivalves indet.
Class Gastropoda	
	Campanile trevorjacksoni Portell and Donovan, 2008 (Fig.6)

***Table 2**: Molluscs of the Eocene Stettin Formation, Wait-a-Bit Cave, parish of Trelawny, Jamaica. [After Donovan* et al*., 1995; Miller and Donovan, 1996a; Portell and Donovan, 2008.]*

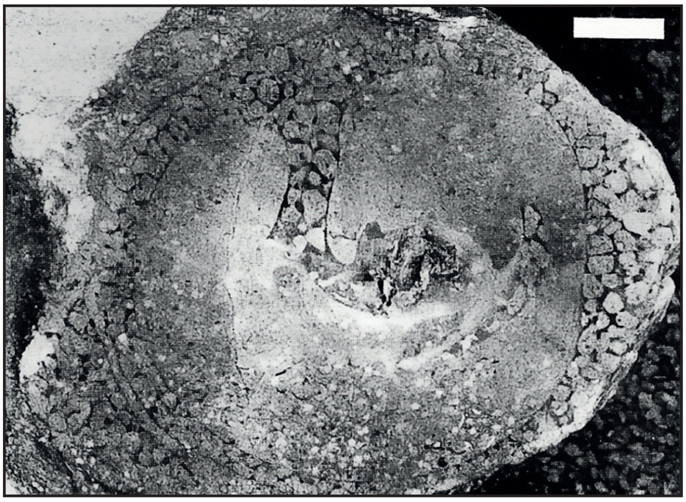

***Figure 6**: Polished, oblique transverse section (viewed under water) of* Campanile trevorjacksoni *Portell and Donovan, 2008, infested by* Entobia *isp. cf.* E. laquea *Bromley and d'Alessandro, 1984.*
[After Donovan and Blissett, 1998, fig.1.]
This view shows the more apical end of the specimen.
Scale bar represents 10mm.
[University of the West Indies Geology Museum specimen number UWIGM 1997.17.]

If these echinoids were indeed buried alive, as seems probable, their occurrence in this thin unit would support the inference that they were only, at best, weak burrowers. Alternately, this unit might represent a hiatal concentration, although the complete preservation of tests and the absence of an encrusting epibiota is more suggestive of a rapid deposition event.

Echinoids

The one group of Eocene macrofossils from Wait-a-Bit Cave that have been studied in detail are the echinoids. There are eight known species (Table 1).

The illustrated succession of the Stettin Formation, Wait-a-Bit Cave, can be broadly divided into two groups of sedimentary facies, unit 1 and units 2–6 (Miller and Donovan, 1996a, pp. 45–47). The commonest echinoids are limited to particular lithofacies, indicative of original environmental preferences. Infaunal *Schizaster hexagonalis* is limited to the nodular limestones (unit 1) that were originally bioturbated, lime muds stabilized in seagrasses in less than 30m of water. This contrasted with overlying beds. *Eurhodia matleyi* and neolaganids were probably mainly epifaunal, found only in carbonate sands and echinoid conglomerates (units 2–6), deposited within storm wave base in a shallow water, low energy, lagoonal setting.

Molluscs

The Eocene molluscs of Wait-a-Bit Cave are undoubtedly diverse, but in need of detailed study. The few taxa named herein (Table 2) are the big and the beautiful. Preservation is commonly mouldic and, to be blunt, they are not the most attractive fossils to be found on the island; see the plates in Trechmann (1923). Specimens identified to genus were collected from float.

Cephalopods are a rare component of the Jamaican Cenozoic (Portell *et al*., 2004). The single conch of *Hercoglossa* sp. (Fig.5) may be conspecific with a specimen from western Jamaica (Schmidt and Jung, 1993; Donovan *et al*., 1995).

Cardium (*Trachycardium*) sp. of Trechmann (1923, p.363) is a large and obvious bivalve mollusc. Other, smaller, burrowing bivalves are apparent in the walls of the cave (Miller and Donovan, 1996a, p.45). The giant gastropod *Campanile trevorjacksoni* Portell and Donovan, 2008, is discussed under trace fossils (below).

Trace fossils

The burrows and borings of the Yellow Limestone Group need detailed examination by systematic ichnologists, unlike the older Richmond Formation and younger White Limestone Group, both of which have been studied in detail (Donovan *et al*., 2015; Donovan and Blissett, in press). The only recent examination of a site in the Yellow Limestone Group was from the Litchfield Formation (Donovan and Portell, 2019), which identified four ichnotaxa of borings. The one nominal trace fossil from Wait-a-Bit Cave is the sponge-boring *Entobia* isp. cf. *E. laquea* Bromley and D'Alessandro, 1984, infesting the giant gastropod *Campanile trevorjacksoni* Portell and Donovan, 2008 (= *Campanile* sp. A of Jung, 1987) (Fig.6). This specimen is significant in that the borings infest a calcite cast of the snail shell, undoubtedly bored before recrystallisation. Jamaican *Campanile* is almost invariably preserved as an internal mould, so this specimen is notable both for its ichnology and taphonomy.

Benthic foraminifera

(Adapted from Miller and Donovan, 1996a, p. 38.) The biostratigraphy of Wait-a-Bit Cave and the Stettin Formation was considered by Robinson (1993, Locality ER973, table 2), Robinson and Wright (1993, fig.6a) and Robinson (1969, Locality 10967). Robinson and Wright (1993, p.285) considered the Stettin Formation to represent a transgressive, carbonate platform deposit containing a typical fauna of larger benthic foraminifers, including *Verseyella jamaicensis* (Cole), *Fabularia colei* Robinson, *Coleiconus zansi* Robinson, *Peneroplis* spp. and *Helicostegina gyralis* Barker and Grimsdale. Taken together, these indicate an Early Eocene age (Robinson and Wright, 1993, fig.2). *Coleiconus zansi* from ER973 was figured by Robinson and Wright (1993, figs 7.4; 7.6; 7.7) (also as '*Coskinolina*' *elongata* Cole in Robinson, 1969, pl. 2, fig.7, pl. 3, figs 3; 5) and *F. colei* from Locality 10967 by Robinson (1969, pl. 1, fig.7).

Discussion

This brief review has two purposes, one informative, the other inquisitive. I am delighted to bring the Eocene invertebrates of the Wait-a-Bit Cave to a wider audience, although it remains known only patchily. The echinoids and benthic foraminifera are well-known. Molluscs and trace fossils are recorded only sparingly, although there are certainly more taxa to be recorded. Some groups remain to be recognized from the Cave, let alone described; bryozoans, scleractinian corals and decapod crustaceans (but see below), amongst others, are probably present, but need to be recorded adequately.

To date, the only vertebrate fossils recorded are ribs of a primitive sirenian or dugong (Miller and Donovan, 1996a, p.46). These cannot be identified further without reference to superior specimens such as crania.

The undescribed specimens already known make the site a temptation for a postgraduate researcher, which I encourage. Museums with collections from Wait-a-Bit Cave are few, but include the Geology Museum, University of the West Indies, Kingston (UWIGM), and the Florida Museum of Natural History, Gainesville (FLMNH XJ018;

[https://specifyportal.floridamuseum.ufl.edu.ip/];

includes one calappid crab, and gastropods *Conus*, *Paraseraphs* and *Xenophora*).

Certainly, there is great potential for a research project in Eocene palaeontology in and around Wait-a-Bit Cave. Any new collections should be deposited in the UWIGM to comply with the current legislation in Jamaica. The field is wide open – I am not aware of any serious field or laboratory research being carried out on the Eocene fauna of Wait-a-Bit Cave since the 1990s.

Acknowledgements

Writing this review has taken me back 30 years to the joint field programme with my colleague, Dr David J. Miller, when I learnt so much about Jamaica's marvellous karstlands. So, I dedicate this paper to him and his insightfulness in the field – thanks, Dave. I also thank my external reviewers, Mr Roger W. Portell (Florida Museum of Natural History, Gainesville, USA) and Dr Donovan J Blissett (University of the West Indies, Mona, Jamaica), for their constructive comments.

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