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Reef corals of the White Limestone Group of Jamaica

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Sedimentary rocks of the White Limestone Group of Jamaica were deposited in a range of shallow- to deep-water marine settings from the Middle Eocene to Middle Miocene. Horizons rich in scleractinian corals occur throughout this lithologic unit. The present study, using large, new collections (>2,000 specimens) and museum specimens, recognises 98 scleractinian species in 42 genera in the White Limestone Group. Thirty-six of these species have not been previously described in the literature. From the Middle to Upper Eocene, eleven species are reported from the Troy Formation, twelve from the upper Middle Eocene Swanswick Formation and eleven species from the Late Eocene Somerset Formation. In the Moneague Formation, fifty-two species are recorded from the lower part of the Upper Oligocene succession in units formerly mapped as the Browns Town Formation. Also, in the uppermost Oligocene of the Moneague Formation, sixty-four coral species are reported from rocks formerly mapped as the Newport Formation. An additional fifteen species are reported from the Early Miocene portions of the Montpelier Formation. In addition to scleractinian corals, a stony octocoral species (*Parapolytremacis* sp.) is found in the Upper Oligocene of the Moneague Formation, and at least two species of *Millepora* (class Hydrozoa) are recorded from the Eocene and Oligocene portions of the White Limestone Group.

Coral assemblages from the Eocene of the White Limestone Group are largely dominated by scattered, thinly branched and free-living corals, while Late Oligocene assemblages contain a diverse group of large massive, plate-shaped and branched corals in a system of patch reefs and coral carpets. The Early Miocene assemblage represents a possible deeper forereef community transported into deep water sediments in an olistostromic block. The total number of species found exceeds that known from any other single region or lithologic unit in the Caribbean Eocene through Miocene.

KEY WORDS: Scleractinia, reefs, Paleogene, Neogene, White Limestone Group, Jamaica.

Introduction

The Early to Middle Tertiary was a period of significant changes in Caribbean coral reef communities. The Middle Eocene has been interpreted as a time during which the first true coral reefs of the Tertiary were developing in the Caribbean and coral species numbers were increasing (Frost, 1972, 1977a; Budd, 2000). A species turnover event apparently separated Eocene faunas from those of the Late Oligocene, widely recognised as the acme of Tertiary reef development in the Caribbean and Mediterranean (Vaughan, 1919; Frost, 1972, 1977b; Budd, 2000). An even more significant extinction or turnover event has been described from the Lower Miocene (Edinger & Risk, 1994, 1995) during which corals and reefs were drastically reduced in numbers.

However, our understanding of coral diversity patterns in the Caribbean Paleogene through Early Neogene is based on relatively few well-sampled faunas. In a recent review of Caribbean Tertiary reef corals, Budd (2000) tabulated fewer than twenty well-described assemblages from the Caribbean Eocene to Middle Miocene. Many of these assemblages are from units composed of mixed siliclastic/carbonate sedimentary rocks deposited in marginal reef settings, for example, the Eocene localities in Chiapas (Mexico) described by Frost & Langenheim (1974). This lack of adequate sampling through the Middle Tertiary clearly limits the scale at which patterns in coral community change can be examined. Therefore, in order to be able to interpret finer-scale variation in Caribbean coral diversity and reef evolution through the Tertiary, more fossil collections are needed from shallow-water carbonates representing true reef facies.

The Eocene to Middle Miocene White Limestone Group of Jamaica preserves a nearly continuous Middle Eocene to Middle Miocene record of macro-invertebrate faunas across a shallow-water carbonate bank in the centre of the Caribbean/Western Atlantic coral province. Horizons rich in transported or *in situ* reef corals occur throughout this lithologic unit and are exposed across broad areas of the island (Figure 1). This provides a unique opportunity to examine reef community structure and reef coral biodiversity in one region within the Caribbean over some 20+ million years.

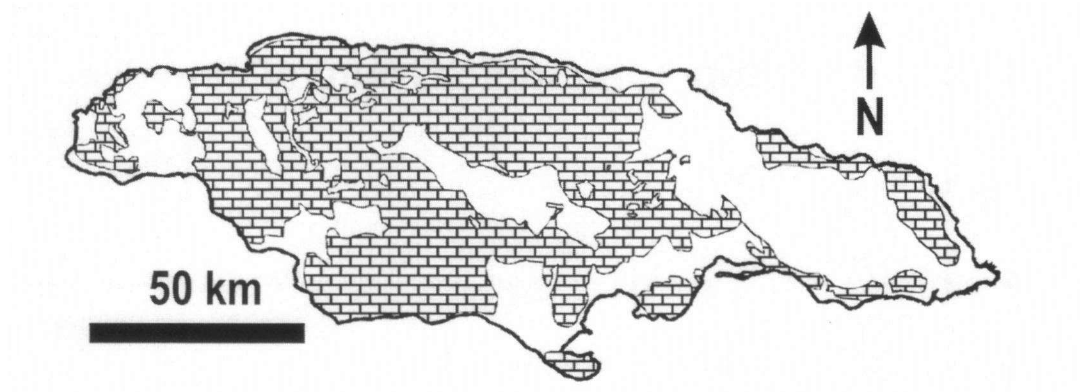


Figure 1. Simplified geologic map of Jamaica showing distribution of White Limestone Group (= block pattern) (modified from Robinson, 1994).

The present study represents a preliminary review of the reef corals of the White Limestone Group, and includes an examination of material deposited in museums as well as some extensive new collections made by the author from 1999 through 2002. A provisional set of species diagnoses was developed for the fauna as a step toward documenting patterns of diversity and palaeoecologic change in the Jamaican coral community from the Middle Eocene to the Middle Miocene. These patterns can then be related to the local geologic history of Jamaica as well as to the overall history of Caribbean reefs.

The White Limestone Group

The White Limestone Group of central Jamaica includes sedimentary rocks of Middle Eocene through Middle Miocene age (Robinson, 1994, 2004). These pure carbonate sedimentary rocks were deposited in a range of shallow- and deep-water environments (Mitchell, 2004) and are exposed across nearly half of Jamaica (Figure 1).

While the White Limestone Group is exposed to a varying extent across the entire island, its age and stratigraphy are best understood from exposures in the Clarendon Block of central Jamaica (Robinson, 1994; Robinson & Mitchell, 1999). Mitchell (2004) has recently revised the lithostratigraphic nomenclature of the White Limestone Group of central Jamaica. Based on this revision, the relationships of the coral-bearing lithologic units within the White Limestone are shown in Figure 2. The Eocene formations have been recognised as reasonably discrete units for some time as have the chalks of the Montpelier Formation (Robinson, 1994; Robinson & Mitchell, 1999; Mitchell, 2004). The Moneague Formation is used here to describe rocks that had been traditionally mapped as the Oligocene Walderston and Browns Town formations, and the largely Lower to Middle Miocene Newport Formation (Mitchell, 2004).

The rocks of the White Limestone Group are made up of pure carbonates that were deposited across a series of carbonate banks and intervening troughs that mark the northern edge of the Nicaragua Rise (Droxler *et al.*, 1998; Robinson & Mitchell, 1999). The unit as a whole overlies and, in part, interfingers with the impure carbonates and clastics of the Lower to Middle Eocene Yellow Limestone Group (Robinson & Mitchell, 1999), and is capped by the carbonates and mixed siliciclastics of the Neogene Coastal Group (Robinson, 1994). The base of the White Limestone Group generally represents the onset of complete inundation of the island and flooding of all local sources of siliciclastics, while the top coincides with the tectonic reactivation of Jamaica and consequent uplift and erosion of Tertiary and Cretaceous rocks (Robinson, 1994; Mitchell, 2004). A possible unconformity (McFarlane, 1974) may separate the Eocene portion of the White Limestone Group from parts of the Oligocene-Miocene Moneague Formation, but otherwise the section appears to be reasonably continuous.

The biostratigraphy of the White Limestone Group is relatively well known, allowing most units to be linked into an international standard. Parts of the deeper-water facies have been related to international zonation schemes based on planktonic foraminifera and calcareous nannoplankton (Robinson, 2004). Robinson (2004) has produced a well-documented zonation of shallow-water facies based on large benthic foraminifera. This zonation has been followed in the present work.

The Eocene coral-bearing units of the White Limestone Group (Figure 2) include the Troy Formation, a largely micritic, recrystallized and commonly dolomitised unit; the upper Middle Eocene Swanswick Formation, composed of algal- and foraminifer-rich grainstones; and the Upper Eocene Somerset Formation, consisting chiefly of foraminiferal packstones. Eva & McFarlane (1985) considered the Troy and Somerset formations to represent a lagoonal or protected inner platform facies, while the coarser-grained rocks of the Swanswick Formation were considered to be part of a shoal or shelf edge facies.

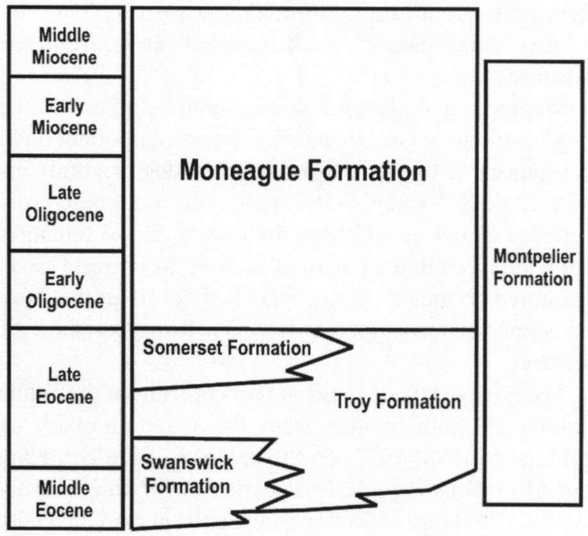


Figure 2. Simplified stratigraphic relationships of coral-bearing lithologic units in the White Limestone Group (after Mitchell, 2004). See text for unit descriptions. Vertical scale schematic and not meant to reflect relative unit thicknesses, or duration of time intervals.

McFarlane (1974, 1977) proposed a possible unconformity between the Eocene portion of the White Limestone Group from parts of the Oligocene-Miocene Moneague Formation, a thick unit generally comprised of pure white, recrystallized sedimentary rocks ranging from large foraminifer grainstones and reefal carbonates to dense fossil-poor micrites. The Moneague Formation as presently defined (Mitchell, 2004) was probably deposited in a variety of shallow-water carbonate environments from protected 'back reef' habitats through patch reef and possibly barrier and fringing reef systems (Wallace, 1969; McFarlane, 1974; Eva & McFarlane, 1985).

Corals are also present in parts of the bedded chalks of the Montpelier Formation. These scleractinians co-occur with other benthic macro-invertebrates in olistostromic blocks or coarse-grained bioclastic lenses that apparently represent material transported from shallow carbonate banks into bathyal environments during the Tertiary. This transported fauna is best known from northern coast areas of the central Clarendon Block (Wallace, 1969; Land, 1991; see below).

History of research

Although the White Limestone Group is the thickest and most widely exposed stratigraphic unit in Jamaica, comparatively little research has been published on its constituent macro-invertebrate fauna. While considerable work has been published on fossil scleractinian assemblages from Jamaica as a whole, most studies have concentrated on the Cretaceous, earliest Paleogene or Late Neogene parts of the geologic column. In fact, no palaeontological descriptions have been published on any part of the White Limestone coral fauna.

Duncan (1863, 1864, 1868, 1873) and Duncan & Wall (1865) presented lists of species and published descriptions of corals from the Jamaican Upper Cretaceous, from the Lower-Middle Eocene Yellow Limestone Group and the Richmond Formation, as well as from the Neogene Coastal Group. Similarly, Vaughan (1899, 1919) and Wells (1934a, 1935) also described Cretaceous, Early Eocene and Neogene corals, but revealed nothing about corals from the White Limestone Group. The most recent published coral faunal lists from Jamaica also have centred on Neogene/Quaternary Coastal Group scleractinians and reefs (Budd *et al.*, 1994; Budd & McNeil, 1998; Mitchell *et al.*, 2001).

For the most part, work on Jamaican Paleogene corals has focused on material from the Lower to Middle Eocene Yellow Limestone Group, chiefly from the Chapelton Formation (*e.g.*, Vaughan, 1899; Wells, 1934a, 1935). Work on the Neogene in Jamaica has traditionally concentrated on the Pliocene Bowden Formation (Duncan, 1863; Vaughan, 1919; Budd *et al.* 1994; Budd & McNeil, 1998). This may, in part, be the result of preservation and collection bias since both these units are composed of mixed carbonate/siliciclastic sedimentary rocks that commonly yield well-preserved casts of coral skeletons. The dense, pure carbonates of the White Limestone Group, however, generally preserve only scattered, mouldic material that is difficult to separate from surrounding limestone. A similar preservational bias has also been proposed as a factor contributing to the relatively low apparent diversity of White Limestone Group echinoids (Dixon & Donovan, 1994).

The lack of published work on much of the White Limestone corals may also be related to overall patterns in Caribbean scleractinian diversity. Detailed records of Middle to Late Eocene Caribbean coral faunas are rare and diversity appears to be relatively low at most sites (Budd *et al.*, 1992; Budd, 2000). Indeed, there are only six well-documented Eocene coral assemblages known in the entire Caribbean-western Atlantic region (Budd, 2000). Similarly, Early and especially Middle Miocene Caribbean coral faunas are also scarce (Budd, 2000; Johnson, 2001).

Oligocene corals and reefs, however, are comparatively much more common across the Caribbean (Vaughan, 1919; Frost, 1977a; Edinger & Risk, 1994; Budd, 2000). Not surprisingly, most of the published accounts of corals and reefs in the White Limestone Group cover material from the Upper Oligocene portion of the unit.

Wallace (1969) provided a list of nineteen scleractinian species in fourteen genera in a description of coral-rich facies from a thick section of Upper Oligocene rocks from the White Limestone Group along a railroad cut near the town of Thickets north of Browns Town, parish of St Ann. This section has been described as having been part of a fossil shoal reef system (Wallace &

Frost, 1976). Frost (1972, 1977a) and Frost & Langenheim (1974) also briefly discussed part of the coral fauna collected from the north and south sides of the Clarendon Block in what is here considered the Moneague Formation. Frost & Langenheim (1974) specifically noted two species, *Montastraea limbata* (Duncan, 1863) and *Psammocora trinitatis* Vaughan *in* Vaughan & Hoffmeister, 1926 (= *Coscinaraea colei* Frost *in* Frost & Langenheim, 1974) from the Moneague Formation. Neither of these species were encountered in collections of the author or in museum collections from the White Limestone Group (see below).

Coral-bearing localities in the White Limestone Group have been noted in several published field guides and overviews of Jamaican geology. An Oligocene patch reef exposed near the Tobolski loading station of the Kaiser Bauxite mine southwest of Browns Town, parish of St Ann, was briefly described by Woodley & Robinson (1977) and Liddell *et al.* (1984). This well-known site is found in beds formerly mapped as Browns Town Formation, but now considered part of the Moneague Formation. East of Browns Town, Donovan *et al.* (1995) noted scattered colonial corals in the type locality of the Browns Town Formation, Lee's Marl Crushing Plant (Mitchell, 2004).

Wright & Robinson (1974) briefly discussed the coral fauna near Browns Town. These authors noted also that abundant corals mark the base of the ?Oligocene/Miocene Newport Formation (here defined as part of the Moneague Formation). No locality information was given, however, and this 'coral marker' is not recorded elsewhere in the literature.

Mapping and general stratigraphic studies of the White Limestone Group have noted some important coral occurrences in the unit. Specific mentions of corals include Hose & Versey's (1957) citation of a single coral species (*Meandrina* sp.) from the Eocene Troy Formation near Claremont in the parish of St Ann. Robinson (1969) also noted abundant, thinly branched corals in the Troy and Somerset formations at Red Gal Ring, parish of St Andrew.

The most detailed record of reef corals from the White Limestone Group comes from the mapping work of McFarlane (1974, 1977) on the geology of the Dry Harbour Mountains region of the parish of St Ann. McFarlane's (1974) large collections, deposited in the University of the West Indies Geology Museum (UWIGM), formed an important resource in the present study. Using lithostratigraphic definitions of units similar to those in use for the Eocene Formations in the present study, McFarlane (1974, 1977) recorded seven coral species from the Troy, five in the Swanswick and six in the Somerset formations from localities across the northern part of the parish of St Ann. Additionally, McFarlane (1974, 1977) cited thirty-nine species and two subspecies from the Oligocene of the Moneague Formation near Browns Town.

Species as Figured or Labelled	Troy Fmn.	Swanswick Fmn.	Somerset Fmn.	Comments
Astrocoenia cf. *duerdeni*		X		not found
Astrocoenia cf. *incrustans*	X			*Astrocoenia jukesbrownei*
Astrocoenia sp. (branching form)	X			= *Madracis* sp. A
Astrocoenia sp.		X		= *Stylocoenia* sp. A
?*Stylocoeniella* n.s.?		X		= *Stylocoenia* sp. A
Stylophora affinis		X		not found
Stylophora contorta ?			X	= *Pocillopora* sp. A.
Stylophora sp.			X	= *Pocillopora* sp. A & *Millepora sp.*
Porites sp.	X		X	= *Goniopora taberi* & *Millepora* sp.
Goniastrea variabilis		X		*Hydnophora variabilis*
Oculinid sp			X	not found
Meandrina sp.	X			= *Meandrina (Placocyathus)* sp. A.
Acanthophyllia sp.	X			= *Antillia* sp. ?
Antillocyathus sp.			X	= *Trachyphyllia* sp. A
Placotrochus sp.			X	= *Antillia hadleyi*
Flabellum sp.	X			= *Trachyphyllia* sp. A
Balanophyllia ponderosa	X			= *Antillia* sp ?.

Table 1. Corals recorded from the Eocene of the White Limestone Group by Hose & Versey (1957) and McFarlane (1974, 1977). Comments are based on examination of labelled material in UWI collections (from Hose & Versey, 1957; Zans *et al.*, 1963; McFarlane, 1974) and indicate identifications of this material based on species diagnoses from the present study (see Table 3). The comment 'not found' indicates that no specimens labelled with the listed species name were found in museum collections studied.

Species as Figured or Labelled (McFarlane, 1974)	Comments
Acropora crassa	= *Acropora* C
Acropora panamensis	= *Acropora panamensis*
Astrocoenia D'Archiardii	= *Astroocoenia incrustans*
Astrocoenia decaturensis	= *Astrocoenia portoricenis*
Astrocoenia portoricensis	= *Astrocoenia portoricensis*
Stylophora affinis	= *Stylophora* G
Stylophora canalis	= *Stylocoenia* A
Stylophora goethalsi	= *Stylophora geothalsi*?
Stylophora granulata	= *Stylophora geothalsi*?
Stylophora imperatoris	= *Alveopora* A in part
Stylophora macdonaldi?	not found
Stylophora panamensis	= *Stylophora* G
Stylophora ponderosa	not found
Stylophora portobellensis	= *Stylophora imperatoris*
Calamophyllia dendroidea?	not found
Leptoseris portoricensis	= *Fungophyllia* A in part
Trochoseris sp.	= *Fungophyllia* A
Porites anguillensis	= *Porites chipolanum*
Porites baracoaensis	= *Porites baracoaensis*
Porites boracoaensis var. *matanzasensis*	= *Porites baracoaensis*
Porites panamensis	= *Porites portoricensis*
Porites toulai	= *Porites portoricensis*
Goniopora canalis?	= *Porites portoricensis*
Goniopora clevei	= *Porites portoricensis* & *Actinacis barretti*
Goniopora portoricoensis	= *Porites portoricensis*
Agathiphyllia sp.	= *Agathiphyllia hilli*
Antiguastrea cellulosa	= *Antiguastrea cellulosa*
Diploastrea crassolamellata	= *Diploastrea crassolamellata*
Diploastrea crassolamellata var. *magnifica*	= *Diploastrea crassolamellata*
Goniastrea variabilis	= *Hydnophora variabilis*
Leptoria spenceri	= *Leptoria spenceri*
Montastrea annularis?	= *Antiguastrea prava* & *Solenastrea bournoni*
Montastrea cavernosa	= *Colpophyllia willoughbiensis*
Montastrea imperatoris	= *Antiguastrea cellulosa*
Montastrea tampaensis	not found
Montastrea costata	= *Diploastrea* A
Thysanus sp	= *Trachyphyillia* A
Oculinids	= *Leptoseris* C
Septastrea sp.	not found
Meandrina antiguensis	= *Colpophyllia duncani*
Meandrina filograna?	not found

Table 2. Corals recorded from the Oligocene of the White Limestone Group by McFarlane (1974, 1977). These corals are from localities in the Dry Harbour Mountains, parish of St Ann, from the Browns Town Formation, here considered to be a part of the Moneague Formation. Comments are based on examination of labelled material and figured specimens (McFarlane, 1974) in UWIGM collections and indicate identifications of this material based on species diagnoses from the present study (see Table 3). The comment 'not found' indicates that no specimens labelled with the listed species name were found in museum collections studied.

All of McFarlane's (1974) figured and non-figured specimens, along with material in the Versey (1957) and Zans collections (UWIGM), were examined and placed into the taxonomic framework (see below) of the present work. On the whole, species designations listed in McFarlane (1977) do not closely match designations based on the present study, although the number of species listed for each Eocene stratigraphic unit is fairly close to the number now recognised in the UWIGM material.

Among the Eocene coral specimens examined (Table

1), six scleractinian and one hydrocoral species (*Millepora* sp.) were identified from the Troy Formation. For the Swanswick Formation, two of five listed species (McFarlane, 1977) were not found and two were synonymised. Among the deposited coral specimens from the Somerset Formation one of six listed species (McFarlane, 1977) could not be located, one was synonymised and one additional form was identified (*Millepora* sp.).

McFarlane's (1974, 1977) material from the Upper Oligocene portions of the Moneague Formation was also examined in a re-evaluation of earlier published faunal lists for the Browns Town Formation (Table 2). In this case, McFarlane's (1977) list of coral species and subspecies can be reduced from forty-one taxa to a total of twenty-seven species in the material studied.

Material

The present work examined reef corals from extensive new collections by the author and from the above-noted material in the UWIGM as well as the Florida Museum of Natural History (UF). All the material studied was collected from the Clarendon Block with key localities in the parishes of St Andrew, St Ann, Manchester and Trelawny (Figure 3).

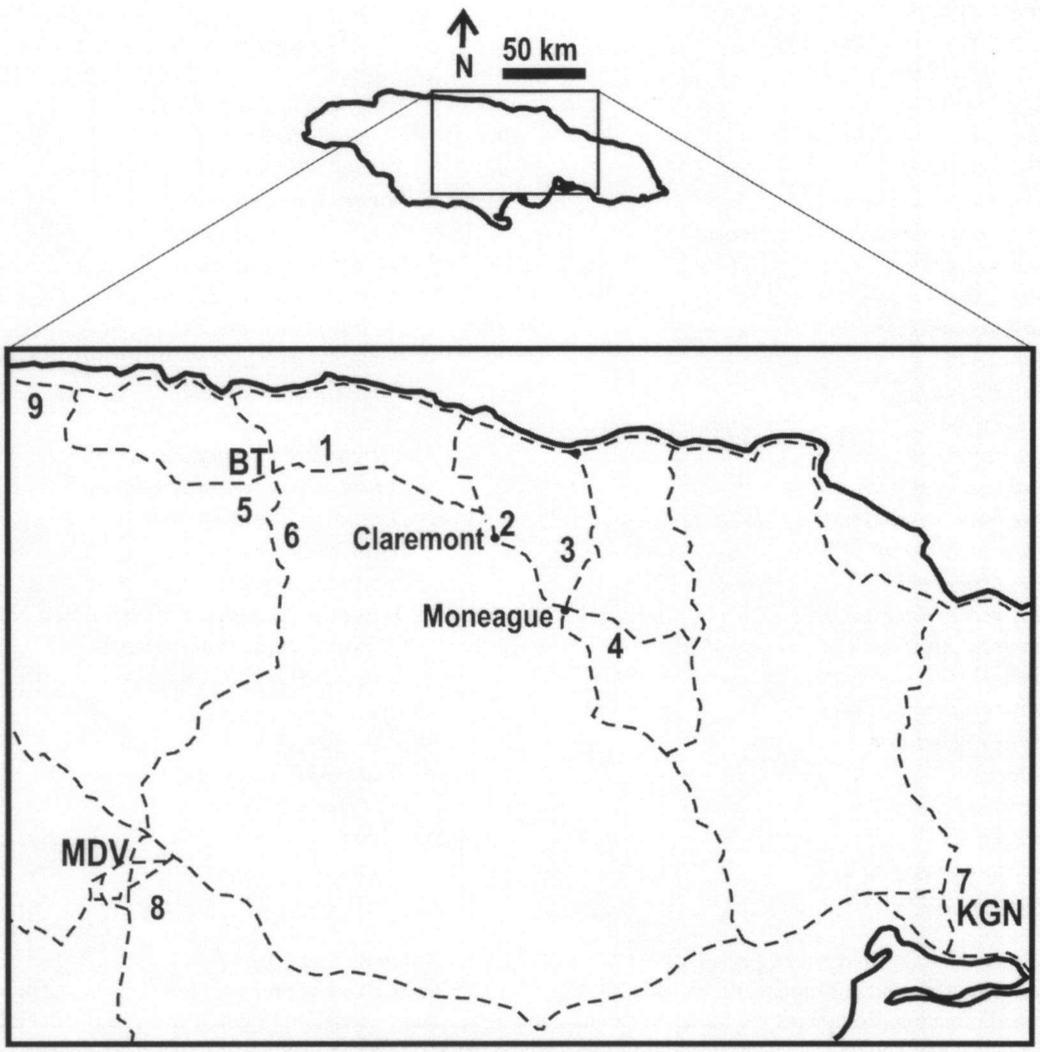


Figure 3. Map showing important coral localities in the White Limestone Group noted in text. Jamaica shown along with an inset of the Clarendon Block. Dashed lines indicate major roads. Numbers indicate positions of key localities; all parish of St Ann unless stated otherwise. Key: **1.** Troy, Swanswick and Somerset Formation localities west and north of the town of Philadelphia. **2.** Troy Formation locality near Claremont. **3.** Swanswick Formation locality, Pimento Hill, Beecher Town. **4.** Moneague and Somerset Formation localities, Schwallenburgh Bauxite Mine excavations. **5.** Moneague Formation locality, Tobolski Load Station. **6.** Moneague Formation locality, Kaiser Bauxite Mine excavations, Knutsford. **7.** Somerset Formation locality, Red Gal Ring, parish of St Andrew. **8.** Moneague Formation locality, Kirkvine Bauxite Mine excavations, Albion, parish of Manchester. **9.** Montpelier Formation locality, quarry west of Duncans, parish of Trelawny. **BT** = Browns Town; **KGN** = Kingston; **MDV** = Mandeville.

		Colony Form	Corallite Diameter	Corallite Spacing	Number of Septa	Columella	Branch Thickness	Additional Comments
Family Astrocoeniidae								
Astrocoenia	*decaturensis*	M	2.2-3.5	0.2-0.4	16	–	–	–
Astrocoenia	*incrustans*	M	1.4-1.8	0.1-0.3	16	–	–	columnar, massive or knobby
Astrocoenia	*jukesbrownei*	M	1.1-1.4	0.1-0.4	16	strong	–	encrusting, small massive; distinct pali
Astrocoenia	*portoricensis*	B	1.2-1.6	0.2-0.5+	16	–	20-30	–
Stephanocoenia	A	M	2.4-3.1	<0.5-1.0	24	1.0	–	small massive
Stephanocoenia	B	M	3.0-4.0	>1.0	24	–	–	small massive; weak pali
Stylocoenia	A	M	0.8-1.0	0.3-0.5	12	small	–	small knobs or massive
Stylocoeniella	A	B	0.5-0.7	<.2	6	–	12	rounded branches
Stylocoeniella	B	B	1.0-1.2	0.3-0.5	6?	–	5-10	flattened branches
Family Pocilloporidae								
Madracis	*decaseptata*	B	1.3-1.7	–	10-20	–	10-20	10 major septa; up to 10 minor septa
Madracis	A	B	1.6-2.1	1.5-2.6	8-16	–	5-9	exsert corallites; 8 major septa
Pocillopora	*arnoldi*	B	0.8-1.0	<1.0-1.4	rare	none	5-10	corallites with raised rim, smooth surface
Pocillopora	A	B	0.5-0.7	0.5-0.7	none	none	6x17	flat branches; raised calicular rim
Seriatopora	A	B	<0.7	0.7-1.0	6-12 weak	weak	2.5-4	spacing in series 1-1.5 mm; granulate surface
Stylophora	*affinis*	B	0.8-1.0	1.0-1.5	6+6 weak	–	18-34	clusters of rounded branches
Stylophora	*cambridgensis*	B	0.8-1.0	<0.4	–	–	8-10	flattened, twisted branches
Stylophora	*canalis*	B	>1.0	0.8-1.0	–	–	10-20	–
Stylophora	*goethalsi*?	B	0.5-0.8	0.5-0.8	6	high	7.5-17	branches flat with bifurcating ends
Stylophora	*granulata*	B	0.8-1.0	0.5-0.8	–	–	<10	smooth surface
Stylophora	*imperatoris*	B	0.8-1.0	0.5	6	–	>30	broad plate-shaped branches
Stylophora	*minor*	B	<0.7	0.6-1.0	6	–	4-6.5	smooth
Stylophora	*undata*	M	0.8-1.0	0.5-0.8	6	–	–	nodose, granulate surface
Stylophora	*willoughbyi*	B	0.6-0.8	<0.8	6	–	8-10	flat or rounded branches
Stylophora	F	B	0.5-0.8	0.8-1.5	6	–	20-30	branching frequent
Stylophora	G	B	1.0-1.2	0.5-0.8	6	–	12-15	smooth round branches
Family Acroporidae								
Acropora	*panamensis*	B	0.5-1.0	3.0-4.0	weak	weak	20-40	sub-immersed corallites; dense coenosteum
Acropora	*saludensis*	B	1.0-1.2	1.5-3.0	6	strong	10<30	exsert corallites; costate coenosteum
Acropora	B?	B	–	–	–	–	<5	poorly preserved, abundant thin branches
Acropora	C	B	0.8-1.0	0.3-0.5	6 weak	–	35-45	palmate branches
Astreopora	*antiguensis*	M	2.0-2.5	1.0-2.0	12	–	–	small massive
Astreopora	*goethalsi*	B	1.5-2.0	0.5-1.5	–	–	15-25	–
Dendracis	*cantabrigiensis*	B	0.8-1.0	0.6-1.4	–	–	3-8	–
Family Agariciidae								
Gardineroseris	A	M	3.0-6.5	–	40-55	weak	–	polygonal corallites, abundant endotheca
Leptoseris	*anguillensis*	P	2.5-5.0	4.0-14.0	20-30	weak	–	15 septocostae/5 mm; thin branched plates
Leptoseris	*portoricensis*	P	2.0-3.5	–	6-12	–	–	8 septocostae/5 mm; false corallites; broad plates
Leptoseris	*walli*	P	2.0-3.2	5.0-10.0	25-30	weak	–	no series, 25-30 septocos/5 mm, broad plates
Leptoseris	C	B	5.0-10.0	<12.0	40-65	weak	3.5-10	individuals budded along branches
Leptoseris	D	P	5.0-6.0	–	45-55	weak	–	8.0-9.0 mm between series
Pavona	A	M	0.4-0.7	<0.4	10-12	strong	–	small knobs
Trochoseris	*meinzeri*	F	38-57	–	>150	weak	–	height 2.0-2.5 mm; ?attached
Family Siderastreidae								
Pironastrea	*antiguensis*	M	vw5.0-6.0	–	–	–	–	short valleys
Siderastrea	*conferta*	M	5.0-6.3	–	72-80	–	–	large-small massive
Siderastrea	A	M	3.2-4.5	0.5-0.8	59-62	–	–	small knobs, acute walls
Siderastrea	B	M	3.0-4.0	thick	40-46	weak	–	–
Family Actinacididae								
Actinacis	*alabamensis*	M	1.0-1.3	0.6-1.0	17-20	–	–	5-6 pali
Actinacis	*barretti*	B	0.8-1.0	0.8-1.5	12-16	–	10-20	dense clusters of flattened branches

		Colony Form	Corallite Diameter	Corallite Spacing	Number of Septa	Columella	Branch Thickness	Additional Comments
Family Poritidae								
Alveopora	*tampae*	M	1.8-2.7	0.5-1.0	12	strong	–	massive columnar
Alveopora	A	M	1.2-1.8	0.5-1.0	weak	–	–	small massive usually <10 cm
Goniopora	*imperatoris*	M	1.9-2.2	0.8-1.0	–	–	–	nodular-massive
Goniopora	*panamensis*	M	2.7-3.2	1.5-2.3	–	–	–	massive > 10cm
Goniopora	*taberi*	B	3.2-3.5	<0.6	22-25	low	9-12	cd > than Wells (1934)
Porites	*anguillensis*	M	1.6-2.2	>0.3	12	–	–	massive-laminar
Porites	*baracoaensis*	B	<1.2	–	12	–	10-20	cerioid with rounded branches
Porites	*chipolanum*	M	1.5-1.8	<0.4	12	–	–	mounds 10 cm +
Porites	*macdonaldi*	P	1.2-1.4	–	–	–	–	platy with irregular corallite distribution
Porites	*portoricensis*	B	1.6-1.8	–	12-14+	–	17-25+	sub-cerioid,. large colonies
Porites	*trinitatis*	M	1.6-1.8	0.3-0.5	12	–	–	small massive
Porites	*waylandi*	M	1.0-1.5	0.8-1.5	–	simple	–	small knobs
Porites	A	B	<0.6	0.4-0.8	–	–	<6-8.7	*Goniopora*? *christianiaensis* (Wells, 1934a)
Family Faviidae								
Agathiphyllia	*hilli*	M	7.0-12.0	–	>60	–	–	many with cd >10 mm
Agathiphyllia	*tenuis*	M	2.5-3.5	1.0-2.2	24-26	–	–	8-12 pali, large colonies >10 cm
Agathiphyllia	A	M	3.5-6.0	2.0-7.0	~48	–	–	unequal costae 3 mm wide; small knobs 5 cm
Antiguastrea	*cellulosa*	M	4.5-6.0	0.6-1.5	>40	–	–	–
Antiguastrea	*prava*	M	2.1-3.4	0.4-0.8	24-26	–	–	columnar
Caulastraea	*portoricensis*	PB	7.0-11.0	–	>40	–	–	wall thickness 0.55 mm
Caulastraea	A	PB	5.0-8.0	–	12-24	–	–	12 distinct widely separated septa, strong costae
Caulastraea?	B	PB	5.5-8.0	–	40-55	absent	–	epithecate
Colpophyllia	*duncani*	M	vw 10-16	–	16-21/cm	–	–	–
Colpophyllia	*willoughbiensis*	M	vw 4.0-8.0	–	30/cm	–	–	–
Diploastrea	*crassolamellata*	M	7.0-12.0	–	60	–	–	thin septa
Diploastrea	A	M	5.0-7.0	1.0-2.0	36-40+	weak	–	–
Diploria	*portoricensis*	M	vw 6.0-9.0		20/cm	–	–	explanate-massive; acute collines
Favites	*mexicana*	M	8.0-14.0	<0.2	16-20/cm	–	–	with minor septa 8-10/5 mm
Favites	*polygonalis*	M	9.5-20.0	0.4-0.6	8-11/cm	–	–	–
Goniastrea	A	M	3.0-5.0	0.5-1.0	20/5 mm	solid	–	weak lobes, 30 septa in small corallites
Goniastrea	B	M	4.0-7.0	0.5-1.5	>40	weak	–	distinct lobes on major septa
Hydnophora	*variabilis*	M	vw 3.0-4.0	–	–	thin	–	15-22 septa per colline
Hydnophora	A	P	vw 4.0-6.0	–	6-8/5 mm	–	–	thick septa >0.5 mm
Leptoria	*spenceri*	M	vw <6.0	–	–	–	–	–
Montastraea	*canalis*	M	4.0-6.0	1.5-2.5	30-36	–	–	strong costae
Montastraea	*cylindrica*	M	4.5-6.0	3.0-5.0	24-28	–	–	–
Montastraea	*endothecata*	M	6.5-8.0	3.5-8.0	–	–	–	–
Montastraea	*nodosa*	M	4.0-5.0	<2.5	30	–	–	–
Montastraea	*tampaensis*	M	4.5-5.5	–	42-48	–	–	exsert corallites
Montastraea	*trinitatis*	M	2.0-3.5	<2.0	35	–	–	elliptical corallites uncommon
Montastraea	A	M	5.3-7.4	2.0-6.2	29-38	–	–	–
Montastraea	B	M	5.6-7.0	3.0-5.0	40-46	–	–	thick costae; similar to *M. cavernosa* morph-2 of Budd *et al.*, (1994)
Solenastrea	*bournoni*	M	2.0-2.5	1.0-2.0	24	–	–	small massive
Family Rhizangiidae								
Hexastrea	A	M	7.0-9.0	<0.3	=>12	high	–	6 major septa reach exsert columellar spine
Family Trachyphylliidae								
Trachyphyllia	A	F	25-40	–	14-17/cm	12X6	–	elliptical or pinched

		Colony Form	Corallite Diameter	Corallite Spacing	Number of Septa	Columella	Branch Thickness	Additional Comments
Family Meandrinidae								
Meandrina (Placocyathus)	A	F	25-30	–	28-32/cm	–	–	height 18-25 mm
Family Oculinidae								
Galaxea	*excelsa*	M	2.9-5.4	–	–	–	–	–
Oculina	A	B	3.0-4.5	1.0-2.0	~48	–	15	deep corallites; smooth coenosteum
Oculina	B	B	2.0-4.0	3.0-5.0	~24	–	8-14	costate coenosteum
Family Mussidae								
Antillia	*hadleyi*	F	30-50	–	>100	–	–	slightly elliptical outline; thin septa, height <7 cm
Mussa	A	PB	14-24	3.0-5.0	24/cm	–	–	–
Family Pectiniidae								
Fungophyllia	A	P	>100	–	8-10/cm	–	–	septa >1 mm at centre; attached solitary coral; may possess some small peripheral corallites
Family Dendrophylliidae								
Balanophyllia (Eupsammia)	*clarendonensis*	F	8.0-12.0	–	>60	2.2	–	height 12 mm; large for this species
Subclass Octocorallia								
Family Helioporidae								
Parapolytremacis	A	B	0.8-1.2	3.0-5.0	12-20	–	6-18	round to elliptical branches, short pseudosepta

Table 3. Diagnostic characters used in identification of anthozoan species from the White Limestone Group. Genera are listed alphabetically according to family as defined by Wells (1956). Notes on species synonymies are given in Appendix 1 and text. Previously undescribed species are listed here only with provisional letters. Measurements are given in mm unless otherwise stated and indicate typical ranges for specimens examined for this study. Abbreviations for Colony Form are as follows: M = massive; B = branching; PB = phaceloid branching; P = plate shaped; F = free living or attached solitary. Corallite Diameter for meandroid corals is measured as width of valleys (vw). Corallite spacing is measured between corallites from wall to wall (see text for description). Number of septa are given per corallite or listed as the number of septa per cm or per 5 mm along the corallite wall or colline for meandroid coralla. Dashes are given for characters that are not applicable, not available or not clearly diagnostic for a species. For the octocoral, *Parapolytremacis* A, values for Corallite Diameter and Corallite Spacing are measurements of Autopore Diameter and Spacing respectively and Number of Septa equals the Number of Pseudosepta.

The Troy Formation produced only scattered, relatively poorly preserved, mouldic coral colonies nearly all of which are from previously collected material reposited in the UWIGM (see above). Most are found in northern and eastern portions of the parish of St Ann. While the Troy Formation is generally a fossil-poor micrite, it also contains localised beds of coarser-grained limestone with large molluscs and uncommon corals. This facies has been variously termed the 'Claremont fauna' (Cox, 1941), the 'Phacoides band' (Hose & Versey, 1957) or the 'Claremont Limestone' (see Mitchell, 2004, for review). It is material from this facies that has produced the bulk of the corals known from the Troy Formation.

Corals from the Swanswick Formation were examined from localities north of the towns of Philadelphia and Bamboo, parish of St Ann (Figure 3). Each of these sites yields typically more than five specimens of recrystallized coral skeletons. The most important collecting locality in the Swanswick Formation is found at Pimento Hill near Beecher Town in eastern St Ann (Figure 3, locality 3). Here, large (5-25 cm), massive and phaceloid colonies weather out of a hill slope along with small blocks of grainstone rich in rhodoliths and large benthic foraminifera. The site also yields a rich fauna of irregular echinoids (Donovan, 2004).

Compared to the other Eocene units in the White Limestone Group, corals are fairly common and widespread in the Somerset Formation. Preservation is generally mouldic or as highly recrystallized casts, although some well-preserved fossil casts were collected from weathered outcrop surfaces west of Philadelphia, parish of St Ann on the B13 road (Figure 3, locality 1). Corals are also common in the Somerset Formation exposed in the Schwallenburgh Bauxite mine (Windalco), parish of St Ann (Figure 3, locality 4). Corals, though common, are usually scattered through the unit and may not all be *in situ*. Locally, such as at Red Gal Ring (Figure 3, locality 7), there are horizons and lenses up to 50 cm thick, dominated by dense accumulations of thinly branched coral colonies.

Corals were found to be most abundant and widespread in the Moneague Formation. Collections from this unit were made across the entire Clarendon Block with localities in the parishes of St Ann and Manchester yielding thousands of specimens. Preservation of coral colonies, often as casts, is far better in the Moneague Formation than in other parts of the White Limestone Group. In the parish of St Ann, the most important collection sites are associated with excavations and road cuts in the Kaiser Bauxite mine south of Browns Town to the town of Alexandria (Figure 3, localities 5, 6). These include coral rudstones, floatstones and occasional framestones of Late Oligocene age (Robinson, 2004) that have previously been mapped as part of the Browns Town Formation (McFarlane, 1974). Where corals are abundant they generally occur in biostromal units. One site, the Tobolski load station (Figure 3, locality 5), includes a dense accumulation of corals that appears to represent a small patch reef (McFarlane, 1974; Woodley & Robinson, 1977; Liddell *et al.*, 1984). Here the Moneague Formation consists of 2-4 m of massive coral framestone capped and in part interfingering with 3 m of packed, largely *in situ*, branched coral.

Rich Moneague Formation faunas from the high plateau in the parish of Manchester (Figure 3, locality 7) come from excavations in the Kirkvine Windalco Bauxite mine near the communities of Albion and Jones Depot. Rocks from this area had been mapped as part of the Newport Formation and were considered to be Early Miocene in age (McFarlane 1977; Stemann, 2000, 2001). Recent analysis of the foraminiferal fauna suggests that these rocks are latest Oligocene in age (Robinson, 2004). Similarly, a Sr isotopic age estimate based on a *Kuphus* tube from this site yielded an $^{87}Sr/^{86}Sr$ value of 0.70823 and an age of 24.44 Ma (determination by A. Paytan, Stanford University; Robinson, 2004). Therefore, material from the Kirkvine Bauxite Works is considered to be younger than the material collected from the Browns Town area. Corals from the Manchester plateau region were collected from scattered coral rudstones, floatstones and framestones similar to those seen in localities south of Browns Town (Stemann, 2000, 2001).

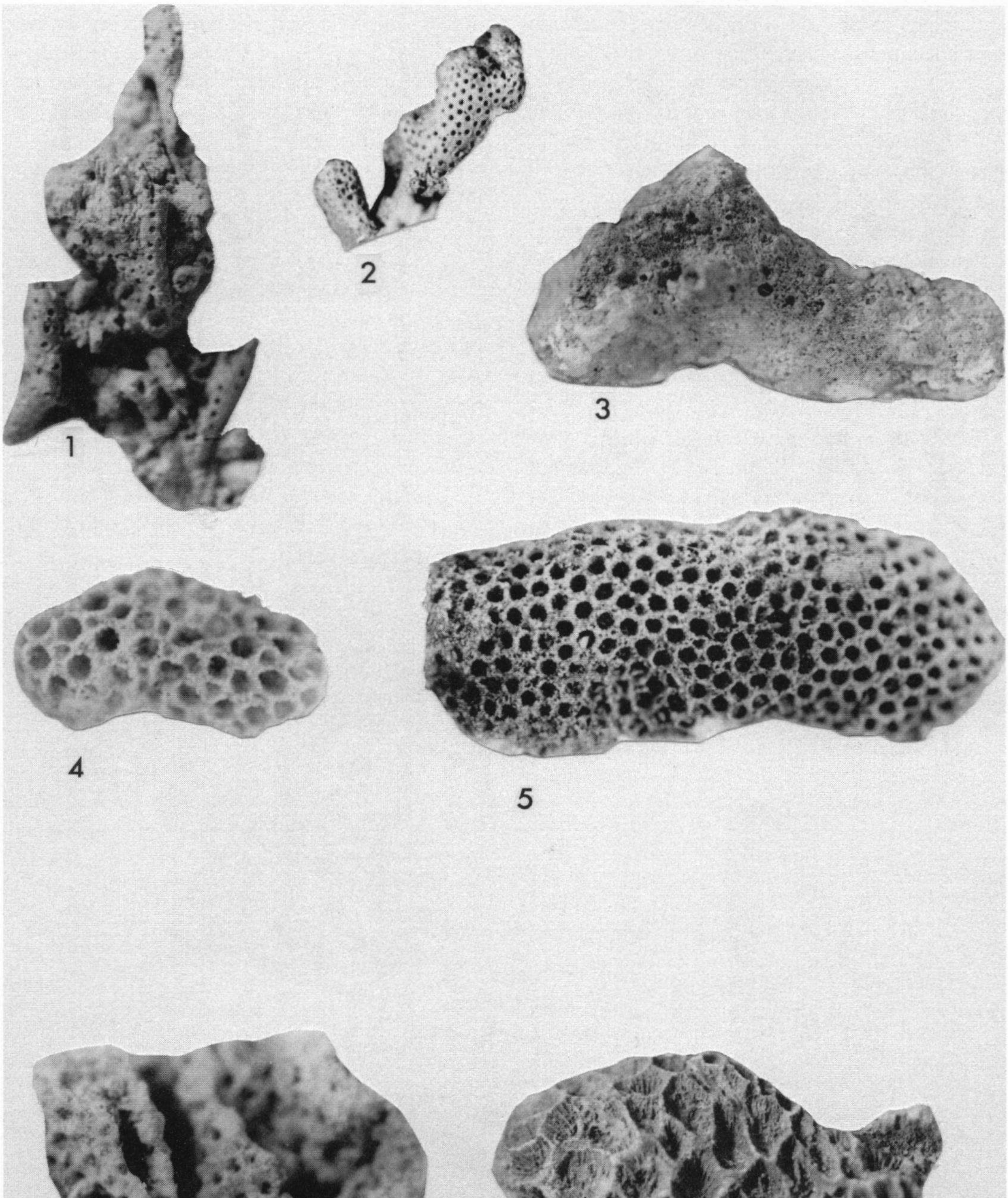
Collections from the Lower Miocene Montpelier Formation (Figure 3, locality 8) were made at a quarry west of Duncans, parish of Trelawny. These collections were supplemented by material deposited in the UF. Corals from this site are derived from allochthonous blocks of shallow-water limestone that slid into the deeper-water sediments of the Montpelier Formation. Rocks at this site have also yielded a rich fauna of decapod crustaceans (Portell & Collins, 2004). Preservation of the corals is most often mouldic although some partial casts are also found. The allochthonous blocks and accompanying corals are assumed to be roughly the same age (Early Miocene) as the surrounding chalks and bioclastic sedimentary rocks at this locality (Robinson, 2004).

Figure 4 (opposite). White Limestone Scleractinia (Astrocoeniidae, Pocilloporidae, Acroporidae, Agariciidae and Poritidae). All specimens are from Albion, parish of Manchester (Moneague Formation), unless stated otherwise.

1 - *Seriatopora* A, UWIGM 2003.24, x 1.5
2 - *Pocillopora arnoldi*, UWIGM 2003.25, x 1.2
3 - *Acropora saludensis*, UWIGM 2003.26, x 1.4
4 - *Alveopora tampae*, UWIGM 2003.27, x 1.8
5 - *Alveopora* A, UWIGM 2003.28, x 1.8
6 - *Stylocoeniella* B, UWIGM 2003.29, south of Essen Castle, parish of St Ann, Somerset Formation, x 1.8
7 - *Gardineroseris* A, UWIGM 2003.30, x 1.5

Figure 5 (overleaf). White Limestone Scleractinia (Faviidae, Rhizangiidae). All specimens are from Albion, parish of Manchester (Moneague Formation), unless stated otherwise.

1 - *Hexastrea* A, UWIGM 2003.31, x 1.4
2 - *Trachyphyllia* A, UWIGM 2003.32, Philadelphia, parish of St Ann, Troy Formation, external mould, x 1.8
3 - *Colpophyllia duncani*, UWIGM 2003.33, Knutsford, parish of St Ann, Moneague Formation, external mould, x 0.5
4 - *Antiguastrea cellulosa*, UWIGM 2003.34, x 1.2
5 - *Caulastraea* A, UWIGM 2003.35, x 1.8
6 - *Diploria portoricensis*, UWIGM 2003.36, x 1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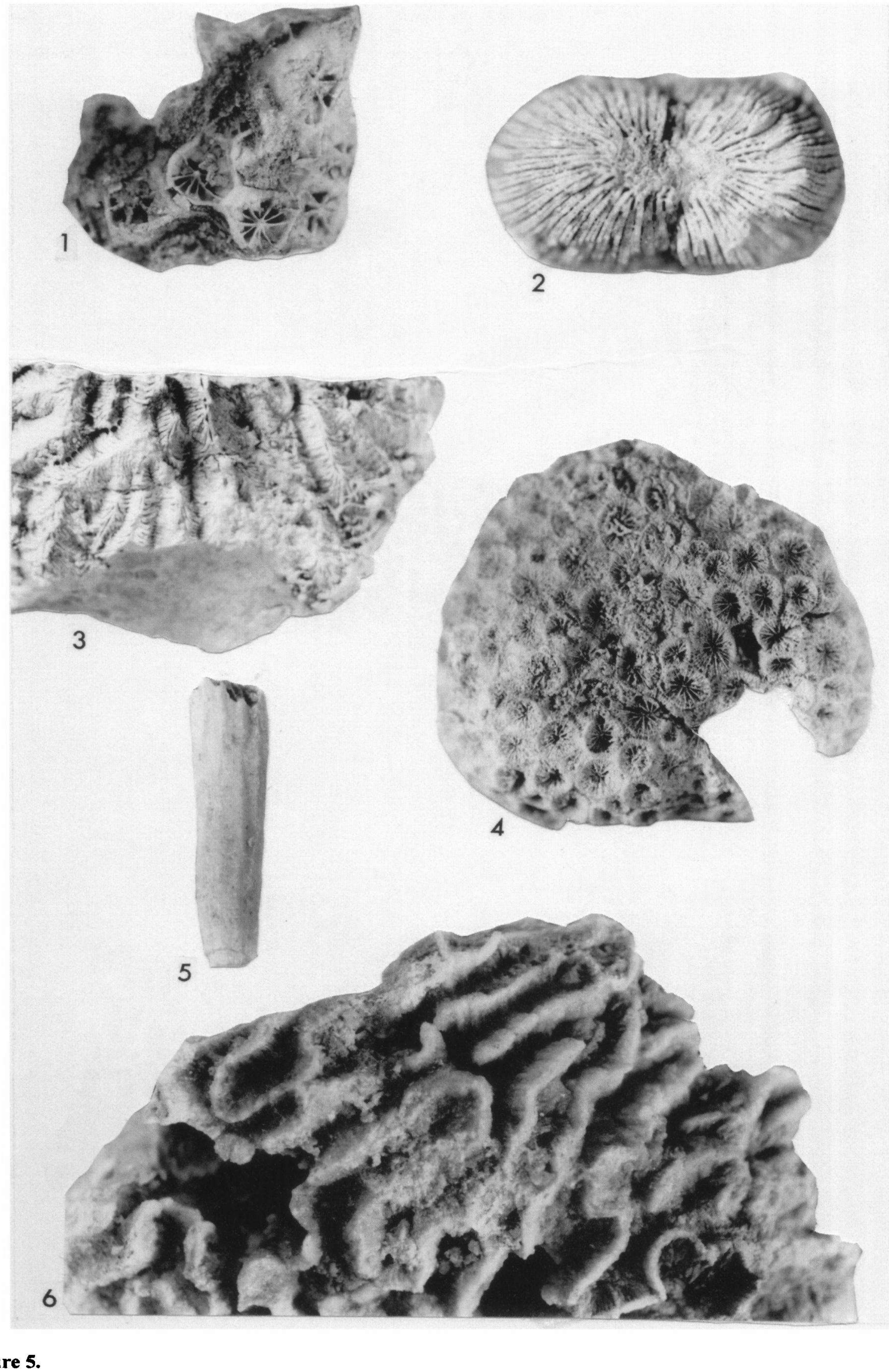

Figure 5.

		Middle to Upper Eocene			Upper Oligocene		Lwr. Miocene
					Moneague Fm		
		Troy Fm.	Swanswick Fm.	Somerset Fm.	'Browns Town'	'Newport'	Montpelier Fm.
Astrocoenia	*decaturensis*	X	–	–	–	–	–
Astrocoenia	*incrustans*	–	–	–	X	X	X
Astrocoenia	*jukesbrownei*	X	–	–	–	–	–
Astrocoenia	*portoricensis*	–	–	–	X	X	–
Stephanocoenia	A	–	–	–	–	X	–
Stephanocoenia	B	–	–	–	X	X	–
Stylocoenia	A	–	X	–	X	X	–
Stylocoeniella	A	X	X	X	X	–	–
Stylocoeniella	B	–	–	X	–	–	–
Madracis	*decaseptata*	–	–	–	–	–	X
Madracis	A	X	–	X	–	–	–
Pocillopora	*arnoldi*	–	–	–	X	X	–
Pocillopora	A	X	X	–	–	–	–
Seriatopora	A	–	–	–	X	X	–
Stylophora	*affinis*	–	–	–	–	X	–
Stylophora	*canalis*	–	–	–	–	–	X
Stylophora	*cambridgensis*	–	–	–	X	X	–
Stylophora	*granulata*	–	–	–	–	–	X
Stylophora	*goethalsi?*	–	–	–	X	–	–
Stylophora	*imperatoris*	–	–	–	X	–	X
Stylophora	*minor*	–	–	–	X	X	X
Stylophora	*undata*	–	–	–	X	X	X
Stylophora	*willoughbyi*	X	–	–	–	X	–
Stylophora	F	X	X	X	–	–	–
Stylophora	G	–	–	–	X	–	–
Acropora	*panamensis*	–	–	–	X	X	–
Acropora	*saludensis*	–	–	–	X	X	–
Acropora	B	–	–	–	X	–	–
Acropora	C	–	–	–	X	–	–
Astreopora	*antiguensis*	–	–	–	X	–	–
Astreopora	*goethalsi*	–	–	–	–	–	X
Dendracis	*cantabrigiensis*	–	–	X	–	–	–
Gardineroseris	A	–	–	–	–	X	–
Leptoseris	*anguillensis*	–	–	–	–	X	–
Leptoseris	*portoricensis*	–	–	–	X	X	–
Leptoseris	*walli*	–	–	–	–	X	–
Leptoseris	C	–	–	–	X	X	–
Leptoseris	D	–	–	–	–	X	–
Pavona	A	–	–	–	X	–	–
Trochoseris	*meinzeri*	–	–	X	X	–	–
Siderastrea	*conferta*	–	–	–	X	X	–
Siderastrea	A	–	–	–	–	X	–
Siderastrea	B	–	–	–	–	X	–
Pironastrea	*antiguensis*	–	–	–	X	X	–
Actinacis	*alabamensis*	–	X	–	–	–	–
Actinacis	*barretti*	–	–	–	X	X	–
Alveopora	*tampae*	–	–	–	X	X	–
Alveopora	A	–	X	–	X	X	–
Goniopora	*imperatoris*	–	–	–	–	X	X
Goniopora	*panamensis*	–	–	–	–	X	–
Goniopora	*taberi*	X	–	X	–	–	–
Porites	*anguillensis*	–	–	–	X	–	–
Porites	*baracoaensis*	–	–	–	X	X	–
Porites	*chipolanum*	–	–	–	X	X	–
Porites	*macdonaldi*	–	–	–	–	X	X
Porites	*portoricensis*	–	–	–	X	X	–
Porites	*trinitatis*	–	–	–	–	X	–
Porites	*waylandi*	–	–	–	X	X	X
Porites	A	X	–	X	–	–	–
Agathiphyllia	*hilli*	–	–	–	X	X	–
Agathiphyllia	*tenuis*	–	–	–	X	–	–
Agathiphyllia	A	–	–	–	–	X	–
Antiguastrea	*cellulosa*	–	–	–	X	X	–
Antiguastrea	*prava*	–	–	–	X	–	–
Caulastraea	*portoricensis*	–	–	–	X	X	–
Caulastraea	A	–	–	–	–	X	–
Caulastraea?	B		X	–	–	–	–

		Middle to Upper Eocene			Upper Oligocene		Lwr. Miocene
					Moneague Fm		
		Troy Fm.	Swanswick Fm.	Somerset Fm.	'Browns Town'	'Newport'	Montpelier Fm.
Colpophyllia	*duncani*	–	X	–	X	X	–
Colpophyllia	*willoughbiensis*	–	–	–	X	X	–
Diploastrea	*crassolamellata*	–	–	–	X	X	–
Diploastrea	A	–	X	–	X	X	–
Diploria	*portoricensis*	–	–	–	X	X	–
Favites	*polygonalis*	–	–	–	–	X	–
Favites	*mexicana*	–	–	–	–	X	–
Goniastrea	A	–	–	–	–	X	–
Goniastrea	B	–	–	–	–	X	–
Hydnophora	*variabilis*	–	X	–	X	–	–
Hydnophora	A	–	–	–	–	X	–
Leptoria	*spenceri*	–	–	–	X	X	–
Montastraea	*canalis*	–	–	–	X	X	–
Montastraea	*cylindrica*	–	–	–	X	X	X
Montastraea	*endothecata*	–	–	–	X	X	X
Montastraea	*nodosa*	–	X	–	–	–	–
Montastraea	*tampaensis*	–	–	–	–	–	X
Montastraea	*trinitatis*	–	–	–	–	X	–
Montastraea	A	–	–	–	–	X	–
Montastraea	B	–	–	–	X	X	–
Solenastrea	*bournoni*	–	–	–	X	X	X
Hexastrea	A	–	–	–	–	X	–
Trachyphyllia	A	X	–	X	X	X	–
Galaxea	*excelsa*	–	–	–	X	–	–
Oculina	A	–	–	–	–	X	–
Oculina	B	–	–	–	–	X	–
Meandrina (Placocyathus)	A	X	–	X	–	–	–
Fungophyllia	A	–	–	–	X	–	–
Antillia	*hadleyi*	–	–	X	–	X	–
Mussa	A	–	–	–	–	X	–
Balanophyllia (Eupsammia)	*clarendonensis*	–	X	–	–	–	–
Parapolytremacis	A	–	–	–	X	X	–
Millepora	spp.	X	X	X	X	X	–

Table 4. Scleractinian coral, octocoral and hydrozoan species found in the White Limestone Group. The relationships between the formations are shown in Figure 2. 'Browns Town' and 'Newport' are here considered informal units within the Moneague Formation (see text for details). An 'X' indicates a presence for a species in a particular formation, '--' indicates absence. See Table 3 for diagnostic characters of each listed coral and octocoral species. See Appendix 1 for authors and synonomy notes for each previously described species. *Millepora* records probably represent more than one species.

Taxonomic method

Table 3 presents the range of variation in taxonomically diagnostic characters for 98 coral morphospecies encountered in this study. Selected examples of some of these taxa are shown in Figures 4 and 5. Sixty-one of these species were previously described from the Caribbean region (see Appendix 1); thirty-six could not be grouped with known and described species, and are left in open nomenclature with species names designated by a letter. Most of these are probably new species. At the present time, these have not been rigorously defined statistically, but this will be pursued in future work on the fauna.

Species designations for all material examined are based in part on recent revisions of Caribbean Eocene (Budd *et al.*, 1992) and Neogene (Budd *et al.*, 1994) coral taxa. Work on those species that range into the Neogene relied also on the diagnoses used in the Neogene Biota of Tropical America project as described by Budd *et al.* (2001) (NMITA: http://nmitageology.uiowa.edu).

Taxonomically important characters at the species level included corallite diameter and spacing, and the number and distribution of septa. Estimates on the range of variation in a species were made based on measurements from colony surfaces and, less commonly, polished slabs. Because much of the material examined was in the form of imperfect external moulds, corallite spacing was measured from the interior surface of a corallite wall to the interior wall surface in adjacent corallites. This was found to be more efficient and precise than attempting to measure the distance between the centres of adjacent corallites. Since none of the corals here described (Table 3) are truly thamnasteroid (Wells, 1956), there was little difficulty in identifying discrete corallite walls in the scleractinian species encountered in the White Limestone Group.

All family and generic designations for the scleractinians in the fauna follow Wells (1956) except for *Gardineroseris* (Scheer & Pillai, 1974) and *Hexastrea* (Sismonda & Michelotti, 1871). *Gardinoseris* (Figure 4/7) is a relatively recently described scleractinian genus, previously known only from the Caribbean Neogene and the Quaternary through Recent of the Indo-Pacific (Budd *et al.*, 1994; Veron, 1995). *Hexastrea* (Figure 5/1), previously known only from the European Paleogene, had been synonymised by Wells (1956), but is maintained as a distinct group herein based on its large corallite diameter, laminar septa and its highly exsert, styliform columella. This genus is only tentatively referred to the family Rhizangiidae d'Orbigny, 1851.

In addition to the two genera noted above, two other genera, *Stylocoenia* Milne Edwards & Haime, 1849, and *Stylocoeniella* Yabe & Sugiyama, 1935, are used here somewhat differently from the usage of Wells (1956). These two genera are not clearly diagnosed by Wells (1956); the only difference appears to be in the overall density or robustness of the skeletal elements. This has led to some confusion concerning placement of species into one or the other of these genera. In this work, I have placed massive astrocoeniids with intercorallite pillars in the genus *Stylocoenia* and considered branched forms with intercorallite pillars to be in the genus *Stylocoeniella* (Figure 4/6). These massive forms generally appear more nearly cerioid than species here placed in *Stylocoeniella*.

A stony octocoral species has been identified in this study (Table 3). Stony octocorals have skeletons that are superficially similar to those of scleractinians although their soft tissues are distinct (Bayer, 1956). They are found in the modern Indo-Pacific, but are absent from the modern Caribbean. The species recognised here is referred to the genus *Parapolytremacis* (Alloiteau, 1957) and represents the first report of this group from the Caribbean. The genus is a common, though never dominant, component of Paleogene coral faunas in the Mediterranean region (Pfister, 1980). The suprageneric taxonomy of this species follows Bayer (1956).

Examples of fossil stony hydrozoans have also been collected from the White Limestone Group. These are colonial anthozoans that possess dimorphic zooids (forming gastropores and dactylopores) that lack septa or pseudosepta, and lack axial structures such as a columella or a gastrostyle (Boschma, 1956). Species-level diagnoses for these forms have not been completed although all material can be referred to the genus *Millepora* (Linné, 1758), the common fire or stinging coral of the modern Caribbean and Indo-Pacific.

The fauna

Coral, octocoral and hydrocoral species occurrences were tabulated for each formation in the White Limestone Group (Table 4). The fauna consists of 98 scleractinian species in 42 genera. These include branched (ramose and phaceloid), massive, plate-shaped, and free-living colonial and solitary growth forms (Figure 6). Total scleractinian species richness for the Eocene portion of this unit is twenty-two; seventy-nine species occur in the Oligocene; and fifteen species are recorded from the Miocene (Table 5). Generic richness follows a similar pattern, peaking at thirty-eight in the Oligocene portion of the White Limestone Group.

Of the 98 coral species recognised, only *Balanophyllia (Eupsammia) clarendonensis* is clearly an azooxanthellate form. This species is a member of the family Dendrophylliidae Gray, 1847, an exclusively azooxanthellate taxon (Wells, 1956). Based on comparisons with closely related modern forms, the two *Oculina* spp. and the single *Hexastrea* sp. may be either zooxanthellate, azooxanthellate or facultatively both (i.e., they are apozooxanthellate).

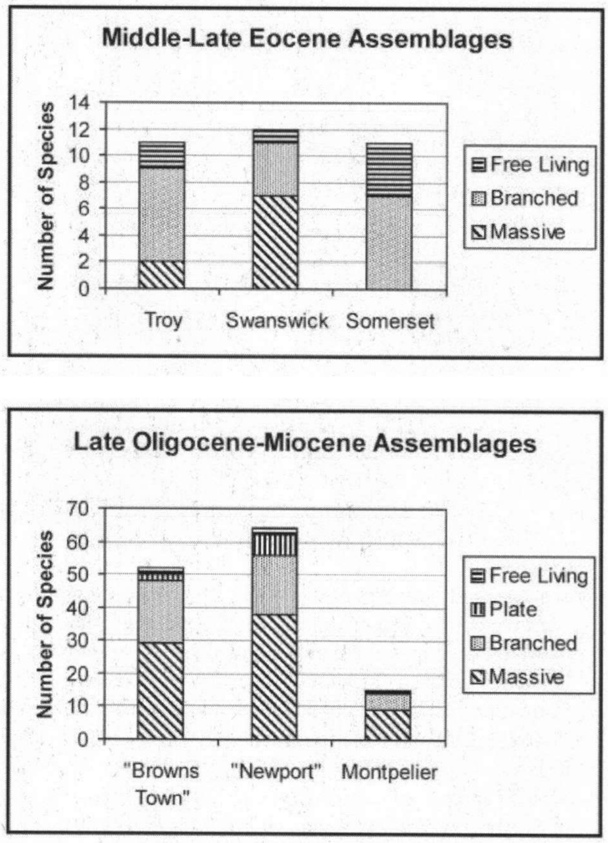

Figure 6. Faunal comparison of assemblages from lithologic units in the White Limestone Group showing numbers of massive, branched, free-living, and plate-shaped species found in each stratigraphic unit. Branched category includes both ramose and phaceloid branching corals. Free-living category here includes unattached solitary or unattached meandroid forms with a single series. Note differing vertical scales on graphs for Eocene and Oligocene/Miocene faunas. 'Browns Town' and 'Newport' are records from two informal Upper Oligocene units from the Moneague Formation (see text for explanation).

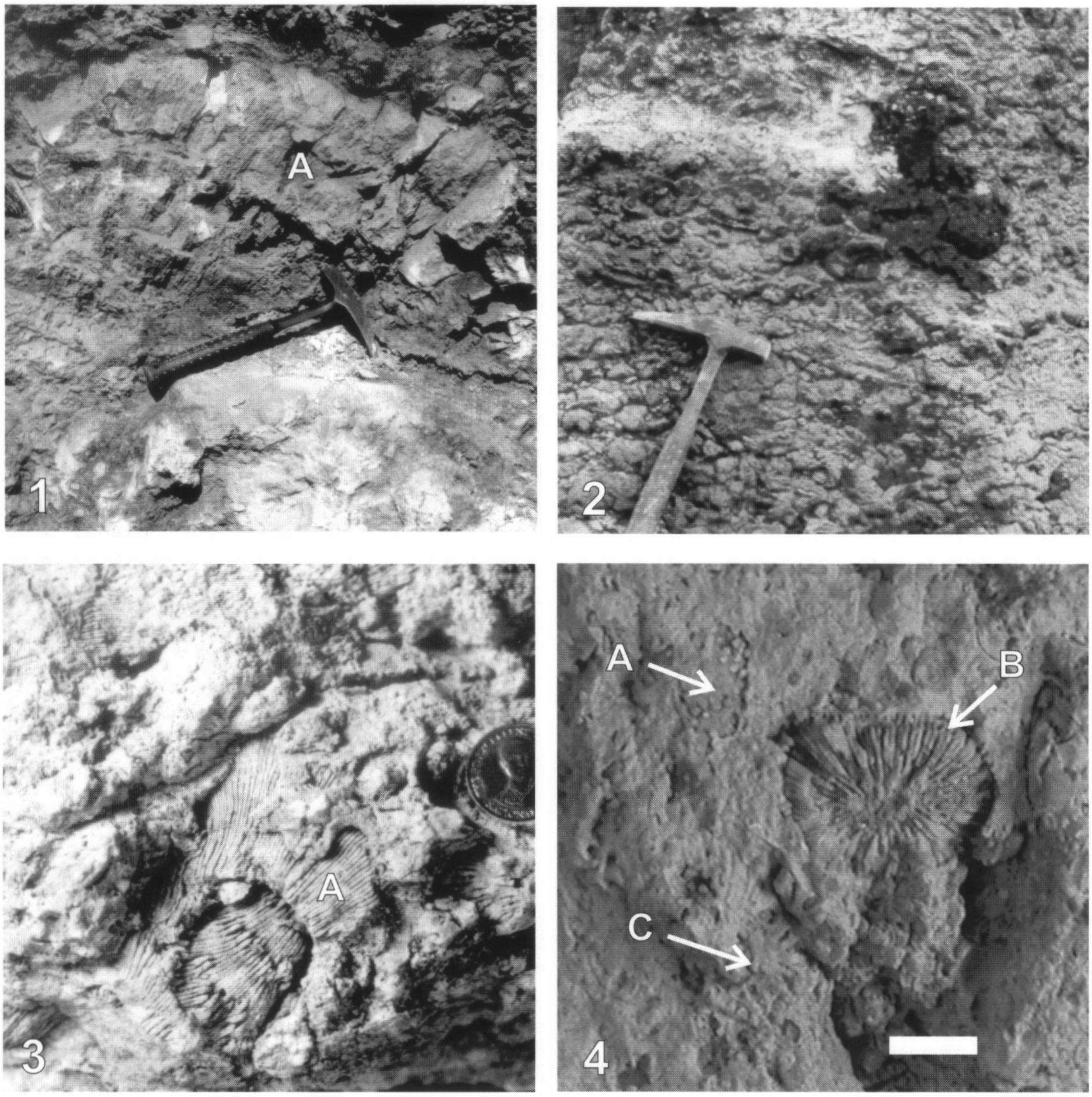

Figure 7. Coralline facies of the White Limestone Group.

1 - Massive coral colonies in framestone from the Upper Oligocene of the Moneague Formation at Tobolski load station, parish of St Ann. Large massive coral (labelled A) is *Antiguastrea cellulosa*. Hammer is 320 mm long.

2 - Branched coral in floatstone/framestone at Kirkvine Windalco Bauxite Works, near Albion, parish of Manchester (Moneague Formation). Branched coral is almost exclusively *Porites portoricensis*. Note hammer for scale.

3 – Plate-shaped coral facies dominated by *Leptoseris portoricensis* (labelled A) from Upper Oligocene Moneague Formation near Knutsford, parish of St Ann. Corals preserved as external moulds. Coin is 16 mm in diameter.

4 - Moulds and partial casts of branched and free-living corals from the Somerset Formation at Schwallenburgh Bauxite Mine, parish of St Ann. (A) *Millepora* sp.; (B) *Antillia hadleyi*; (C) *Stylophora cambridgensis*. Scale bar represents 10 mm.

Thus, this fauna includes some 94 zooxanthellate scleractinian species, clearly indicating shallow-water, open-marine conditions ideal for reef corals.

Troy Formation

The Troy Formation coral fauna, eleven species of scleractinians and one branched *Millepora* species, is dominated by thin (<1 cm thick) branched coral colonies and occasional free-living species. Coral specimens are scarce and do not appear to form buildups, thickets or biostromes of any kind. Given the sparse fauna it is difficult to estimate the relative abundance of constituent species. Small, thinly branched *Stylophora* spp., however, are the most commonly encountered corals in the material studied.

	Middle to Upper Eocene			Upper Oligocene		Lower Miocene
Total Genera	21			38		8
Total Species	24			79		15
	Troy Fmn.	Swanswick Fmn.	Somerset Fmn.	Moneague Fmn.		Montpelier Fmn.
				'Browns Town'	'Newport'	
Total Genera	9	12	10	30	32	8
Total Species	11	12	11	52	64	15

Table 5. Total scleractinian coral species and genera found in the White Limestone Group. Totals are listed for each formation and for the number of taxa found in each series in Jamaica. Totals include counts of all scleractinian species identified (Tables 3, 4). The octocoral species (*Parapolytremacis* A) found in the Oligocene Moneague Formation and hydrocorals (*Millepora* spp.) listed in Table 4 are not included herein.

Swanswick Formation

The Swanswick Formation corals include twelve scleractinians and one hydrocoral, *Millepora* sp. This assemblage includes the highest number of massive species of the three Eocene formations in the White Limestone Group. The bulk of these are recorded from Pimento Hill (Figure 3, locality 3). Collections from this site are dominated by *Actinacis alabamensis* and subdominant massive faviid corals (*Montastraea* spp., *Diploastrea* A). This assemblage also includes abundant large (>20 cm) colonies of *Caulastraea*? B, a densely branched phaceloid species. The large colony size and robust, compactly branched growth form of most of these species is similar to that found in wave resistant coral buildups (Geister, 1975). This may suggest that the site represents a fossil coral patch reef of some kind. All of the corals, however, were collected from weathered float along a hillside and were not observed *in situ*. Therefore, it is difficult to say with any certainty whether a true coral build-up exists at this Swanswick Formation locality. It should be noted, though, that the abundance of massive corals in the Swanswick Formation is consistent with Eva & McFarlane's (1985) interpretation of this unit as a shelf edge, open-water limestone.

Somerset Formation

The fauna of the Somerset Formation includes eleven species of branched and free-living scleractinians (Figure 4) as well as one branched *Millepora* sp. Corals are common and distributed throughout the unit usually as fragments of thin to moderately thick (0.5-2 cm) branched coral and isolated free living forms (Figure 7/4). The unit contains local biostromal horizons composed of abundant branched coral species dominated by *Porites* A, *Dendracis cantabrigiensis*, *Goniopora taberi* and *Millepora* sp. These corals are fragmented to some degree, but are not highly worn by transport. These may represent small coral thickets or coral carpets. The fragile nature of the thin coral branches in these biostromes indicates that this assemblage could not have withstood significant wave energies. They most likely were low superstratal or constratal accumulations (Insalaco, 1998) forming below wave base in deeper-water or in protected back reef or inner platform settings. The common co-occurrence of the free-living corals *Antillia hadleyi* and *Trachyphyllia* A suggests a relatively soft or mobile substrate for this facies.

One of the most interesting aspects of the Somerset Formation fauna is the common occurrence of fossil partial casts and moulds of the stinging hydrozoan *Millepora*. All hydrocorals have very poor fossil records compared to that of the Scleractinia (Boschma, 1956). *Millepora*, hough common on modern reefs, is generally absent from all but the best preserved Late Pleistocene assemblages (see Geister, 1975) and rarely noted in older material (Boschma, 1956). A distinctive *Millepora* with rounded branches 1-3 cm thick occurs in all the Eocene formations of the White Limestone Group (Table 4). It is actually the dominant macrofossil in some parts of the Somerset Formation (e.g., west of Philadelphia, parish of St Ann; Figure 3, Locality 1). It is likely as well that some of the earlier records of branched poritid corals or *Stylophora* spp. in this unit (McFarlane, 1977; Robinson, 1969) may actually refer to *Millepora*.

It is difficult to interpret the significance of the abundant *Millepora* in the Somerset Formation. In part, it may be the result of fossil preservation. This particular species may be more easily preserved than other hydrocoral species or perhaps the diagenetic history of parts of the Somerset Formation allowed for early preservation of these otherwise fragile skeletons.

The abundant *Millepora* may also reflect palaeoenvironmental conditions. Stony hydrozoans dominate the most exposed wave washed reef crest environments in the modern Caribbean (Geister, 1975). There is, however, no other lithological or palaeontological evidence for a shallow, wave-exposed reef facies in the Somerset Formation horizons dominated by *Millepora*. It appears likely that this species was forming localised branched thickets, but not significant wave resistant buildups.

Moneague Formation

The Moneague Formation contains a rich fauna of seventy-nine scleractinian species, one octocoral (*Parapolytremacis* A), and at least one species of the hydrocoral *Millepora* (Tables 4, 5). All of these species were encountered in the Upper Oligocene portion of the formation. The Oligocene fauna here consists of predominantly massive corals (Figure 4), although locally branched or plate-shaped colonies are common. Corals are most often found as isolated colonies in wackestones and packstones, but also make up the dominant bioclasts in some coral floatstones, rudstones and framestones. Distinct coral assemblages or biofacies characterised by massive, branched or plate-shaped species can be recognised (Stemann, 2000, 2001). Free-living solitary or small colonial species are generally less important aspects of the fauna.

Corals appear to occur throughout the Oligocene-Miocene Moneague Formation. The present species list, however, has been generated only from collections at well-dated Oligocene exposures south of Browns Town (Figure 3, localities 5 and 6) and from the Albion area in the parish of Manchester (Figure 3, locality 8) (see above). The assemblages from these two sites are considered separately below. The material from the area near Browns Town (and formerly mapped as part of the Browns Town Formation) is called here informally the 'Browns Town' fauna. The coral assemblage from near Albion (formerly mapped as part of Newport Formation) is informally labelled the 'Newport' fauna. Other smaller collections have been made from across the Clarendon Block and these may range into the Lower Miocene. No additional species were found in these small collections and biostratigraphic control for these sites is difficult, therefore they are not considered further herein.

'Browns Town' corals

The fauna of the Moneague Formation near Browns Town includes fifty-two scleractinian species, one octocoral species and several small encrusting hydrozoans that are here refered to as *Millepora* spp. Most of the species encountered here were massive forms; relatively few plate-shaped or free-living species were collected (Figure 4). Three distinct coral biofacies assemblages characterised by massive, branched or plate shaped corals can be recognised in sites near Browns Town.

A biofacies dominated by massive corals occurs in horizons and lenses up to several metres thick at several localities. At Tobolski load station (Figure 3, locality 5), a 2-4 m thick coral framestone is dominated by very large (0.25- >1.0 m) mounds of *Antiguastrea cellulosa* (Figure 7/1). Also occurring are large colonies of *Siderastrea conferta*, *Diploastrea* spp., *Colpophyllia* spp. and *Montastraea* spp. This framestone is built almost exclusively of large, massive corals and suggests a depositional environment with a firm substrate above normal wave base. This could be analogous to a wave-resistant reef core facies on modern reefs, although massive corals can clearly form accumulations in less exposed habitats as well (Geister, 1975). At the Tobolski load station, the somewhat lense-shaped geometry of the massive coral zone may suggest that these corals formed a build up above the surrounding substrate (superstratal in the sense of Insalaco, 1998). At other sites (Figure 3, locality 6) the massive coral biofacies may form biostromal units with no clear evidence of distinct reefal formation.

A branched coral biofacies in the Browns Town fauna is dominated by moderately thick (1.5-3.0 cm) branched ramose species *Porites portoricensis*, *Astrocoenia portoricensis* and less common *Stylophora imperatoris*. This branched assemblage may occur as upright in-place colonies, but most commonly consists of toppled, packed branches in horizons rarely >1 m thick. These ramose branching corals possess fairly robust morphologies that would have been somewhat wave resistant as are similarly shaped *Acropora* spp. in the modern Caribbean (Geister, 1975). The interstitial bioclastic sediment and the branching morphology of the corals in this assemblage suggest a moderately exposed environment, perhaps with patches of soft or mobile substrate.

A biofacies assemblage dominated by thin (<1 cm thick; up 25 cm broad), plate-shaped colonies may also be seen in the Browns Town area. The most common species in this assemblage is *Leptoseris portoricensis* (Figure 7/3). The attached, explanate solitary or colonial coral, *Fungophyllia* A, and *Leptoseris* C may also be common. This plate-shaped coral biofacies occurs in horizons 0.5-1 m thick. Uncommonly they consist of densely packed plates making up 50-70% of the rock fabric. Coral colonies in these units are preserved generally with corallites facing upward in a matrix of finer-grained carbonate sediment. This biofacies may also occur as a more loosely packed floatstone with corals scattered and randomly oriented in a matrix of fine- to medium-grained bioclasts. In most cases, colonies are not highly fragmented, suggesting little significant transport before deposition. Given the fine-grained nature of the interstitial sediment associated with this assemblage as well as the thin, fragile morphologies that characterise its dominant corals, this biofacies probably represents a coral community formed below wave base either in deeper-water or in protected back reef settings and/or turbid environments with low sedimentation rates (Rosen *et al.*, in press).

'Newport' corals

The fauna of the Moneague Formation near Albion, parish of Manchester, is more diverse than the Browns Town fauna (Tables 4, 5). The Newport coral assemblage (sixty-four scleractinians, one octocoral) are approximately 20% more species rich than the Browns Town fauna, although each of these faunal assemblages possesses similar relative proportions of massive, branched and plate-shaped species. As with the Browns Town fauna, distinct biofacies assemblages characterised by groups of species sharing similar growth forms can be recognised in the 'Newport' coral fauna of the Moneague Formation (Stemann, 2000, 2001).

A massive coral biofacies in floatstones and framestones at Albion is commonly dominated by columnar *Alveopora tampae* and massive *Siderastrea conferta.* At some localities, large (>20 cm) colonies of *Diploastrea* spp., *Leptoria spenceri, Montastraea endothecata* and *Antiguastrea cellulosa* are common. This biofacies may occur as isolated clusters of corals or mound-shaped lenses of coral framestone that may be 1-2 m thick and 5->10 m in lateral extent. These coral lenses probably formed under conditions similar to those of the massive coral biofacies in the Browns Town fauna.

Two biofacies assemblages are characterised by branched coral. One includes abundant, moderately thick (1-3 cm) branched *Porites portoricensis* and *Actinacis barretti* with less common *Stylophora* spp. The assemblage may be composed of in place clusters of ramose branches or toppled, slightly fragmented colonies in mixed fine- to coarse-grained, generally bioclastic matrix (Figure 7/2). At some localities, this biofacies may grade into a floatstone containing roughly equal proportions of branched and small massive corals.

A second commonly occurring branched coral biofacies is composed of a diverse assemblage of thin (<1 cm thick) stick corals in fine- to medium-grained carbonate sedimentary rock. Chief corals in this biofacies are *P. baracoaensis, Seriatopora* A (Figure 4/1), *Stylophora minor, Leptoseris* C and phaceloid-branching *Caulastraea* spp. Again, these may include upright in-place colonies or more commonly beds of packed, slightly fragmented though not worn branches. Either of these branched coral biofacies assemblages may form beds or lenses up to 2 m thick. The thick-branched *Porites portoricensis* assemblage would likely have been deposited in a more exposed setting than the thin-branched *P. baracoaensis* and *Seriatapora* dominated biofacies.

Plate-shaped *Leptoseris* spp. and *Porites macdonaldi* characterise a fourth biofacies in the Newport fauna near Albion. This assemblage of attached thin, platy corals generally occurs in floatstones with loosely packed colonies in fine- to medium-grained, largely bioclastic sedimentary rock. Free-living species, such as *Antillia hadleyi* and *Trachyphyllia* A, may also be common. As with the similar plate-shaped assemblage in the Browns Town fauna noted above, this biofacies likely formed in deeper water or more protected back reef settings, or perhaps in turbid environments experiencing low sedimentation rates. The free-living species found in the Newport fauna from Albion suggest a depositional environment with a locally loose or soft substrate.

The coral biofacies here described from both the Browns Town and the Newport faunas commonly occur as isolated horizons or lenses separated laterally and vertically by coral-poor wackestones or packstones. Thus, these biofacies are best interpreted as local coral accumulations rather than large-scale fringing or barrier reefs composed of closely associated zones of massive, branched and plate shaped corals. The richest coral localities in the Moneague Formation occur some distance from the margin of the Clarendon Block and thus do not represent true shelf edge reef tracts. Based on the presence of olistostromic blocks and debris layers composed of coral rich limestone found in parts of the deep-water chalks of the Montpelier Formation (Wallace, 1969; Land, 1991; see below), extensive kilometre-scale reef systems may have existed on the margins of the Clarendon Block. No such large barrier or fringing reef systems, however, are preserved or exposed in the Moneague Formation.

Montpelier Formation

The fifteen coral species from the Montpelier Formation (Table 4) were collected from a block of fossil-rich, recrystallized limestone at a quarry west of Duncans, parish of Trelawny (Figure 3, locality 9). The fauna includes massive and branched species along with a single free-living coral taxon (Figure 4). The massive species are chiefly colonies of *Montastraea endothecata* and *Montastraea tampaensis* while the branched forms are commonly small fragments of several *Stylophora* spp. At the Duncans quarry, colonies are oriented randomly and scattered in a recrystallized coral floatstone. The massive colonies are generally laminar, up to 25 cm broad and 10 cm thick. These shapes are commonly associated with deeper habitats on modern reefs. Thus, the colony form and orientation of the corals suggest that the fossil-rich block of recrystallized limestone represents deep forereef material that has undergone some downslope transport prior to lithification and eventual implacement in the Montpelier Formation.

The species richness at this site is remarkably high considering the fact that the coral-bearing material is exposed over an area less than 20 m^2 and given that coral preservation is poor. It is worth noting, however, that scleractinian diversity in modern fore reef sites may be relatively high (Huston, 1984; Liddell & Ohlhorst, 1987). Also, a death assemblage of material transported from shallow to deeper forereef habitats (as this locality may represent) may be expected to include a sample of corals from a range of environments and, therefore, to possess a higher species richness.

Discussion

The White Limestone scleractinian fauna differs markedly from earlier Paleogene coral faunas of Jamaica. The best described Early to Middle Eocene coral assemblages in Jamaica come from the Yellow Limestone that underlies and in part interfingers with the base of the White Limestone Group. Based on a literature review and some new material collected by the author, nineteen species in thirteen genera are found in the Yellow Limestone Group (Table 6). Eight of these species are found in the overlying White Limestone Group, with the ranges of most of them extending into the Oligocene. In general, the overall colony morphology of these species (i.e., branched and free living with few massive colonies) is similar to that seen in the Eocene portions of the White Limestone.

	Growth Form	**Zooxanthellate/ Azooxanthellate**	**White Limestone Group**
Astrocoenia d'achiardi (Duncan, 1873)	B	Z	--
Astrocoenia dixae Wells, 1935	B	Z	--
Astrocoenia jamaicensis Wells, 1934a	M	Z	--
Stylophora cambridgensis Wells, 1934a	B	Z	X
Stylophora F	B	Z	X
Astreopora walli Wells, 1934a	B	Z	--
Dendracis cantabrigiensis Vaughan, 1899	B	Z	X
Antilloseris jamaicaensis (Vaughan, 1899)	F	A	--
Antilloseris cantabrigiensis (Vaughan, 1899)	F	A	--
Trochoseris meinzeri Vaughan, 1919	F	Z	X
Actinacis alabamensis (Vaughan, 1900)	M	Z	X
Actinacis barretti Wells, 1934a	B	Z	X
Goniopora christianiaensis (Wells, 1934a)	B	Z	?
Goniopora hedbergi Wells, 1945	B-M	Z	--
Cladocora bosquensis Frost & Langenheim, 1974	B	?	--
Colpophyllia duncani Wells, 1935	M	Z	X
Favia gregoryi? Wells, 1935	M	Z	--
Balanophyllia (Eupsammia) clarendonensis Wells, 1934a	F	A	X
Dendrophyllia sp.	B	A	--

Table 6. Scleractinian coral species from the Yellow Limestone Group, Jamaica based on literature (Duncan & Wall, 1865; Duncan, 1868; Vaughan, 1899; Wells, 1934a, 1935) and on collections made by the author. Growth form is noted for each species (B = branched; M = massive; F = free living or solitary). Probable zooxanthellate (Z) and azooxanthellate (A) species are noted as well. Those species found in the White Limestone Group are noted with 'X', absences are noted with '–'.

There are some evident ecological differences between White Limestone faunas and those of the underlying Yellow Limestone Group. In the Yellow Limestone fauna, of nineteen species, three (*Cladocora bosquensis, Balanaophyllia (Eupsammia) clarendonensis* and *Dendrophyllia* sp.) were possibly azooxanthellate based on comparison with closely related modern taxa. Two other Yellow Limestone corals, *Antilloseris jamaicaensis* and *A. cantabrigiensis*, are both extremely small solitary forms (0.5–1.5 cm maximum diameter) and are not found associated with other larger colonial corals (Wells, 1934a; pers. obs.). Therefore, these two species of *Antilloseris* are also considered probable azooxanthellate corals. In the White Limestone, however, only one species out of 98 is clearly azooxanthellate. This significant difference in the ratio of azooxanthellate to zooxanthellate species is undoubtedly the result of a shift from the likely more eutrophic transitional environments influenced by terrestrial runoff in the Yellow Limestone to clearer water, normal marine conditions favourable to zooxanthellate corals in the Middle Eocene of the White Limestone Group.

Species richness in the Eocene formations of the White Limestone Group is considerably lower than in younger units. This may in part be a result of sampling. Of the three Eocene formations considered here, only the Somerset Formation was sampled at multiple sites with >20 specimens collected at each site. Species richness is low for most Caribbean Paleocene (Stemann, 1997) and Eocene (Budd *et al.*, 1992; Budd, 2000) reef coral faunas. The species richness values of 11 or 12 for each of the Eocene White Limestone Group formations are comparable to median values found for other Middle to Late Eocene lithostratigraphic units in the Caribbean (Budd, 2000; Stemann, 2002).

The Eocene/Oligocene transition in the White Limestone Group is marked by a considerable increase in species and generic level richness in the scleractinian fauna. Some degree of faunal turnover between the Eocene fauna discussed here and the Moneague coral assemblages can also be recognised. Key aspects of the Eocene coral fauna, *Dendracis cantabrigiensis*, *Goniopora taberi* and branched *Millepora* sp., are missing from the younger horizons of the White Limestone Group. In the Moneague Formation assemblages, these branched corals are replaced by *Porites portoricensis* and *Stylophora* spp. Based on a review of published faunal lists, *Dendracis canta-*

brigiensis and *Goniopora taberi* are also absent from other Upper Oligocene faunas of the Caribbean (Frost & Langenheim, 1974; Frost & Weiss, 1979; Frost *et al.*, 1983; Edinger & Risk, 1994, 1995).

A diversity peak in the White Limestone Group occurs in the Upper Oligocene portions of the Moneague Formation. This coincides with the Late Oligocene peak in the number of genera and species of Caribbean reef corals (Budd, 2000), and a peak in reef development in the Caribbean and Mediterranean regions (Vaughan, 1919; Frost, 1977b; Veron, 1995). The distinct biofacies assemblages recognised in the Browns Town and Newport faunas reflect the varied development of patch reefs and coral thickets in the Moneague Formation. These biofacies assemblages are very similar to those seen in other Late Oligocene Caribbean coral faunas (*e.g.*, Frost & Weiss, 1979; Frost *et al.*, 1983).

There is a considerable drop in coral species richness between the Late Oligocene and Early Miocene of the White Limestone Group. Similar drops in scleractinian diversity have been noted for the Oligocene/Miocene transition in the Caribbean (Edinger & Risk, 1994, 1995; Frost, 1977a). However, in the White Limestone coral faunas, this diversity drop is almost certainly related to a small Early Miocene sample size and to the fact that Early Miocene age corals recorded in the present work are derived from allochthonous material in deeper-water sedimentary rocks of the Montpelier Formation. As noted above, the species richness in the coral fauna of the Montpelier Formation may actually be high given the relatively small amount of exposed outcrop sampled.

The White Limestone Group contains the richest coral fauna of any lithostratigraphic unit in Jamaica. Indeed, values for species and generic richness for the Late Oligocene portion of the Moneague Formation are among the highest for any formation size unit in the Caribbean Tertiary (Budd, 2000). More than a third of the White Limestone Group species (those left in open nomenclature here) have so far been recorded only from Jamaica. This results from the fact that the Paleogene coral fauna of the Caribbean is still incompletely described. Indeed, the present study must be considered only a preliminary report in this respect. Unfortunately, even for the relatively densely sampled and well-known Late Oligocene interval, many published faunal lists for the Caribbean do not give even rudimentary generic or species descriptions or diagnoses. Without these diagnoses, it is difficult to create a working taxonomy of the Caribbean coral fauna and an integrated assessment of species ranges across the entire region is impossible. Any review of regional species level coral biodiversity will be incomplete until this basic alpha taxonomy has been done.

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APPENDIX 1. Systematic list of previously described scleractinian species present in the White Limestone Group.

Genera and species are listed alphabetically according to family as defined by Wells (1956). Original authors are listed. All synonymies follow those in Budd *et al.* (1992, 1994) except that *Astrocoenia portoricensis* is here considered to be separate from *Astrocoenia incrustans*. *Stylophora goethalsi*? is considered to be different from *S. goethalsi* *sensu* Budd *et al.* (1994). Species diagnoses are given in Table 3.

Astrocoenia decaturensis Vaughan, 1919
Astrocoenia incrustans (Duncan, 1873) = *Stephanocoenia incrustans* Duncan, 1873
Astrocoenia jukesbrownei Wells, 1945
Astrocoenia portoricensis Vaughan, 1919, not *sensu* Budd *et al.*, 1992
Madracis decaseptata (Weisbord, 1971) = *Stephanocoenia decaseptata* Weisbord, 1971
Pocillopora arnoldi Vaughan, 1919
Stylophora affinis Duncan, 1863
Stylophora canalis Vaughan, 1919
Stylophora cambridgensis Wells, 1934a
Stylophora granulata Duncan, 1864
Stylophora goethalsi? Vaughan, 1919, not *sensu* Budd *et al.*, 1994
Stylophora imperatoris Vaughan, 1919
Stylophora minor Duncan, 1863
Stylophora undata Weisbord, 1971
Stylophora willoughbyi Wells, 1945
Acropora panamensis Vaughan, 1919
Acropora saludensis Vaughan, 1919
Astreopora antiguensis Vaughan, 1919
Astreopora goethalsi Vaughan, 1919
Dendracis cantabridgiensis Vaughan, 1899
Leptoseris anguillensis (Vaughan, 1919) = *Agaricia anguillensis* Vaughan, 1919
Leptoseris portoricensis Vaughan, 1919
Leptoseris walli Vaughan *in* Vaughan & Hoffmeister, 1926
Trochoseris meinzeri Vaughan, 1919
Siderastrea conferta (Duncan, 1863) = *Isastraea conferta* Duncan, 1863
Pironastrea antiguensis Vaughan, 1919
Actinacis alabamensis (Vaughan, 1900) = *Turbinaria*(?) *alabamensis* Vaughan, 1900
Actinacis barretti Wells, 1934a
Alveopora tampae Weisbord, 1973
Goniopora christianiaensis (Wells, 1934a) = *Goniaraea christianiaensis* Wells, 1934a
Goniopora imperatoris Vaughan, 1919

Goniopora panamensis Vaughan, 1919
Goniopora taberi Wells, 1934b
Porites anguillensis Vaughan, 1919
Porites baracoaensis Vaughan, 1919
Porites chipolanum Weisbord, 1971
Porites macdonaldi Vaughan, 1919
Porites portoricensis (Vaughan, 1919) = *Goniopora portoricensis* Vaughan, 1919
Porites trinitatis Vaughan *in* Vaughan & Hoffmeister, 1926
Porites waylandi Foster, 1986
Agathiphyllia hilli (Vaughan, 1919) = *Cyathomorpha hilli* Vaughan, 1919
Agathiphyllia tenuis (Duncan, 1863) = *Astraea tenuis* Duncan, 1863
Antiguastrea cellulosa (Duncan, 1863) = *Astraea cellulosa* Duncan, 1863
Antiguastrea prava Budd *in* Budd *et al.*, 1992
Caulastraea portoricensis (Coryell *in* Coryell & Ohlsen, 1929) = *Calamophyllia portoricensis* Coryell *in* Coryell & Ohlsen, 1929
Colpophyllia duncani Wells, 1935
Colpophyllia willoughbiensis (Vaughan, 1919) = *Manicina willoughbiensis* Vaughan, 1919
Diploastrea crassolamellata (Duncan, 1863) = *Astraea crassolamellata* Duncan, 1863
Diploria portoricensis (Vaughan, 1919) = *Meandra portoricensis* Vaughan, 1919
Favites polygonalis (Duncan, 1863) = *Astroria polygonalis* Duncan, 1863
Favites mexicana Vaughan, 1919
Hydnophora variabilis (Duncan, 1873) = *Goniastrea variabilis* Duncan, 1873
Leptoria spenceri Vaughan, 1919
Montastraea canalis (Vaughan, 1919) = *Orbicella canalis* Vaughan, 1919
Montastraea cylindrica (Duncan, 1863) = *Astraea cylindricus* Duncan, 1863
Montastraea endothecata (Duncan, 1863) = *Astraea endothecata* Duncan, 1863
Montastraea nodosa Budd *in* Budd *et al.*, 1992
Montastraea tampaensis (Vaughan, 1919) = *Orbicella tampaensis* Vaughan, 1919
Montastraea trinitatis (Vaughan *in* Vaughan & Hoffmeister, 1926)
Solenastrea bournoni Milne Edwards & Haime, 1849
Galaxea excelsa Weisbord, 1973
Antillia hadleyi (Wells, 1934b) = *Syzygophyllia hadleyi* Wells 1934b
Balanophyllia (Eupsammia) clarendonensis (Wells, 1934a) = *Eupsammia clarendonensis* Wells, 1934a

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