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Stratigraphy of the Guinea Corn Formation (Upper Cretaceous) at its type locality in the Rio Minho between Grantham and Guinea Corn, northern Clarendon, Jamaica

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Abstract — Eight stratigraphic sections through the Guinea Corn Formation, exposed in the Rio Minho between Grantham and Guinea Corn (north-west Clarendon), have been logged in detail. The sequence is informally divided into seven units herein designated A to G from the base upwards. Unit A comprises interbedded siltstones and thin silty limestones, and provisionally it is divided into six sedimentary rhythms. Unit B consists of more massive limestones with only minor amounts of siltstone or shale, and is divided into three rhythms. Unit C is represented by a return to interbedded limestones and siltstones and is divided into three rhythms. Unit D is a succession of massive limestones, which is divisible into six rhythms. Unit E represents an interbedded succession of siltstones and tuffaceous sandstones. Unit F is represented by five rhythms each of which shows an alternation of limestone and siltstone. Unit G consists of eighteen limestone beds, which yield abundant examples of the larger foraminiferan *Chubbina*. Lateral thickness variations in the relatively small area studied are rather dramatic, particularly for the tuffaceous units, which show rapid thinning laterally. Eight markers are described; these are: the *Distefanella* event (base of unit C); the *Biradiolites robinsoni* bed (unit C); the first *Sauvagesia* bed (unit C); the second *Sauvagesia* bed (unit D); the Cabbage Hill oncolite bed (unit D); the *Praebarrettia* bed (top of unit D); the *Macgillavryia* bed (base of unit F); and the Cabbage Hill lignite bed (base of unit G).

INTRODUCTION

THE GUINEA CORN FORMATION (Upper Campanian? to Maastrichtian) is one of the most visited formations within the Cretaceous succession of Jamaica (compare the published field guides: Williams, 1959a; Robinson, *et al*., 1972; Wright, 1974; Woodley and Robinson, 1977; Liddell *et al*., 1984; Robinson, 1988; Donovan, 1993a; Donovan *et al.*, 1995). This is probably due to the presence within it of abundant rudist bivalves, which were made famous by the work of Whitfield (1897), Trechmann (1924) and Chubb (1971). Chubb (1971) recorded 27 species of rudist from the sequence at Logie Green, the highest number of rudist species from a single formation in Jamaica. As well as rudists, studies have been conducted on many other fossil groups from the Guinea Corn Formation; these include: barnacles (Donovan and Davis-Strickland, 1993); brachiopods (Harper and Donovan, 1990; Harper, 1993; Sandy *et al*., 1997); calcareous nannofossils (Jiang and Robinson, 1977; Verdenius, 1993); corals (Coates, 1977); echinoids (Donovan, 1990, 1993b); foraminifera (Jiang and Robinson, 1977; Krijnen *et al*., 1993); gastropods (Sohl and Kollman, 1985; Sohl, 1992); and ostracods (Hazel and Kamiya, 1993).

Despite the importance of the rudist faunal assemblages, little detailed work has been published on the lithological succession of the Guinea Corn Formation. The only published sections showing the complete succession (Meyerhoff and Krieg, 1977; Johnson and Kauffman, 1996) are both very generalised. Trechmann (1924) described the succession at Logie Green, but this is generalised and has complications due to faulting. Roobol (1976) published a log showing the upper part of the Guinea Corn Formation, this included two prominent tuff horizons, but their section cannot be correlated with the sections published by Meyerhoff and Krieg (1977) and Johnson and Kauffman (1996). In this paper the Guinea Corn Formation exposed in the Rio Minho between Grantham and Guinea Corn is described in detail.

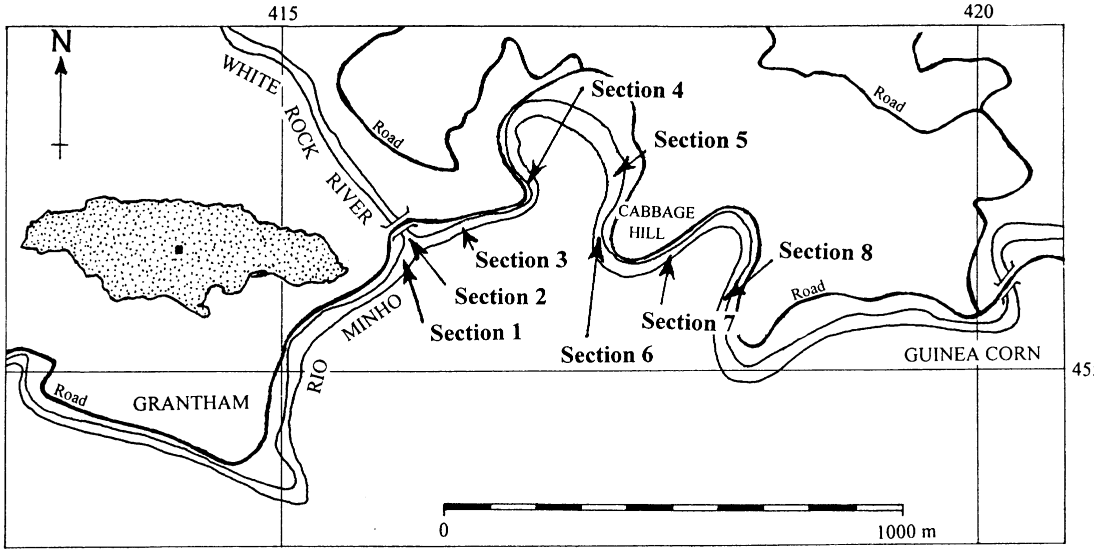

Figure 1. Location of logged sections in the Rio Minho between Grantham and Guinea Corn in northern Clarendon, Jamaica. Location in Jamaica inset. Section 1: Coffee Piece NW; section 2: Rondons River; section 3: Coffee Piece North; section 4: Coffee Piece NE; section 5: Cabbage Hill West; section 6: Cabbage Hill South; section 7: Cabbage Hill; section 8: Guinea Corn West.

HISTORY OF RESEARCH

Hill (1899) recognised a distinctive succession of rudist-bearing limestones at Logie Green (northern Clarendon), which he called the Logie Green Beds. Trechmann (1924) provided a measured section through the Logie Green Beds, and recorded the presence in them of *Praebarrettia sparcilirata* (Whitfield). He also introduced the generic name *Titanosarcolites* for Whitfield's (1897) species *Caprinula gigantea* which was common at Logie Green. Hose (1950) called the limestones exposed at Logie Green, as well as those elsewhere in Jamaica that yielded *Titanosarcolites*, the *Titanosarcolites* Series.

Williams (1959b) summarised the results of the Jamaican Geological Survey's mapping in the Central Inlier during the fifties. He recognised a threefold classification for the Cretaceous rocks of the western part of the Central Inlier. These were, in ascending order: the "Lower Tuffaceous Series"; the "Upper Rudist Limestone and Shales"; and the "Upper Tuffaceous Series". Chubb (in Zans *et al*., 1963, p. 7) suggested a threefold division of the Upper Rudist Limestone in his correlation table for the Central Inlier. In ascending order these were: "*Praebarrettia* Lst."; "Logie Green limestones and intervening shales"; and "Guinea Corn Lst.". In the text, Chubb was of the opinion that the limestones were separate, stating "these limestones have not been separated on the map" (Chubb in Zans *et al*., 1963, p. 14). His opinion that the *Praebarrettia* limestone was at the base of the succession was undoubtedly derived from its position in Trechmann's (1924, p. 388-389) measured section.

Coates (1964, p. 7 & 9) used the terms "Guinea Corn Limestones", "Guinea Corn *Titanosarcolites* limestones", and "*Titanosarcolites* limestone" for these limestones, and gave a measured section in Pindars River (near Crawle River, northern Clarendon). In 1965, he published this section and used the term "Guinea Corn Formation" in a formal publication for the first time. He further stated that the type section of the Guinea Corn Formation was in the "Rio Minho, between Grantham and Guinea Corn" (Coates, 1965, p. 31). In 1968, Coates introduced the term Summerfield Formation for the Upper Tuffaceous Series.

Robinson and Lewis (in Robinson *et al*., 1972, p. 13) proposed the name Slippery Rock Formation for the reddish conglomerates, sandstones and siltstones that represented the upper part of the Lower Tuffaceous Series of Williams (1959b). The proposed type locality was near the Slippery Rock River on the southern side of the Central Inlier. The boundary between the Slippery Rock and Guinea Corn formations was taken at the distinct colour change from red to grey-green, and corresponded to an increase in the carbonate content. Robinson and Lewis (in Robinson *et al*., 1972) also gave details of the Guinea Corn Formation exposed at Cabbage Hill, to the west of Guinea Corn (section 7 in Fig. 1), and suggested that the Guinea Corn Formation had a thickness of about 200 m in the western part of the Central Inlier.

Kauffman and Sohl (1974) published measured sections through two portions of the Guinea Corn

Formation in the Rio Minho (their text figs 22A and 22B). They also introduced descriptive terms for rudist frameworks and published bedding plane maps (their text figs 16B and 18B) showing rudist frameworks in the Guinea Corn Formation.

Roobol (1976) gave a measured section through the upper part of the Guinea Corn Formation and the Summerfield Formation. The Guinea Corn Formation section was section 7 in Figure 1, and clearly shows the presence of two tuff (volcaniclastic) horizons, previously described by Robinson and Lewis (in Robinson *et al*., 1972), in the upper part of the succession.

Coates (1977) suggested that the rudist limestones of Jamaica had formed in an island-arc setting. He recorded a thickness of 140 m for the Guinea Corn Formation in the Central Inlier, and recognised four coral assemblages that were mutually exclusive to the rudist assemblages.

Meyerhoff and Krieg (1977), during an analysis of the petroleum potential of Jamaica, published details from a number of undergraduate theses from the University of the West Indies and unpublished reports of the Geological Survey and Petroleum Corporation of Jamaica. They published Sohl's unpublished composite log (from an unpublished report for the Mine and Geology Division, 1976) through the Guinea Corn Formation at its type locality in the Rio Minho between Grantham and Guinea Corn. They also showed Kozary's section at Smithville (unpublished report for Jamaica Stanolind, Mines and Geology, 1956), and Coates' (1965) section at Pindars River.

Coates (in Liddell *et al*., 1984, p. 54) recognised that the Guinea Corn Formation was about 200 m thick in the western part of the Central Inlier, including the type area between Grantham and Guinea Corn. He stated that the lower 140 m consisted of "70 m of interbedded greenish-gray mudstones, siltstones and impure limestone" succeeded by "70 m of interbedded massive and rubbly limestone with few mudstone layers". The upper part consisted of "thick, rubbly limestone (often containing large *Durania* [now *Macgillavryia* – Rojas *et al*., 1995] sp. and *Titanosarcolites* sp.), alternating with mudstone and sandstone" and "the top of the formation is defined by the last rudist limestone".

Johnson and Kauffman (1996, their fig. 7) published a log through the complete Guinea Corn Formation (149.5 m thick) in the Rio Minho. They also provided a model for the development of rudist frameworks in the sequence (their fig. 8). Sandy *et al.* (1997) published and described a 10 m thick section in the Guinea Corn Formation (section 8 in Fig. 1) that had yielded to them the small terebratulid brachiopod *Dyscritothyris cubensis* Cooper.

THE GUINEA CORN FORMATION EXPOSED IN THE RIO MINHO

The Guinea Corn Formation is exposed at a number of localities between Grantham and Guinea Corn. The presence of north-south trending, upright folds and faults, coupled with the sinuous course of the river (Fig. 1) means that the same beds are exposed at various locations. This enables local variations in the formation to be assessed. Eight sections (Fig. 1) were measured and total about 500 m in composite thickness.

The Guinea Corn Formation is characterised by the presence of often well-defined sedimentary rhythms. These rhythms are generally characterised by three lithologies, which are in ascending order: (1) a shale or siltstone; (2) a shale, siltstone, calcareous siltstone or impure limestone which contains abundant corals and/or algal oncolites; and (3) a limestone. In different parts of the formation, the various lithologies in these rhythms vary in importance. It is particularly significant that these rhythms can be identified throughout all the sections measured in the Guinea Corn Formation along the Rio Minho between Grantham and Guinea Corn. The thicknesses of rhythms in the Guinea Corn Formation are shown in Table 1. The rhythms are probably due to variations in relative sea level.

The Guinea Corn Formation has been divided into seven units (Fig. 2) which are here designated, from the base upwards, A to G. These units are based on significant changes in lithology and potentially ultimately deserve member status. However, formal member names are not introduced for the present, until details of the distribution of these units in the Central Inlier are more fully understood.

Eight sections were measured (Fig. 1). Section 1 was exposed in the bed of the Rio Minho immediately upstream of the confluence between the Rio Minho and White Rock River. It exposed steeply dipping beds and exhibited the junction between the Guinea Corn Formation (unit A) and the underlying Slippery Rock Formation. The section contained many minor faults. Section 2 exposed part of unit B in the banks and bed of White Rock River between its confluence with the Rio Minho and the road bridge. Section 3 exposed units A, B and lower C in the banks and bed of the Rio Minho downstream from its confluence with White Rock River. This is the section which Coates (1965) nominated as the type section of the Guinea Corn Formation and also represents Kauffman and Sohl's (1974, text fig. 22B) section (although I calculate, by comparison with my measured sections, that their section represents 180 ft [=55 m] and not the stated 60 ft [=18 m] in their figure caption). Section 4 exposed upper unit C, units D and E (poorly) and basal unit F in the bed and banks of the Rio Minho. This section is the upper part of Sohl's

Table 1. Thicknesses of units/rhythms in the Guinea Corn Formation. Incomplete rhythms shown with + symbol; poorly exposed units shown with ~ symbol.

	Section						
Unit/rhythm	**2**	**3**	**4**	**5**	**6**	**7**	**8**
G				**22.3 m**		**27.8 m**	**21.3 m**
F5				**3.0 m**		**4.5 m**	**5.5 m**
F4				**4.0 m**		**2.3 m**	**2.3 m**
F3				**1.9 m**		**2.7 m**	**2.1 m**
F2				**2.0 m**		**3.0 m**	**2.6+ m**
F1				**8.5 m**		**8.7 m**	
E			**~5.1 m**	**~12 m**		**15.3 m**	**20+ m**
D6			**2.7 m**			**4.6 m**	
D5			**4.8 m**			**4.8 m**	**6.0 m**
D4			**4.9 m**			**4.8 m**	
D3			**4.8 m**			**4.4 m**	
D2			**4.6 m**			**5.3 m**	
D1			**4.1 m**			**4.5 m**	
C4				**3.2 m**			
C3				**5.1+ m**	**3.0 m**		
C2				**12.6 m**	**16.0 m**		
C1					**12.0 m**		
B3		**5.6 m**					
B2	**6.1+ m**	**6.5 m**					
B1	**6.0+ m**	**7.7 m**					
A		**12.2 m**					

unpublished section (Meyerhoff and Krieg, 1977, fig. 11), although the details are difficult to follow. This section also represents Kauffman and Sohl's (1974) upper section (their text fig. 22A). Section 5 is a composite section of unit C up into the Summerfield Formation exposed both in the banks and bed of the Rio Minho and in the bank along the road west of Cabbage Hill. The lower part of this section (units C through E), in particular, is affected by faulting, and there are also minor faults higher in the succession. Section 6 exposed unit C in a fairly long strike section in the bed of the Rio Minho to the south of Cabbage Hill. Section 7 exposed upper unit C through to the base of the Summerfield Formation in the bed and banks of the Rio Minho. This section was shown as a graphic log by Roobol (1976), and was also described by Robinson and Lewis (*in* Robinson *et al*., 1972). Section 8 exposed upper unit C up into the Summerfield Formation on the southern bank of the Rio Minho. Several significant faults affect the succession, and the whole Guinea Corn Formation is overturned at this locality. Part of this section was published by Sandy *et al*. (1997).

DESCRIPTION OF UNITS IN THE GUINEA CORN FORMATION

The section, 50 m downstream of the confluence between White Rock River and the Rio Minho (section 3 in Fig. 1), stated to be the stratotype by Coates (1965, p. 31), is here accepted as the stratotype of the Guinea Corn Formation. It exposes the contact with the underlying Slippery Rock Formation and parts of the lower three units recognised in the Guinea Corn Formation. A fence diagram showing the lateral variation in the thickness of the units of the Guinea Corn Formation in the eight sections studied in the Rio Minho is shown in Figure 2.

Unit A. This is the lowest unit in the Guinea Corn Formation and is exposed at sections 1 and 3 (Fig. 1). Both sections show the conformable junction with the underlying Slippery Rock Formation (Fig. 3 [enclosure]). Unit A is recognised by the thick shales it contains and the thin, silty limestones with their low diversity rudist assemblages. Unit A is equivalent to the lower part of Kauffman and Sohl's (1974, text fig. 22B) section (up to their bed 14), their 'lagoonal centre and back barrier slope sediments'. The base of the Guinea Corn Formation is taken at the base of the first prominent calcareous bed (a carbonate cemented-sandstone overlain by limestone concretions); this bed yields fragments of *Titanosarcolites giganteus* (Whitfield). The underlying Slippery Rock Formation consists of red, green and grey siltstones with thin calcareous sandstones up to 10 cm in thickness (Fig. 3 [enclosure]). These sandstones yield a restricted, low diversity, non-rudist, bivalve assemblage.

Unit A is not well exposed but has an estimated total thickness of 12.2 m. The lower part of unit A consists of silty shales and nodular micritic limestones, locally containing abundant corals, *Biradiolites rudissimus* Trechmann and a few *T. giganteus*. The upper part of unit A comprises shale-limestone rhythms which consist

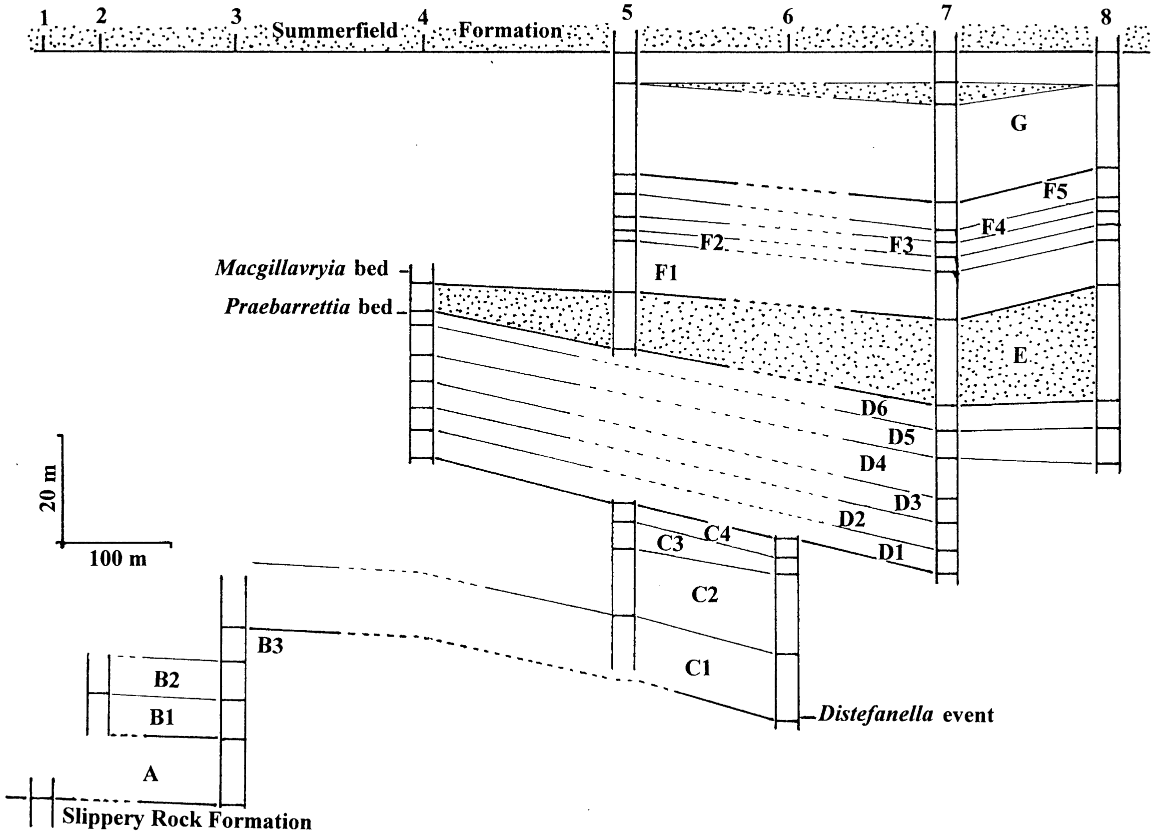

Figure 2. Fence diagram, base of the Summerfield Formation as datum, showing the Guinea Corn Formation (sections from Fig. 1). Volcaniclastic intervals are shown stippled and show rapid lateral thickness variations. In contrast, the siltstone-limestone rhythms in the Guinea Corn Formation show relatively little lateral variation in thickness. Units indicated by letters, rhythms by letter/number pairs.

of three lithologies which are, in ascending order: (1) a shale, locally with abundant lignite fragments and a diverse assemblage of aragonitic bivalves (mouldic preservation) and gastropods (with their shells replaced by calcite), scattered examples of the rudist *Distefanella* sp. and a few examples of the coral *Paracycloseris* sp.; (2) a silty shale, rich in small corals including *Ovalastrea trechmanni* (Wells), *Paracycloseris* sp. and *Actinacis* sp.; and (3) a silty limestone, with abundant examples of the rudist *Bournonia cancellata* (Whitfield), and rarer *T. giganteus*, *Antillocaprina occidentalis* (Whitfield) and *Thyrastylon adhaerens* (Whitfield). Four such rhythms are present in the upper part of unit A (Fig. 3 [enclosure]). By comparison with the faulted succession at section 1 and sections on the southern side of the Central Inlier, the unexposed interval between the lower and upper parts of unit A at section 3 probably consists of siltstones.

Unit B. The base of unit B marks the appearance of thick limestones and the virtual disappearance of thick shale beds (Fig. 3 [enclosure]). The base of this unit is taken at the base of the siltstone beneath the first prominent limestone in the succession. The unit is exposed in sections 2 and 3 (Fig. 1). Section 3 represents beds 15 to 23 (their 'Type B rudist barrier assemblage') of Kauffman and Sohl (1974, text fig. 22B).

Unit B is subdivided into three rhythms, B1 to B3, and the details between the two sections measured (sections 2 and 3) can be matched closely, with levels yielding *T. giganteus* correlating between sections (Fig. 3 [enclosure]). The limestones of unit B contain abundant rudists; *B. cancellata* (Whitfield), *Biradiolites jamaicensis* Trechmann, *A. occidentalis* (Whitfield), and *T. giganteus* are abundant, while *T. adhaerens* (Whitfield), *Chiapasella radiolitiformis* (Trechmann) and *Plagioptychus* spp. also occur. The lower portion of rhythm B2 (bed B2c) consists of a rudist rudstone with numerous *B. cancellata* and *B. jamaicensis*, locally with a few clusters in growth position. A single siltstone/shale bed (bed B3b in section 3) yields *Distefanella* sp. and aragonitic molluscs, while the succeeding nodular siltstone (bed B3c) yields extremely abundant corals, including *Ovalastrea trechmanni* (Wells), *Actinacis* sp., *Vaughanoseris catadupensis* Wells, *Trochoseris catadupensis* (Vaughan), *Leptoria (Dictuophyllia) conferticostata* (Vaughan) and *Dichoecenia* sp. The limestones in the upper part of rhythm B3 (beds B3e-l) show excellently weathered-out rudists including *B. jamaicensis*, *B. cancellata*, *Antillocaprina suboccidentalis* Chubb, *T. adhaerens* and *Plagioptychus* spp. some containing geopetal structures (under NO circumstance should they be hammered) indicating the beds are the right way up.

Unit C. Unit C represents a return to shale deposition, and the base of the unit is represented by the thickest marine siltstone/shale in the succession (Fig. 4 [enclosure]). The unit consists of thin limestones and typically relatively thick interbedded shales. The unit is divided into four, C1 to C4 (C4/D1 is a single couplet which spans the prominent lithological change at the unit C-D boundary).

In section 6, the lower part of rhythm C1 is the thickest marine siltstone within the Guinea Corn Formation and contains an abundant fauna of molluscs, including numerous aragonitic bivalves and gastropods, and soft substrate corals (particularly *Paracycloseris* sp.). In addition, the small rudist *Distefanella* sp. is particularly abundant and marks the *Distefanella* event (indicated by Kauffman and Sohl, 1974, text fig. 22B, bed 24, as "*Distefanella* clusters"). The succeeding limestone (upper rhythm C1) contains a low diversity rudist assemblage consisting of *B. jamaicensis*, *A. suboccidentalis* and *T. adhaerens*.

Rhythm C2 consists of a moderately thick siltstone horizon (up to 1.7 m thick) succeeded by medium-bedded bioclastic limestones with thin intervening siltstones. The rudist assemblages within the limestones show progressive upward changes; a lower assemblage characterised by *A. suboccidenatlis*, *B. jamaicensis* and *T. adhaerens*, is replaced progressively upwards by an assemblage characterised by *C. radiolitiformis*, *T. giganteus* and *T. adhaerens*. Two faunally distinctive beds are recognised, the *B. robinsoni* bed and the first *Sauvagesia* bed, which yield the rudists *Biradiolites robinsoni* Chubb and *Sauvagesia macroplicata* (Whitfield), respectively.

The upper carbonate-rich portion of rhythm C3 contains a rudist assemblage containing *C. radiolitiformis*, *B. jamaicensis*, *A. suboccidentalis* and *T. giganteus*. C4 is the lower part of rhythm C4/D1, which spans the prominent lithological change at the unit C-D boundary. The poor overlap of logged sections across this boundary means it is unwise at present to use a single name for this rhythm. Scattered examples of *Bournonia barretti* Trechmann have been recorded within the middle of the siltstone of C4 at section 7.

Unit D. The base of unit D marks a return to thick limestones with only minor intervals of shale (Fig. 5 [enclosure]). This unit represents the lowest limestone in Roobol's (1976) section through the upper part of the Guinea Corn Formation. Unit D can be divided into six rhythms which herein are labelled D1 (upper rhythm C4/D1) to D6. These rhythms have very thin shale intervals and thick limestone intervals (Fig. 5 [enclosure]). The base of unit D is taken at the significant change from siltstones (locally with ash-fall tuffs, section 4, Fig. 5 [enclosure]) to limestones.

D1 consists of thin nodular limestones, separated by gritty, bioclastic siltstones. At section 4, it contains a few *Bournonia* sp., *B. jamaicensis*, and scattered *T. giganteus* (Fig. 5 [enclosure]), while at section 7, it yields scattered *A. occidentalis* in its lower, and abundant *C. radiolitiformis* in its upper parts (Fig. 5 [enclosure]).

Rhythm D2 consists of more massive limestones. In section 4, rhythm D2 contains *C. radiolitiformis* in the basal limestone and scattered *A. occidentalis* above (Fig. 5 [enclosure]). In section 7, rhythm D2 yields abundant *C. radiolitiformis*, with more frequent *B. jamaicensis*, *Bournonia* sp. and *T. adhaerens* in the upper two limestone beds (Fig. 5 [enclosure]).

In section 4, the lower part of rhythm D3 is represented by a deeply weathered notch in the bank of the river, which contains thin siltstones and silty limestones rich in *T. adhaerens* with rarer *T. giganteus*, *C. radiolitiformis* and *B.* cf. *jamaicensis* (Fig. 5 [enclosure]). In section 7, rhythm D3 yields scattered *T. adhaerens* and a few *Antillocaprina* sp. at the top (Fig. 5 [enclosure]).

In section 4 the lower part of rhythm D4 consists of shales and calcareous siltstones and weathers to form a gutter; it contains occasional rudists including *C. radiolitiformis* and rarer *Thyrastylon coryi* (Trechmann), and locally common corals (including *L. (D.) conferticostata*). The upper part of D4 contains alternating rudist assemblages dominated, in turn, by either *T. giganteus* or *C. radiolitiformis* (Fig. 5 [enclosure]). The upper part of D4 is present as a strike section at this locality and is the best locality in the Rio Minho between Grantham and Guinea Corn for seeing well-exposed *T. giganteus* (under NO circumstances should it be hammered). In section 7, D4 is represented by massive limestones with thin marlstone flasers, and contains only scattered rudists: occasional *C. radiolitiformis* and *Bournonia* sp. in the lower part; and more common *Bournonia* sp. in the upper part (Fig. 5 [enclosure]). The upper part of D4 is also present in section 8, and also yields *C. radiolitiformis* and *T. giganteus* (Fig. 5 [enclosure]).

In section 4, the lower part of rhythm D5 is an unexposed gutter, while the upper part consists of typically massive limestones with rare *C. radiolitiformis* (Fig. 5 [enclosure]). In section 7, D5 contains a distinctive bed in its lower part, the Cabbage Hill oncolite bed. This bed is characterised by abundant algal oncolites, up to 8 cm in diameter, with small branching corals as their nuclei. This is the thickest bed of oncolites so far recorded in the Guinea Corn Formation. The massive limestones above the oncolite bed contain a few examples of *C. radiolitiformis*. In section 8, D5 is represented by two lithologies: coraliferous shales and massive, bedded limestones. The coral-yielding intervals consist of coral fragments in a shale matrix, and at some levels *in situ* corals are present and form a framework. Locally, lophid oysters are also present forming cemented clusters. The bedded limestones contain few rudists. A single graded tuffaceous sandstone is present in D5 at this locality.

Rhythm D6 is the uppermost rhythm within unit D and is characterised by its distinctive lithology and by the presence of the *Praebarrettia* bed at the top. The distinctive limestones of this unit are impure and contain a large amount of volcaniclastic debris up to coarse sand grade. This renders the limestone of this rhythm highly distinctive. In section 4, D6 consists of two impure limestones and two gritty calcareous siltstones (Fig. 5 [enclosure]). The *Praebarrettia* bed occurs at the top, and yields *Praebarrettia sparcilirata* (Whitfield), *Macgillavryia nicholasi* (Whitfield), *T. giganteus*, and *C. radiolitiformis*. This is the only bed in the Guinea Corn Formation, exposed between Grantham and Guinea Corn, that has yielded *P. sparcilirata*. In section 7, the lower part D6 is unexposed, but the upper part consists of bedded, impure (volcaniclastic-rich) limestones with the *Praebarrettia* bed (yielding the same fauna as at section 4) at the top (Fig. 5 [enclosure]). In section 8 only the lower portion of D6 is present, the upper part, including the *Praebarrettia* bed, being faulted out. At the base there are two graded tuffs, succeeded by a thin oncolite bed which yields relatively small (up to 2 cm diameter) algal oncolites. The uppermost beds present at this locality are characterised by the same impure (volcaniclastic-rich) limestone as present at the other localities exposing D6.

Unit E. The base of unit E is defined by the appearance of volcaniclastic sediments, and often marks an interval of poor or no exposure. This represents the thickest interval of volcaniclastic sediments within the Guinea Corn Formation (Fig. 6). Unit E is particularly well-exposed at section 7, but is also present elsewhere. This unit represents the lower of Roobol's (1976) two volcaniclastic units in his section through the Guinea Corn Formation. Unit E shows progressive thinning from east to west (Fig. 6; Table 1). At section 7 the unit can be divided into a lower part and an upper part. The lower part is represented by an interval of thinly bedded tuffs with abundant sedimentary structures, including cross-bedding, ripple cross-lamination, unidirectional ripple form sets, and normally graded sandstones. The upper part is represented by a thick interval of siltstones, with frequent normally graded (coarse sand to silt) beds up to 1.1 m in thickness. In the most easterly section studied (section 8) two thin limestones are present in unit E (Fig. 6). At this locality, the lower part of unit E contains a marine fauna including undetermined crustaceans. The details of unit E seen at section 7 and 8 cannot be correlated with one another. It appears that thickness variations, and probable erosion at the bases of the thicker graded tuffaceous sandstones have resulted in the generation of highly localised successions. The unit is too poorly exposed at sections 4 and 5 to determine details of the succession.

Unit F. The base of unit F is marked by the reappearance of dominantly limestone lithologies within the Guinea Corn Formation. This is the lower part of the middle unit of limestone in Roobol's (1976) section through the Guinea Corn Formation. Unit F contains thicker siltstones than unit D, and these thicken towards the east, while the intervening limestones correspondingly become thinner. The unit is divided into 5 rhythms, labelled F1 to F5 (Fig. 7). The rudist assemblages, other than in the basal part of the lowest rhythm, are significantly impoverished in unit F when compared with those of units B through D.

F1 (the upper part of a rhythm with unit E as its lower part) is characterised by the presence of the *Macgillavryia* bed (Fig. 7), which yields abundant, large examples of *M. nicholasi* together with *T. giganteus*, *C. radiolitiformis*, and *B. jamaicensis*. Although *Macgillavryia* is common to both the *Praebarrettia* bed of unit D and the *Macgillavryia* bed, the former bed also yields *P. sparcilirata*. Furthermore, the *Macgillavryia* bed is a hard, massive, thick limestone bed, while the *Praebarrettia* bed is a soft, impure, volcaniclastic-rich, thin limestone. The *Macgillavryia* bed occurs in the lower part of F1 (Fig. 7). The *Macgillavryia* bed is present at section 8, but the upper part of F1 is faulted out at this locality. Apart from the well-developed rudist assemblages from the *Macgillavryia* bed, rudists are generally rare in F1, and limited to occasional examples of *T. giganteus* and *B. jamaicensis* in the upper parts of some of the limestone beds (Fig. 7).

Rhythm F2 is represented by a lower, relatively thick siltstone bed, often with nodular carbonate bands, and an upper limestone, sometimes containing thin siltstones, which is locally nodular (Fig. 7). This represents the most silty of the rhythms present in unit F, and the proportion of silt increases towards the east (Fig. 7). The siltstones contain very few fossils, and they probably represent reworked, fine-grained, volcaniclastic deposits. Rudists are generally inconspicuous in this rhythm: a few *C. radiolitiformis* occur in the upper part of section 8, while rare *T. giganteus* are present at the top of the limestone of section 5. Sandy *et al*. (1997) reported the presence of the small terebratulid brachiopod *Dyscritothyris cubensis* Cooper from the middle of F2 in section 8 (Fig. 7). They recorded about 30 specimens,

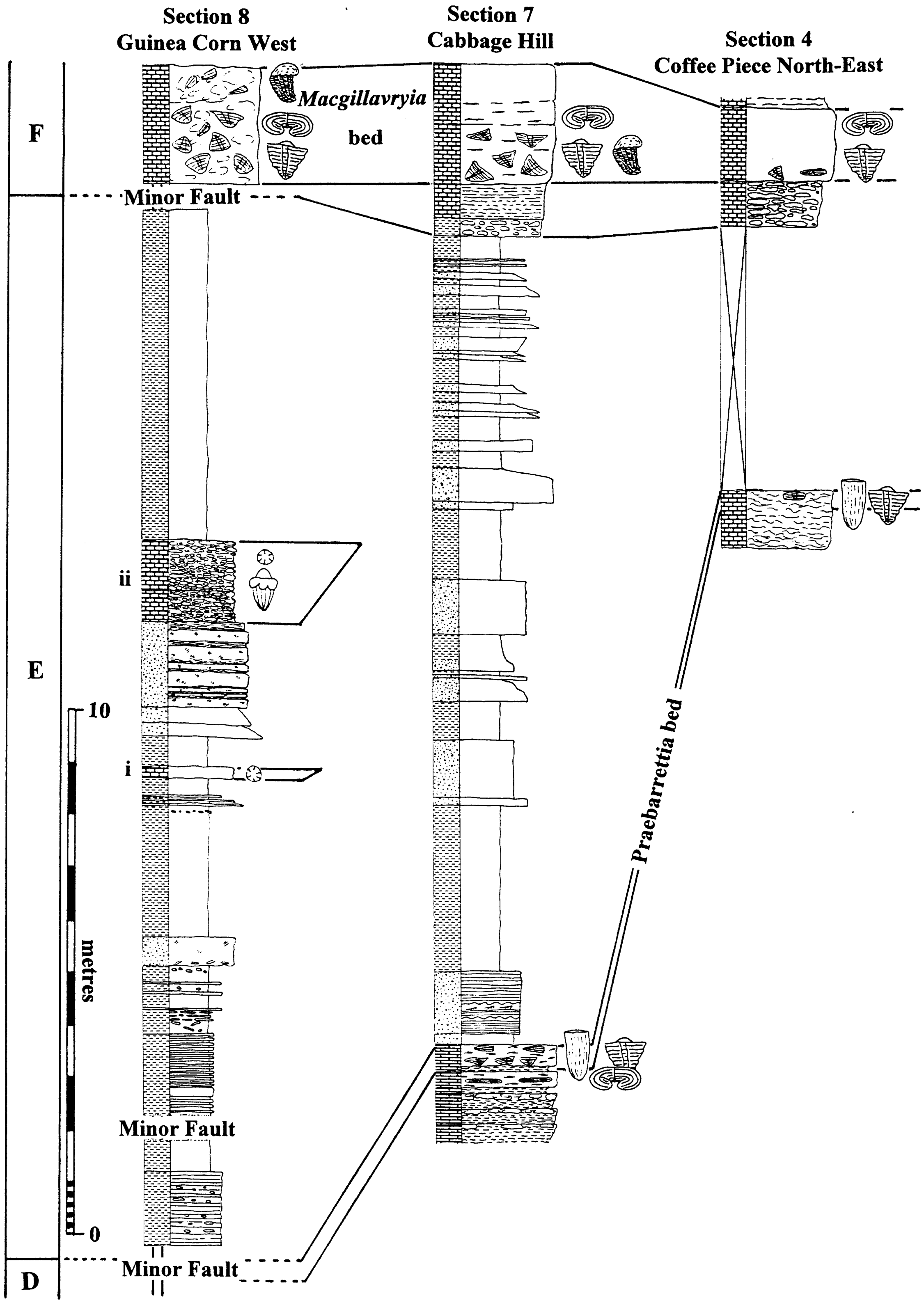

Figure 6. Correlation of unit E of the Guinea Corn Formation, Rio Minho, northern Clarendon, Jamaica. See Figure 4 [enclosure] for key to symbols: intervals with crosses represent unexposed section. Units indicated by letters, limestones in unit E indicated i and ii.

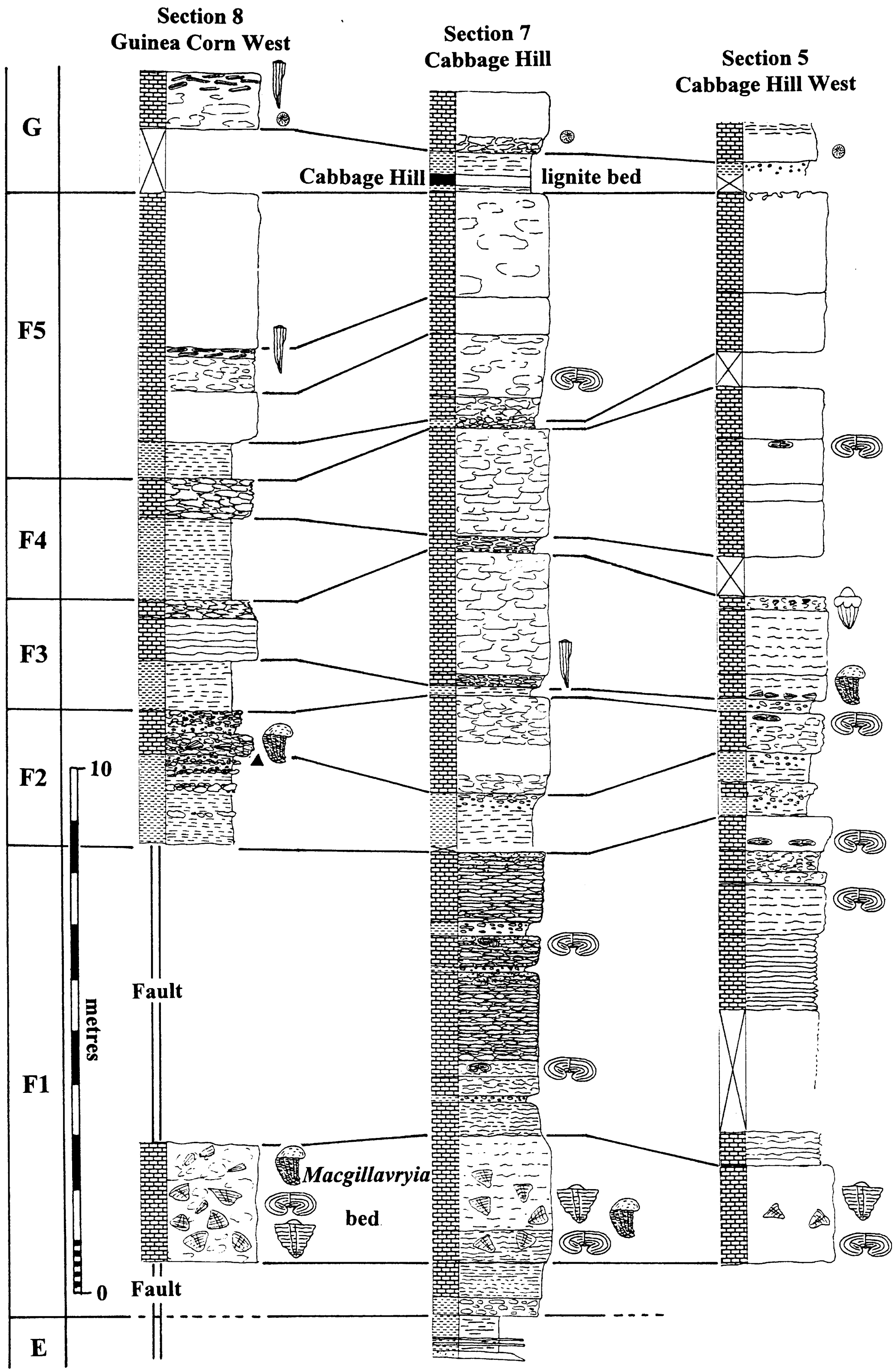

Figure 7. Correlation of unit F of the Guinea Corn Formation, Rio Minho, northern Clarendon, Jamaica. See Figure 4 [enclosure] for key to symbols: intervals with crosses represent unexposed section. Units indicated by letters, rhythms by letter/numbers pairs. Units indicated by letters, rhythms by letter/numbers pairs.

collected over a period of 11 years, from this horizon.

Rhythm F3 is represented by a well-developed siltstone-limestone couplet (Fig. 7). The proportion of silt increases towards the east (Fig. 7). Rudists are rare in F3; a few *C. radiolitiformis* occur at the base, and a few *Bournonia* sp. at the top of the limestone in section 8 (Fig. 7).

Rhythm F4 is similar to F3, although a little thicker. The proportion of silt increases towards the east and rudists are generally rare (only *T. giganteus* was recorded in the limestones of section 5).

The upper limestone portion of rhythm F5 is divisible into three beds in sections 7 and 8. However, only two limestones are recognised in section 5, consequently only a tentative correlation of these limestones is possible at present (Fig. 7). Rudists are generally rare; a layer of reworked *B. jamaicensis* occurs within the limestone portion of F5 in section 8.

Unit G. This is the uppermost unit in the Guinea Corn Formation. This unit represents the upper part of Roobol's (1976) middle limestone, together with his upper volcaniclastic layer and his upper limestone. The upper volcaniclastic unit of Roobol (1976) is, however, only present in section 7; it is absent elsewhere (Fig. 8 [enclosure]). Consequently, this volcaniclastic unit is not used to define additional units herein. The base of unit G is taken at the very irregular top surface of the uppermost limestone of unit F. This very irregular surface is overlain by a siltstone rich in fine- to coarse-sand grade volcaniclastic material, and is succeeded by a 30 cm thick lignite, and finally, a silty limestone. This is the thickest lignite (the Cabbage Hill lignite bed) recorded to date within the Guinea Corn Formation. Above this lignite the limestones are noticeably richer in the larger benthic foraminiferan *Chubbina* sp., although this genus also occurs in the upper part of unit F.

Unit G can be divided into 18 marlstone-limestone couplets (although the marlstones are usually very thin) which are here labelled G1 to G18. These limestones can be correlated between all three measured sections (Fig. 8 [enclosure]). Some limestone layers show significant thickness variations, while others have certain distinctive characteristics: G1 has the Cabbage Hill lignite bed at its base, and abundant *Chubbina* sp. in its upper part; G3 is of a distinctive grey colour which makes the pale-coloured *Chubbina* sp. conspicuous, gastropod steinkerns are also abundant; G5 has a nodular texture; G15 has a thick lower silty interval and a nodular limestone with marlstone flasers. Rudists are generally rare and the various occurrences are shown on Figure 8 [enclosure]. The base of the overlying Summerfield Formation is marked by a change to volcaniclastic strata without limestones or fossils. These are well exposed in section 7 (Fig. 8 [enclosure]).

THICKNESS OF THE GUINEA CORN FORMATION

The following thicknesses have been quoted for the Guinea Corn Formation: 140 m (Coates, 1977), 149.5 m (Johnson and Kauffman, 1996, their Figure 7), and 200 m (Robinson and Lewis in Robinson *et al.*, 1972; Coates in Liddell *et al.*, 1984). The composite sections measured here for the Guinea Corn Formation range from a minimum of about 140 m in the vicinity of the confluence of the Rio Minho and White Rock River to 165 m between Cabbage Hill and Guinea Corn West (Fig. 2). The thicknesses of individual units and rhythms are shown in Table 1.

CONCLUSIONS

The Guinea Corn Formation ranges in thickness from 140 m to 165 m. Seven units are recognised in the Guinea Corn Formation on the basis of lithological variation and fossil content. These units can be recognised in all sections between Grantham and Guinea Corn. Seven distinctive marker horizons are named, as follows: the *Distefanella* event (unit C); the *B. robinsoni* bed (unit C); the first *Sauvagesia* bed (unit C); the second *Sauvagesia* bed (unit D); the Cabbage Hill oncolite bed (unit D); the *Praebarrettia* bed (unit D); the *Macgillavryia* bed (unit F); and the Cabbage Hill lignite bed (unit G).

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APPENDIX A - DESCRIPTION OF MARKER BEDS IN THE GUINEA CORN FORMATION

The following marker horizons are defined informally herein. These horizons are extremely valuable in studying small sections in the Guinea Corn Formation, and although largely palaeontological in nature appear to have significant stratigraphic value. Their true lithostratigraphic or biostratigraphic value will only become apparent when further studies of the Guinea Corn Formation in the Central Inlier, which are currently being undertaken by the author, have been completed. It is hoped that these beds will enable the establishment of a usable event stratigraphy for the Cretaceous of Jamaica. Type localities for each bed are given here for reference purposes only.

1. *Distefanella* event. This level was marked on the graphic log given by Kauffman and Sohl (1974, text fig. 22A, bed 24). This marker event occurs at the base of unit C of the Guinea Corn Formation and is easily recognisable in the immediate vicinity of Coffee Piece. The type locality of the bed is at section 3.

2. *Biradiolites robinsoni* bed. *B. robinsoni* is a rare fossil in the Jamaica Upper Cretaceous. In the Guinea Corn Formation, this species is restricted to a narrow interval within rhythm C2. Whether this level represents a significant biostratigraphic or palaeoenvironmental marker is, at present, unknown. At the very least, the naming of this bed indicates the level at which this rare rudist may be collected. Future study may demonstrate that this level has great stratigraphic value. The type locality of this bed is at section 6.

3. First *Sauvagesia* bed. *Sauvagesia* is a rare rudist within the Jamaican Maastrichtian succession. The lower level at which this species occurs is in C2 above the *B. robinsoni* bed. The type locality of this bed is at section 6.

4. Second *Sauvagesia* bed. The second level at which Sauvagesia occurs is in D3; type locality at section 4.

5. Cabbage Hill oncolite bed. This bed, at the base of D5, is characterised by abundant algal oncolites up to 8 cm in diameter. Each oncolite has a nucleus consisting of a rounded fragment of coral. The type locality is at section 7.

6. *Praebarrettia* bed. This bed is characterised by the occurrence of common examples of the rudist *Praebarrettia sparcilirata* together with *Macgillavryia nicholasi* within a volcaniclastic-rich soft limestone at the top of unit D. This is the only level found within the Guinea Corn Formation to date that has yielded this rudist. In addition to this rudist, the bed also yields the bivalve *Neithea*, and probably represented more open marine conditions than the rest of the Guinea Corn Formation. The bed appears to have a great correlation potential within the Guinea Corn Formation. The type locality of the bed is at section 7 where it is well exposed.

7. *Macgillavryia* bed. This is a massive limetone at the base of unit F which contains abundant examples of *Macgillavryia nicholasi*. This bed forms an extremely prominent limestone within the Guinea Corn Formation. The type locality of this bed is at section 7.

8. Cabbage Hill lignite bed. The Cabbage Hill lignite bed occurs at the base of unit G. It is characterised by a lignite-rich siltstone and rests on a very irregular surface. The type locality of this bed is at section 7.

Description of Figures.

Figure 3. Correlation of units A and B of the Guinea Corn Formation, Rio Minho, northern Clarendon, Jamaica. See Figure 4 [enclosure] for key to symbols: intervals with crosses represent unexposed section. Units indicated by letters, rhythms by letter/numbers pairs.

Figure 4. Correlation of unit C of the Guinea Corn Formation, Rio Minho, northern Clarendon, Jamaica: intervals with crosses represent unexposed section. Units indicated by letters, rhythms by letter/numbers pairs.

Figure 5. Correlation of unit D of the Guinea Corn Formation, Rio Minho, northern Clarendon, Jamaica. See Figure 4 [enclosure] for key to symbols: intervals with crosses represent unexposed section. Units indicated by letters, rhythms by letter/numbers pairs.

Figure 8. Correlation of unit G of the Guinea Corn Formation, Rio Minho, northern Clarendon, Jamaica. See Figure 4 [enclosure] for key to symbols: intervals with crosses represent unexposed section. Units indicated by letters, couplets by letter/numbers pairs.