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Lithostratigraphy of the Central Inlier, Jamaica

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ABSTRACT. The lithostratigraphy of the Central Inlier is revised based on a complete geological map of the entire inlier. Nomenclature problems from previous schemes are reviewed, the Crofts Synthem is changed rank to Crofts Group, and the Back River Formation is corrected to Black River Formation. The following new units are described: Bellas Gate Formation, Dry Hill Formation; Corn Hill Member (Thomas River Formation); Yankee River Member, Two Meeting Member and Moravia Member (Guinea Corn Formation); and Bronte Tuff Member (Mahoe River Formation, Summerfield Group). The age and lateral relationships of the units are illustrated.

Key words: Lithostratigraphy, Cretaceous, Jamaica, Kellits Synthem, Campanian, Maastrichtian.

1. INTRODUCTION

The Central Inlier (**Figure 1**) represents the second largest area of Cretaceous (and Paleocene) rocks in Jamaica. Unlike the Blue Mountain Inlier, which is the largest but largely inaccessible of the Cretaceous inliers, the geology of the Central Inlier is relatively accessible and is much less structurally complex. The lithostratigraphy has been developed since the 1950s, and the most recent revision of the lithostratigraphic scheme was presented by Mitchell and Blissett (2001) and Mitchell (2003a).

The complete Central Inlier has now been mapped at a scale of 1:12,500 by the author (**Figure 2**) and requires revisions to the lithostratigraphic schemes presented by Mitchell and Blissett (2001) and Mitchell (2003a). Additional information is also available on the rudist bivalve succession in the inlier as well as on the igneous rocks (Hastie et al., 2013). This paper therefore provides a revised lithostratigraphy of the Central Inlier, but concentrates on new formations and members as well as age relationships. Details of the historical development of the lithostratigraphy were given in Mitchell and Blissett (2001) and Mitchell (2003a) and are not repeated here.

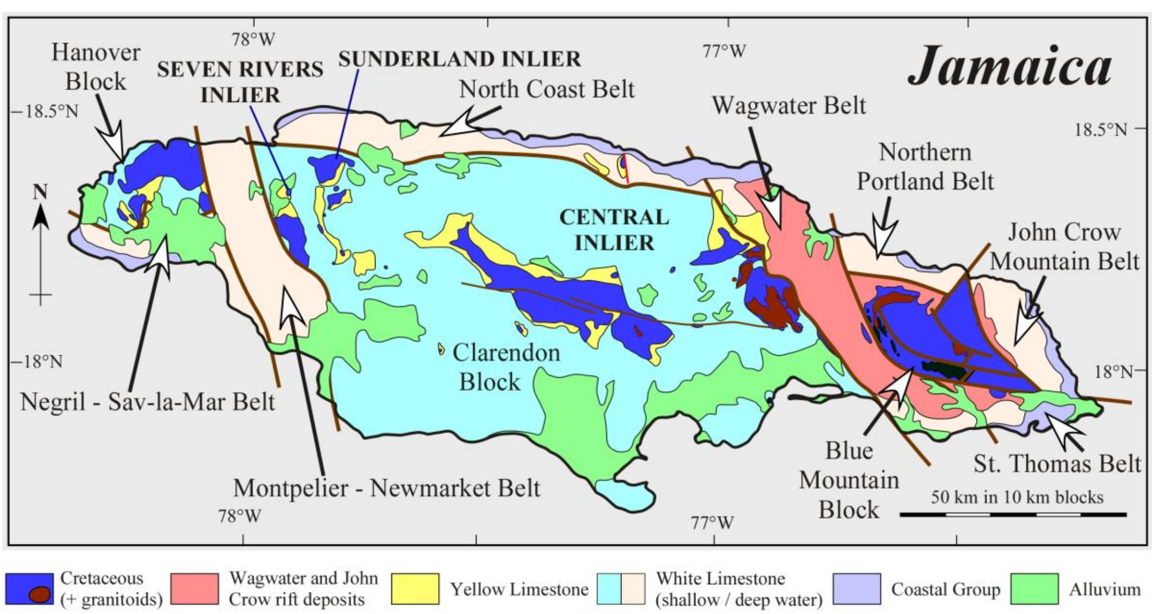

Figure 1. Location of the Central Inlier in Jamaica.

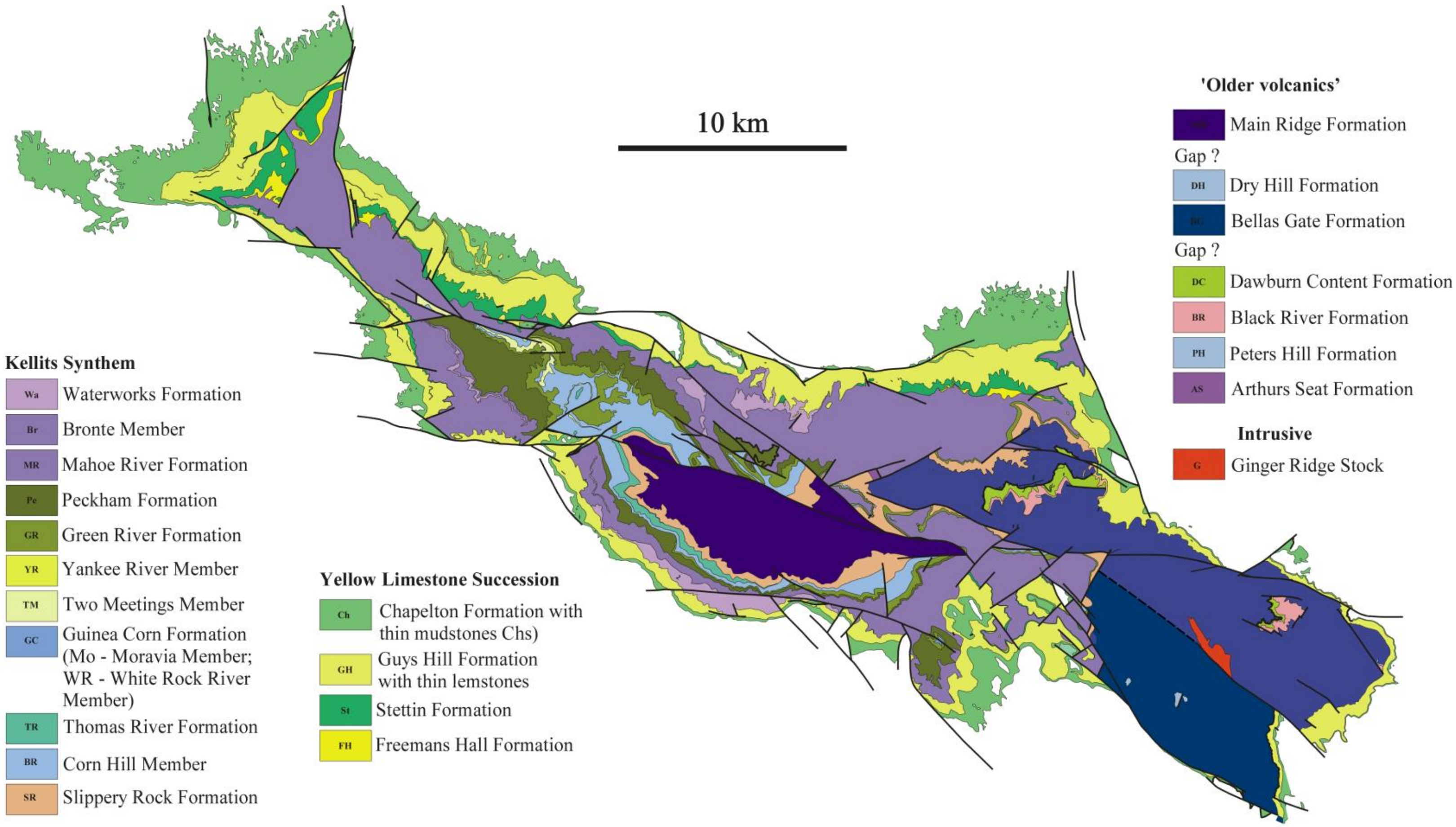

Figure 2. Summary geological map of the Central Inlier based on geological mapping at a scale of 1:12,500 from 1996 to 2004.

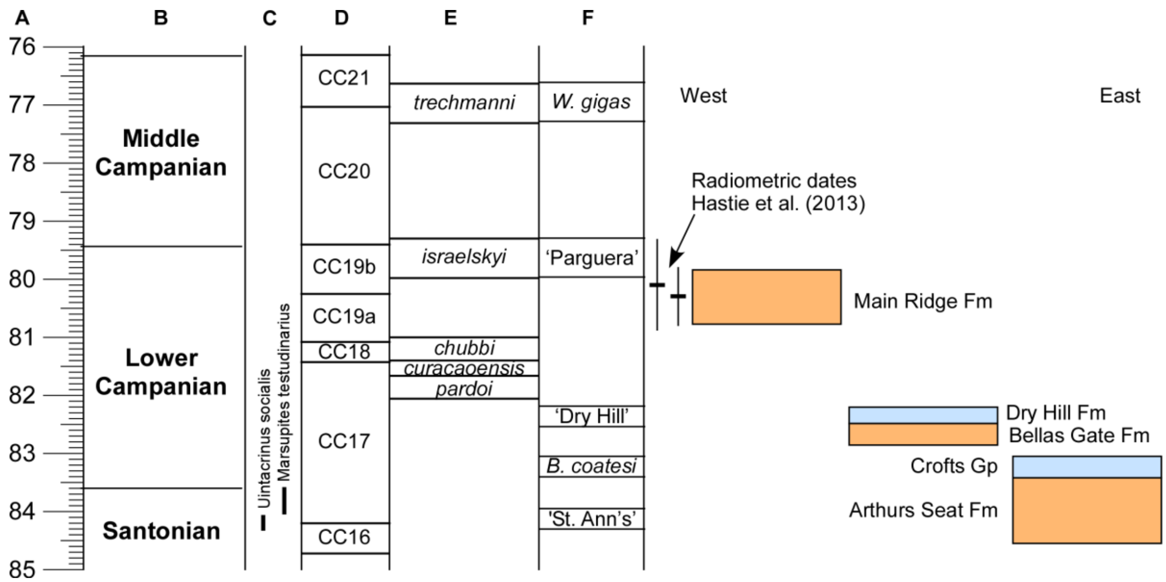

Figure 3. Stratigraphy of the 'older volcanics' in the Central Inlier. A, age (MA); B, Stages; C, Crinoid ranges; D, Calcareous nannofossil zones; E, Pseudorbitoides assemblages; F, Rudist levels.

2. LITHOSTRATIGRAPHY

The lithostratigraphic practice here follows the International Stratigraphic Guide (Salvador, 1994; Murphy and Salvador, 1999). Holostratotypes are indicated by grid references on the metric 1:50,000 scale series maps issued by the Survey Department, Jamaica.

2.1. Older volcanics

The term 'older volcanics' is used here for the succession beneath the Kellits Synthem and includes both volcanics as well as interbedded fossiliferous sedimentary rocks. The term 'older volcanics' is not given formal lithostratigraphic status and is simply used for convenience. The 'older volcanics' comprise five units: the Arthurs Seat Formation, the Crofts Group, the Bellas Gate Formation, the Dry Hill Formation and the Main Ridge Volcanics. These are described below. The stratigraphy of the 'older volcanics' is shown in **Figure 3**.

2.2. Arthurs Seat Formation

The oldest rocks exposed in the Central Inlier are placed in the Arthurs Seat Formation (Coates, 1964, 1969; Mitchell, 2003a) and have been previously described by Coates (1969) and Mitchell (2003a). Mitchell (2003a) suggested that there might be only a single unit of volcanics (basalts, basaltic-andesites and volcaniclastic sediments) in the Central Inlier and that the relationships mapped with the Crofts Synthem could be explained by faulting. Further mapping combined with new (^{40}Ar-^{39}Ar) radiometric dates (Hastie et al., 2013) indicate instead that there are three units of volcanics in the Central Inlier, one underlying the Crofts Group (Arthurs Seat Formation), one between the Crofts Group and the Dry Hill Formation (Bellas Gate Formation) and one above the Dry Hill Formation (Main Ridge Formation).

The name Arthur's Seat was first used by Chubb (1960) for the lower limestone in the Central Inlier from which *Barrettia* (then *Praebarrettia*) *coatesi* (Chubb) had been collected and to which an erroneous Turonian age was assigned (Chubb, 1971). Yet the Arthur's Seat Limestone was never formally described, only named (Chubb, 1960; in Zans et al., 1963), and when Coates (1964, 1969) described the succession around Arthurs Seat he deemed that the name was available and used it for the volcanics below the limestone. The name Arthurs Seat Formation is retained here for the volcanics pending a decision on its validity by the Jamaican Lithostratigraphic Committee.

The Arthurs Seat Formation consists of a thick succession of sedimentary and volcanic rocks, including andesites, basaltic andesties, volcaniclastic sandstones and conglomerates, and rare rhyolites. The stratigraphic sequence cannot be worked out in any detail as both flows and bedding are difficult or impossible to identify in weathered outcrops. The succession has also been intruded by many basaltic and porphyritic andesite dykes, with cross-cutting relationships visible where there are good exposures. The dykes are associated with contact metamorphism, and locally with copper and gold mineralization (Baxter, 1998). Jackson (1987) demonstrated that the basalts and basaltic andesites in the eastern part of the Central Inlier had tholeiitic affinities.

The age of the Arthurs Seat Formation cannot be directly assessed. There are no radiometric dates, and so far the formation has proved unfossiliferous. Mitchell (2003a) tentatively attributed a late early to early late Cretaceous age from regional considerations. However, the fact that similar volcanics occur above as well as below the Crofts Group means there need not be a large age difference between the Arthurs Seat Formation and the Crofts Group. The Peters Hill Limestone at the base of the Crofts Group yields a rudist bivalve assemblage including *Barrettia coatesi*, which regionally in the Caribbean should be regarded as an earliest Campanian species (see below), and therefore the Arthurs Seat Formation is tentatively given a Santonian age here.

2.3. Crofts Group

Mitchell (2003a) introduced the name Crofts Synthem for an unconformity bound sedimentary unit in the northeastern part of the Central Inlier that included the Peters Hill, Back River and Dawburns Content formations. It is now doubtful if the top is an unconformity, and there may be a passage from the Dawburns Content Formation up into the Bellas Gate Formation, but this is obscured by faulting. As such, the rank is changed from synthem to group in this paper.

The lowest unit in the Crofts Group is the Peters Hill Formation (Holostratotype: 163700 224400) which consists of a lower unit of conglomerates (up to 5-m thick) and an upper unit of micritic and bioclastic limestone (20-m thick). The name ‘Peters Hill’ was first introduced by Chubb (1960) for a ‘fossiliferous shale horizon’ (the Back River Formation of Mitchell, 2003a) near Peters Hill, but was never formally described. In consequence, Coates’ (1964, 1969) Peters Hill Limestone is therefore occupied (although the name has never been subsequently applied), but is retained here pending a decision on validity by the Jamaican Lithostratigraphic Committee.

The Peters Hill Formation is succeeded by the Black River Formation (incorrectly spelt Back River Formation by Mitchell, 2003a, and corrected here) (Holostratotype: 164500 222800). This formation consists of a 120-m thick coarsening upwards succession of mudstones passing upwards into thinly bedded sandstones, thickly bedded sandstones and finally cross-bedded sandy limestones.

The Dawburn Content Formation (Holostratotype: 164600 224400) consists of a 130-m thick succession of alternating graded sandstones and shales and is terminated against a thrust fault (Mitchell, 2003a). A fossiliferous horizon near Dawburn Content square contains abundant gastropods assigned to the estuarine genus *Cassiope* sp. (Sohl in Coates, 1977), whereas higher in the succession there is a thin unit of thinly bedded micritic limestone containing thin black, nodular cherts.

The age of the Crofts Group is best considered by examining the fossil assemblages from the Peters Hill and Black River formations. The Peters Hill Limestone contains a rich assemblage of fossils including nerinacean gastropods (*Simploptyxis*), rudist bivalves and echinoids (*Hemiaster* spp. and *Metholectypus trechmanni* Hawkins), whereas the overlying Black River Formation contains rare rudist bivalves, inoceramids and calcareous nannofossils. The rudist bivalves include: *Barrettia coatesi* and *Torreites chubbi* Grubić from the Peters Hill Formation, and *Durania lopeztrigoi* Palmer and *Contraspira khanae* Mitchell from a limestone low in the Black River Formation (Chubb, 1971; Mitchell, 2009). *Barrettia coatesi* is a relatively primitive species of *Barrettia*, but more advanced than forms collected from the late Santonian St. Ann’s Great River Coral Bed at the base of the Liberty Hall Formation in St. Ann’s Great River in northern Jamaica (see Mitchell et al., 2011a, for stratigraphy). Consequently, on morphological grounds *B. coatesi* should be assigned to the early early Campanian. The inoceramids in the Black River Formation include species of *Platyceramus* and *Cataceramus* (Kauffman, 1966) which indicate a level near the Santonian-Campanian boundary. Calcareous nannofossils recovered from the Black River Formation include *Eiffellithus eximius* (Stover), *Micula decussate* Vekshina, *Rucinolithus* sp. and *Lithastrinus grilli* Stradner, but lack *Brionsonia parca parca* (Stradner) which Jiang and Robinson (1987) took to indicate a mid to late Santonian age. However *B. parca parca* appears some way up in the early Campanian (Gale et al., 2008) and the lack of *B. parca parca* does not exclude an early Campanian age. The lack of the pelagic crinoids (*Marsupites* and *Uintacrinus*), of which *Uintacrinus* is present in the Santonian of St. Ann’s Great River (Mitchell, 2009) also suggests a post-Santonian age. Taken together, the biostratigraphic data suggest that the Crofts Group is of earliest Campanian age.

2.4. Bellas Gate Formation (new name)

Introduction. In the south-eastern part of the Central Inlier two hills (Dry Hill and Mitchell's Hill) are capped in Cretaceous limestones which contain abundant rudist bivalves which are more advanced (younger) than those from the Peters Hill Formation. On Dry Hill, the sedimentary rocks can be seen to pass down into volcaniclastics and then into volcanics. This unit of volcanics is therefore younger than the Arthurs Seat Formation and is called the Bellas Gate Formation here.

History. The unit has not previously been recorded.

Description. The Bellas Gate Formation consists of basaltic and andesitic lavas and associated volcaniclastic conglomerates and is cut by basaltic and basaltic-andesitic dykes. Many of the volcanic rocks are deeply weathered and primary textures are difficult to see. The area around Dry Hill has also been extensively mineralized with fault related copper oxides and sulphides that were mined during the mid-nineteenth century.

Type Locality. The type locality is situated on the road below Dry Hill (Grid ref. 155850 241600) where typical basalts of the Bellas Gate Formation are exposed.

Other Localities. Exposures of the Bellas Gate Formation extend southwards from Dry Hill to the southern margin of the Central Inlier and westwards towards Rock River.

Thickness. The nineteenth century mine workings at Dry Hill (Charing Cross and Stamford Hill mines) reached depths of at least 50 fathoms, suggesting a minimum thickness for the Bellas Gate Formation of at least 100 m.

Discussion. The relationship of the Bellas Gate Formation to the Crofts Group is difficult to determine. The Crofts Group crops out to the north-northeast of Dry Hill beyond the Ginger Ridge Stock, but is separated from the volcanics (Bellas Gate Formation) into which the stock was intruded by an east-west orientated fault of unknown displacement.

2.5. Dry Hill Formation

Introduction. The name Dry Hill Formation is used here for two outcrops of rudist-bearing limestones exposed on Dry Hill and Mitchell's Hill in the south-eastern part of the Central Inlier.

History. The limestones have not previously been named.

Description. The succession is best exposed on Dry Hill where the sedimentary succession can be divided into three units: a lower limestone, a siltstones and an upper limestone.

The lower limestone of the Dry Hill Formation is only about 3 to 5 m thick and locally pinches out. It consists of micritic and impure clastic limestones with black nodular cherts and is locally highly silicified. On weathered surfaces fossils are locally common and include ostracods, tall-spired gastropods and abundant charophyte algae.

The lower limestone is overlain by a 20-m thick unit of laminated siltstones with thin sandstones. No fossils have been seen in this unit.

The laminated siltstone is succeeded by a pale weathering micritic and bioclastic limestone that caps the top of Dry Hill. When freshly broken, the limestone is dark grey. The limestone is estimated to be about 10 m thick. Abundant rudist bivalves occur in the dense limestones together with nerinacean gastropods.

Type Locality. The type locality is situated on Dry Hill (Grid. Ref.: 155700 231100).

Other Localities. The Dry Hill Formation also crops out on Charring Cross (a hill adjacent to Dry Hill) and on Mitchell's Hill near Rock River.

Thickness. The cumulative thickness of the formation is estimated at about 35 m.

Age. Rudist bivalves are abundant in the upper limestone of the Dry Hill and include *Barrettia* sp., *Whitfieldiella* spp., *T. chubbi* and *Macgillavryia nicholasi* (Whitfield) amongst others. The species of *Barrettia* from Dry Hill is more advanced than *B. coatesi* from the Peters Hill Formation, but less advanced that species of *Barrettia* found in the Isla Magueyes Member of the Parguera Limestone of south-western Puerto Rico (Mitchell, person. observation) or the Haughton Hall Formation of Green Island in western Jamaica (Mitchell, 2010a). The Haughton Hall Formation can be assigned to the late middle Campanian based on the associated larger foraminifers (*Pseudorbitoides trechmanni* Bronnimann) which are associated with calcareous nannofossils in the Sunderland Inlier (Jiang, 1993). The *Barrettia* from the Isla Magueyes Member of the Parguera Limestone in Puerto Rico are associated with *Pseudorbitoides israelskyi* Vaughan & Cole (Krijnen, 1978) and should be attributed to some level around the early middle Campanian. Futhermore, the Dry Hill Formation lacks the larger foraminiferan *Pseudorbitoides* which appears somewhere in the late early Campanian (upper calcareous nannofossil zone CC17: Krijnen et al., 1993). In consequence, the primitive nature of the rudists from the Dry Hill Limestone suggests that they should be assigned to the mid early

Campanian.

Discussion. The Dry Hill Formation shows a transgressive sequence. It begins with a fresh or brackish water limestone containing charophytes, ostracods and tall-spired gastropods, passes into lagoonal? siltstones and then into a platform limestone succession.

2.6. Main Ridge Formation

The name Main Ridge Formation was introduced by Robinson and Lewis (in Robinson et al., 1972) for the volcanics exposed in Main Ridge in the core of the Central Inlier (the term Main Ridge Group of Wright, 1974, for a unit in the Blue Mountain Inlier, is therefore preoccupied and unavailable). Mitchell (2003a) considered that this was the same lithostratigraphic unit as the Arthurs Seat Formation and mapped all the 'older volcanics' under one name. Hastie et al. (2013) published two plagioclase $^{40}Ar/^{39}Ar$ ages from the Main Ridge Formation of Effort Bridge which gave plateau ages of 80.3 ± 0.5 Ma (Sample AH-CI-39) and 80.1 ± 0.8 Ma (Sample AH-CI-40) which indicate a latest early Campanian age.

The succession of the Main Ridge Formation in Main Ridge seems to consist of a lower unit of predominantly basaltic lava flows intruded by dykes (e.g., Effort Bridge and Rio Minho) that are succeeded by volcaniclastic conglomerates with thin lava flows and dykes, but the detailed stratigraphy is difficult to work out due to the deep tropical weathering. At Effort Bridge (Hastie et al., 2013), the Main Ridge Formation is represented by a volcanic basement, composed of a plagioclase and clinopyroxene phyric, mesocratic volcanic rock, cut by three dyke suites: (1) an E–W trending aphanitic vesicular intermediate dyke, (2) NE-SW trending porphyritic (plagioclase and amphibole) leucocratic dykes, and (3) NNW–SSE trending porphyritic (plagioclase and clinopyroxene) intermediate dykes.

2.7. Kellits Synthem

The name Kellits Synthem was introduced by Mitchell (2003a) for an unconformably-bound transgressive-regressive unit. However, the name Kellits Series had already been proposed as an unpublished name by Verners Zans (Butterlin, 1956, p. 75) which was subsequently published by Zans (Zans, 1958). Since the Kellits Series and the Kellits Synthem are essentially synonymous, the name is here attributed to Zans (1958, but with changed rank by Mitchell, 2003a).

The Kellits Synthem rests with marked unconformity on the rocks below, and when traced from west to east across the inlier, the Kellits Synthem rests on progressively older levels within the older volcanics. Mitchell (2003a) attributed the formation of this unconformity to the collision between the Great Arc of the Caribbean and the Yucatan Block (North American Plate) which emplaced ophiolites in Guatemala during the Maastrichtian (Rosenfield, 1990). The unconformity at the top of the Kellits Synthem (sub-Yellow Limestone unconformity) is of early middle Eocene age (Robinson and Mitchell, 1999), and marks the collision of the Caribbean Plate (Cuba) with the Bahamas Block (North American Plate) and a change from north-eastwards to eastwards relative motion of the Caribbean Plate with respect to North America (Pindell, 1994).

The stratigraphy of the Kellits Synthem was described by Mitchell and Blissett (2001). For detailed descriptions of published units see Mitchell and Blissett (2001); here I will concentrate on the new lithostratigraphic units that are recognised.

2.8. Slippery Rock Formation

The Slippery Rock Formation (Robinson and Lewis in Robinson et al., 1972, emended Mitchell and Blissett, 2001) consists of a series of red, brown or grey conglomerates and sandstones in relatively thick, poorly defined beds and is some 175 m thick. It is interpreted to have been formed as a series of alluvial fans and fan deltas that formed following the uplift associated with the sub-Slippery Rock unconformity. It is widely distributed around the Central Inlier overlying different levels within the older volcanics. Full details were given in Mitchell and Blissett (2001).

2.9. Thomas River Formation (Corn Hill Member)

The Thomas River Formation (Mitchell and Blissett, 2001) consists of lacustrine to marine red and grey mudstones with thin sandstone units, up to a maximum of some 175 m thick. In the south-western part of the inlier, within the Thomas River and its tributaries, a distinctive unit is developed in the lower part of the Thomas River Formation which is called here the Corn Hill Member.

Description. The Corn Hill Member consists of mixed clastic and carbonate lithologies which interdigitate, with carbonates becoming more frequent towards the southwest. In Thomas River, the Corn Hill Member consists of a 40-m thick unit of flaser bedded sandstones with inclined larger foresets and bidirectional palaeocurrents. It contains shell beds, up to 50 cm thick with abundant lags of large *Lopha*-type oysters, many of which are reworked. To the south-west, thin beds of flaggy limestone containing abundant clastic grains are associated with the sandstones, and some of the limestones yield common small oysters. When the Corn Hill Member is traced to the north, it thins and the sandstones pass into red mudstones, so that in a stream, just off the road, between Coffee Piece and Union, the member has been reduced to a few thin sandstone beds containing an ichnofauna comprising *Taenidium* isp. and ?*Arenicolites* isp.

Type Locality. The type locality of the member is in the Black River just to the west of Corn Hill (Grid ref.: 164650 206800).

Other Localities. The member is exposed in the Slippery Rock River, the Thomas River between Old Works and Coffee Piece and in a stream off the road between Coffee Piece and Union.

Thickness. The maximum thickness seen is 40 m, but it thins rapidly to the north and east.

Discussion. The Corn Hill Member represents the first marine transgression in the Kellits Synthem. This transgression only reached a little way into the area which is now the Central Inlier, subsequently further transgressive pulses eventually allowed the deposition of the Guinea Corn Formation across much of the Central Inlier. The inclined heterolithic strata with bidirectional palaeocurrents are characteristic of deposition under tidal conditions.

2.10. Guinea Corn Formation

The Guinea Corn Formation (Coates, 1965) has received more attention than any other unit within the Central Inlier because of its rudist bivalve assemblages. Aspects of the stratigraphy of the Guinea Corn Formation have been described by Mitchell (1999) and Miller and Mitchell (2003) and the rudist and other fossil assemblages have been discussed in detail in various papers (e.g., Kauffman and Sohl, 1974; Chubb, 1971; Underwood and Mitchell, 2000; Mitchell, 2002a, b, 2003a, 2005a, b, 2010a; Mitchell and Gunter, 2002, 2004, 2006; Mitchell et al., 2004, 2007, 2011a, b; Stemann et al., 2007; Mitchell and Pons 2010). Using a combination of distinctive marker beds, rudist assemblages and rudist and foraminiferan event levels, a high-resolution stratigraphic correlation of the Guinea Corn Formation across the Central Inlier is possible (**Figure 4**) and can be tied into the chronostratigraphy using strontium isotopic ratios determined from pristine calcite from rudist bivalves (Steuber et al., 2002).

Mapping in the western part of the Central Inlier has demonstrated that the Guinea Corn Formation can be divided into three distinctive lithostratigraphic units which can be traced as far east as the type sections in the Rio Minho. These three units are given member status here.

2.11. Yankee River Member

Introduction. This member is introduced for the lower unit of rudist-bearing limestone in the western area of the Central Inlier. In terms of the stratigraphy of Mitchell (1999) it corresponds to the A to Lower F Beds of the Guinea Corn Formation, and includes markers such as the two Macgillavryia beds (Mitchell, 2005a) and acme occurrences of *Chiapasella radiolitiformis* (Trechmann) and *C. aguilae* (Adkins) (Mitchell et al., 2004; Mitchell and Pons, 2010).

History. The unit has not previously been separately recognized.

Description. The Yankee River Member consists of alternating rudist limestone and sandy siltstones arranged in rhythms with thicknesses of from 2 to 15 m or more.

Type Locality. The type locality lies in the Yankee River (Grid ref.: 171100 202300) where the top of the member is exposed.

Other Localities. The member is well exposed in the Rio Minho between Grantham and Frankfield (Mitchell, 1999).

Thickness. The member ranges in thickness from about 140 to 180 m in the western part of the inlier, but northeast of Trout Hall thins rapidly and pinches out between Morgans Pass and Cornel's Ridge.

2.12. Two Meetings Member

Introduction. The name Two Meetings Member is introduced here for the thick unit of marlstones and marly limestones that occurs in the middle part of the Guinea Corn Formation in the western part of the Central Inlier.

History. The marly limestones at Two Meetings were sampled by Verdenius (1993) in his study on the calcareous nannofossils of Jamaica. The member commonly yields examples of the larger foraminiferan *Orbitoides megaloformis* Papp & Küpper and Krijnen et al. (1993) described assemblages from this level from several locations in the Central Inlier. The member has not previously been formally recognized.

Description. The Two Meetings Member consists of a rather monotonous succession of yellowish of buff marlstones that are usually rhythmic with

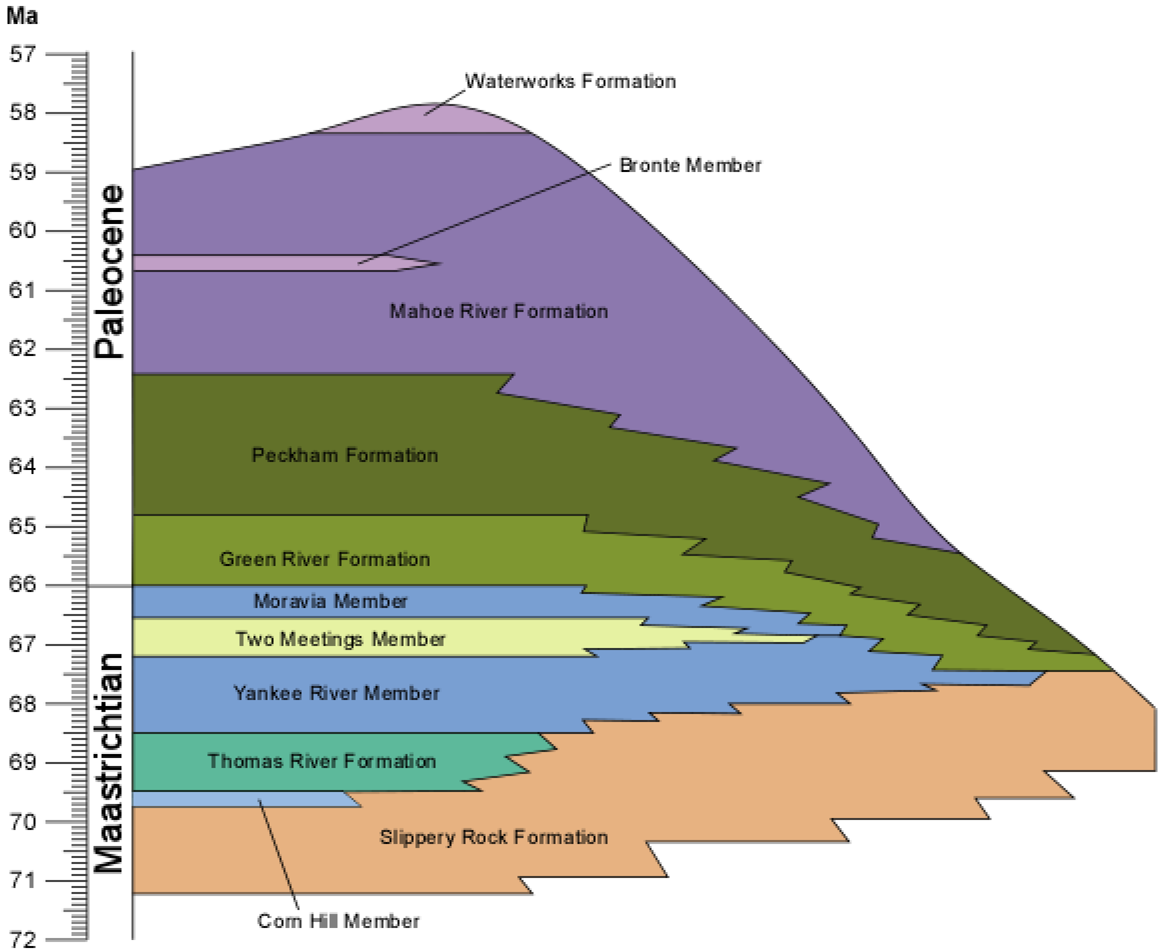

Figure 4. Stratigraphic relationship of members and formations in the Kellits Synthem. The Corn Hill Member is placed in the lowerpart of the Thomas River Formation; the Guinea Corn Formation comprises the Yankee River, Two Meetings and Moravia members; and the Summerfield Group includes all the units from the Green River Formation to the Waterworks Formation.

alternating layers, on a scale of 10 to 20 cm, of more lithified and less marlstones. Some thin limestone bands may also be developed particularly towards the north-east. Fossils are common, with aragonitic forms usually preserved as moulds, although locally, their shells have been replaced by calcite. Rudist bivalves are generally poorly represented except for a clay-loving antillocaprinid. Larger foraminifers (*O. megaloformis*) are common in some layers and assemblages have been described by Krijnen et al. (1993) and Mitchell (2005a).

Type Locality. The type locality (Grid ref.: 171100 203700) is at the bridge at Two Meetings (Verdenius, 1993) where a roadside cutting exposes the member.

Other Localities. The member is seen at various places in the Yankee River (particularly below Moravia) and in the White Rock River northwest of Tweedside. The member is also present in the type section in the Rio Minho between Grantham and Frankfield (Mitchell, 1999) where it occupies a position in the middle F Beds, but here it is largely cut out by faulting and is only visible after floods when that section of the riverbed has been swept clean of sand and gravel.

Thickness. The member is some 30 m thick in the White Rock River near Tweedside (Mitchell, 2005a) and thickens westwards to more than 100 m near Moravia. To the east of Tweedside the member thins and is last recorded in the Rio Minho between Grantham and Frankfield.

Discussion. This member allows the Guinea Corn Formation to be divided into three mappable units. The marlstones with their larger foraminiferal assemblage contrast with the platform limestones with their rudist assemblages and suggest a shallow more open marine setting for the marlstones than for the typical platform limestones of the Guinea Corn Formation. The Two Meetings Member is therefore interpreted as the maximum flooding surface, or interval, related to the transgressive-regressive Kellits Synthem (Mitchell, 2006).

2.13. Moravia Member

Introduction. The name Moravia Member is introduced for the upper rudist-bearing limestone interval in the Guinea Corn Formation.

History. The unit has not previously been separated previously.

Description. The Moravia Member consists of regularly bedded rudist limestones with abundant examples of Titanosarcolites and other rudists. The beds range from 50 cm to 5 m thick. Towards the east, volcaniclastic sandstones become intercalated within the succession as there is a transition from the Guinea Corn Formation into sandstones of the Green River Formation (Summerfield Group). The lower part of the Moravia Member contains layers containing larger foraminifers such as Orbitoides and Vaughnia, whereas the upper half contains abundant examples of the foraminifer *Chubbina* (Mitchell, 2005a).

Type Locality. The type locality (Grid ref.: 171600 200900) is situated below Moravia, where the complete thickness of the member is exposed albeit intermittently.

Other Localities. The member is widely distributed around the Central Inlier; in the Rio Minho, between Grantham and Frankfield, it is represented by the upper F Beds and the G Beds, whereas elsewhere it is easily identified because of the abundance of *Chubbina*.

Thickness. The member has a thickness of 40 m in White Rock River and in the Rio Minho, between Grantham and Frankfield, and appears to be of relatively uniform thickness across the western part of the Central Inlier.

Discussion. Towards the northeast, the Moravia Member changes facies and passes into the Green River Formation of the Summerfield Group through intercalation. East of Trout Hall, the member is absent.

2.14. Summerfield Group (Bronte Tuff Member)

Introduction. The Summerfield Group consists of a shallowing-upward succession of marine to terrestrial volcaniclastic sedimentary rocks that has been interpreted as a prograding braid delta (Mitchell, 2000). Mitchell and Blissett (2001) recognised four formations: the Green River Formation (evenly and thinly bedded volcaniclastic sandstones); Peckham Formation (massive sandstones); Mahoe River Formation (volcaniclastic sandstones and conglomerates); and Waterworks Formation (a thick ash flow tuff or ignimbrite). Although Mitchell and Blissett (1999) demonstrated that on the road from Frankfield to Johns Hall only a single ignimbrite (Waterworks Formation) was present, mapping in the south western part of the Central Inlier has identified a second thick ignimbrite within the Mahoe River Formation. This second ignimbrite is here called the Bronte Tuff Member.

History. The Bronte Tuff has not previously been recorded.

Description. An ash flow tuff (ignimbrite) which contains pumice clasts up to 10 cm in diameter as well as scattered hornblende needles and angular clasts of red shale. The pumice clasts are only weakly flattened. There is no bedding or layering.

Type Locality. The type locality (Grid ref.: 169800 199700) is on the road at Bronte, where the member is well exposed.

Other Localities. The member can be seen on road sections that cut across its outcrop on the southern side of the Central Inlier.

Thickness. The thickness is estimated at 60 m.

Discussion. This member is a useful marker on the south-western side of the Central Inlier where the Mahoe River Formation is thick.

3. Discussion

The revised lithostratigraphy presented here provides a framework for other studies of the rocks of the Central Inlier. The Central Inlier is now seen to have a stratigraphy that probably begins in the Santonian and ranges up to the mid Paleocene.

The older volcanics represent a substantial pile of lavas and volcaniclastic sediments, with two marine incursions: one in the early early Campanian and one in the mid early Campanian. Whether these incursions flood across the entire area or were restricted to the eastern part of the inlier (where they are currently exposed) is not known. Similar flooding events producing limestone intervals are widespread in the Campanian of the Great Antilles, and it may be that these are local representations of eustatic sea level fluctuations, but until a better correlation with the chronostratigraphy can be established this will be impossible to prove.

The Kellits Synthem represent a classic transgressive-regressive cycle of mid

Maastrichtian to mid Paleocene age which can be studied both in vertical section and geographically tracing out individual transgressive surfaces to the east. The Corn Hill Member represents the first transgression into the inlier, and the Two Meetings Member marks the time of maximum transgression when deeper-water marlstones were deposited above platform limestones after which platform limestones of the Moravia Member prograded out across the marlstones.

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