Field Trip 1: Geology of the White Limestone between Middlesex and Riverhead, Parish of St. Ann, Jamaica

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The White Limestone covers some two-thirds of the surface area of Jamaica and has importance for the economic extraction of pure limestone, and as the main aquifer for water supply in Jamaica, it also hosts Jamaica's bauxite deposits. The first attempt at subdivision was by Howard Versey in the 1950s (Versey, 1957; Hose and Versey, 1957) who recognised a series of members based on microfacies analysis and larger foraminifer assemblages. This scheme has proved difficult to apply across the island and several members were amalgamated for use in the 1:50,000 scale geological maps produced by the Geological Survey Department/Mines and Geology Division.

From 2004 to present, a renewed campaign has been undertaken to try and understand the stratigraphy of the White Limestone. The unit has been formally given "Group" status and has been divided up into a series of formations that can be mapped across the Clarendon Block (Mitchell, 2004, 2013). Formations are defined on lithological criteria – that is mainly a combination of limestone textures using the extended Dunham classification (carbonate mudstone, wackestone, packed wackestone, packstone, grainstone, crystalline) coupled with colour. Similar lithofacies do occur in different formations, but can be distinguished using age-diagnostic assemblages of foraminifers. The current scheme being used on the Clarendon Block is shown in **Figure 1**.

The geology between Middlesex and Riverhead is relatively simple (**Figure 2**). The area lies within a fault-bounded block with the White Limestone resting unconformably upon rocks of the Yellow Limestone (Guys Hill Formation) and Cretaceous (Benbow Limestone). The road transect shows rocks of the White Limestone Group exposed in stratigraphic succession beginning with the Troy Formation and ending with the Walderston Formation.

Details of the White Limestone succession can be found in Hose and Versey (1957), Robinson and Mitchell (1999) and Mitchell (2004, 2013). Descriptions of foraminifers and the foraminifer assemblages can be found in Robinson and Wright (1993) and Robinson (2013). The approximate locations of Stops on this field trip are shown on **Figure 2**. Participants will be able to collect samples representing the typical lithologies of each formation.

STOP 1: Benbow Formation at Middlesex. The Benbow Formation (Limestone) is the thickest limestone unit exposed within the Lower Cretaceous Benbow Inlier. It is represented by grey micrites and locally contains fossils including rudists (*Amphitriscoelus*) and gastropods that indicate a Barremian age. The Benbow Formation dips at a relatively steep angle towards the north.

STOP 2: Unconformity between the Troy Formation and the Benbow Limestone. The angular unconformity between the Troy Formation and the Benbow Formation is exposed on the road to the west of Middlesex (**Figure 3**). The unconformity itself is difficult to pick up since one limestone rests on another; however, the lithologies allow easy distinction – the Benbow Limestone is dark grey and micritic, the Troy Formation is recrystallized or dolomitized.

WHITE LMST. GROUP	Newport Fm	White carbonate mudstones in platform interior, locally with wackestones and some packstones closer to the platform margin. Distinguisged from the Walderston Fm by its predominant texture and colour.
	Walderston Fm	Cream packstones and grainstones dominanted by miliolids in the platform interior and by lepidocyclinids towards the platform edge. Layers with lepidocyclinids extend into the platform interior.
	Somerset Fm	Cream packstones, grainstones and wackestones with abundant miliolids and common to abundant examples of *Fabularia verseyi*. The white spotted texture is distinctive.
	Claremont Fm	Pale cream carbonate mudstones and wackestones with thin units of foraminiferal and molluscan packstones near the platform margin. Dolomitized in the southern part of the platform.
	Swanswick Fm	White (and occasionally cream) packstones and grainstones with miliolids and dictyoconids in the platform interior and lepidocyclinids on the platform margin. The white colour is distinctive.
	Troy Fm	Recrystallized limestones and dolostones with vugs after dictyoconids and fennestrae. Locally where not dolomitized it consists of wackestones with miliolids and dictyoconids.

Figure 1. Lithofacies classification of the shallow-water White Limestone Group on the Clarendon Block, Jamaica.

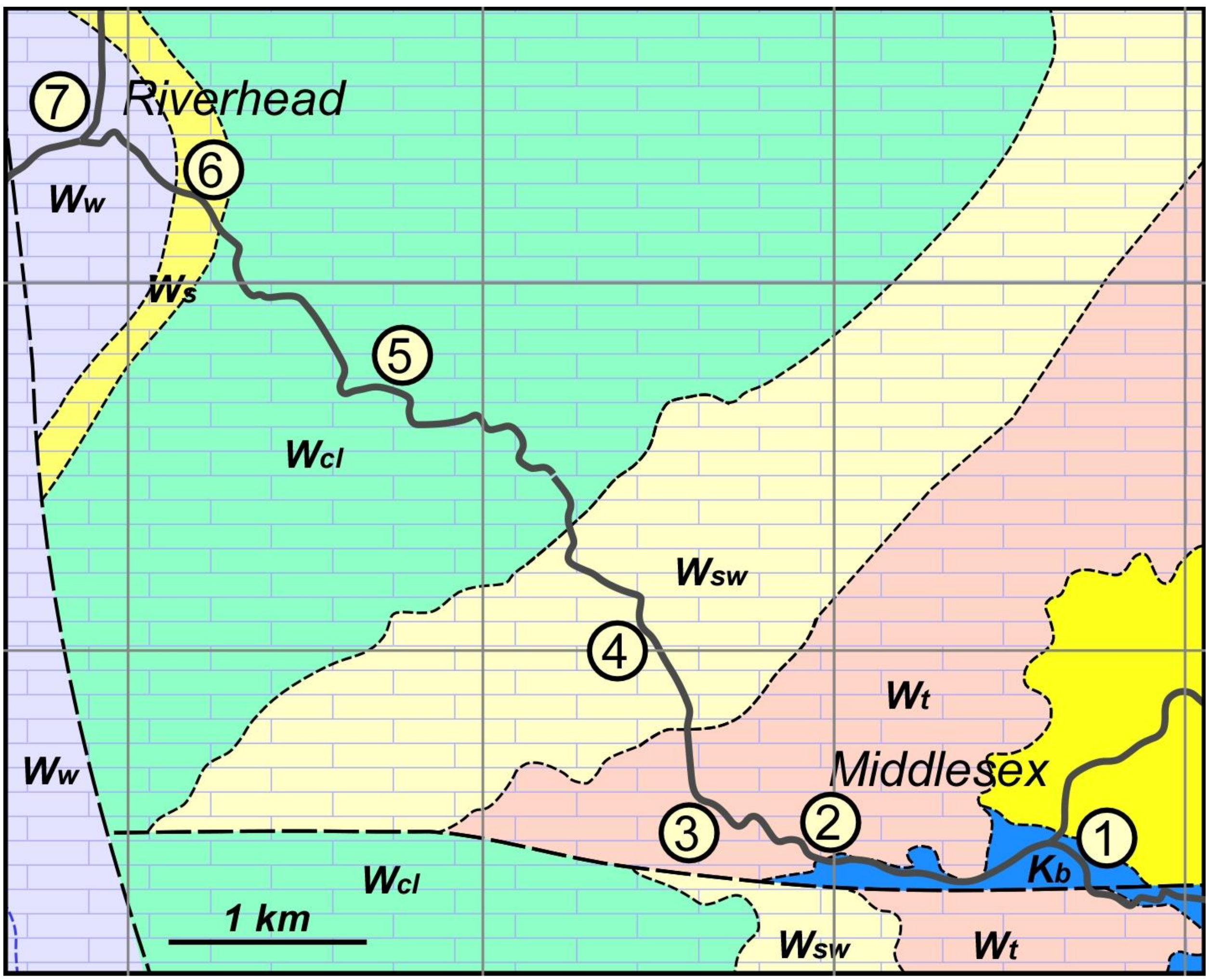

Figure 2. Geology and Stop locations of the area between Middlesex and Riverhead in the Parish of St Ann. Guys Hill Formation (Yellow Limestone Group) shown in yellow; Benbow Limestone (Cretaceous) indicated by *Kb*. For details of the formations in the White Limestone Group see Figure 1. Stops 1 to 7 indicated. Boundaries shown in thin dashed lines; faults by thick black lines. Roads in dark grey.

Figure 3. Unconformity between the Troy Formation and the Benbow Limestone at Stop 2. Hammer (mid left) is resting on the unconformity. The Benbow Limestone dips more steeply away from the road that the overlying Troy Formation.

STOP 3: Troy Formation. The lower part of the Troy Formation is composed of brownish crystalline limestones and dolostones often with conical vugs after dictyoconids. These crystalline limestones pass upwards into white and pale finely crystalline limestones. Other than for the vugs after the dictyoconids, no primary sedimentary fabrics are preserved. Studies elsewhere (Ipswich area of St Elizabeth), indicate that the Troy Formation was originally composed of micrites with scattered miliolids and dictyoconids. This fine-grained limestone allowed for the nucleation of dolomite crystals which grew and obliterated the primary sedimentary fabrics.

STOP 4. Swanswick Formation. The Swanswick Formation comes in rather suddenly above the Troy Formation, and the lower part shows partial irregular dolomitization. Dolomitization seems to have been controlled by lithology, with micrites becoming dolomitized, but packstones and grainstones resisting dolomitization. The Swanswick Formation consists of white grainstones with subsidiary packstones. The foraminiferal assemblage includes miliolids (quinquelocline forms and planispiral forms) *Fabiania cassis*, *Lepidocyclina pustulosa*, *L. macdonaldi*, *Cushmania americana* and *Fallotella* spp. Locally *Eulepidina chaperi* is present and indicates a late Eocene age. The brilliant white colour of these grainstones contrasts with the cream colour of younger Walderston Formation (although locally, the base of the Walderston Formation may also be white). The diverse foraminiferal assemblage with lepidocyclinids suggests an open marine platform environment.

STOP 5. Claremont Formation. The grainstones of the Swanswick Formation are succeeded by a very thick succession of pale carbonate mudstones and wackestones. Foraminifers include miliolids, dictyoconids (*Cushmania americana* and *Fallotella* spp.) and possible *Fabularia* sp. Laminoid and irregular fennestrae are locally present. The low diversity foraminiferal assemblage suggests deposition on a restricted inner platform, and the fennestrae indicate deposition within the intertidal zone. The Troy-Swanswick-Claremont succession therefore can be interpreted as a transgressive regressive cycle and records the first flooding of the Clarendon Block during White Limestone time. The unconformities beneath the Troy and Somerset formations indicates that this was a tectonically controlled/influenced cycle.

STOP 6. Somerset Formation. The Somerset Formation is relatively poorly exposed. The limestones of this formation contrast with those of the underlying Claremont Formation. They are composed of cream packstones and grainstones which carry a foraminiferal assemblage including miliolids, lepidocyclinids and the distinctive species *Fabularia verseyi*. *F. verseyi* is very distinctive; its test is composed of white microcrystalline calcium carbonate and contains an outer margin row of chamberlets and numerous worm-like inner chamberlets. The white spots formed by this species make the Somerset Formation easily identifiable, although other species of *Fabularia* at some levels in the Swanswick and Claremont formations are similar. The top of the Somerset Formation is defined where these distinctive white foraminifers disappear. The extinction of *F. verseyi* has been taken to mark the top of the Eocene in Jamaica, but it most likely represents a level low in the Oligocene (Edward Robinson, pers. commun.) and the top of the Eocene lies either within the lower part pf the Somerset Formation or within the time represented by the unconformity between the Claremont and Somerset formations.

STOP 7: Walderston Formation. The Somerset Formation is succeeded by a very thick succession of cream grainstones and packstones. In the lower part of the succession miliolids dominate together with dictyoconids (*Fallotella* spp.) and occasional specimens of *Eulepidina chaperi*. Higher in the sequence, specimens of *Eulepidina undosa* appear and sometimes occur in rock-forming quantities. Such fabrics have been referred to the Browns Town Formation, but they occur as layers within cream grainstones of typical Walderston lithology across much of the Clarendon Block and the Walderston and Browns Town formations cannot be mapped separately.

References

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