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The lithostratigraphy of the Maldon Inlier, parish of St. James, northwestern Jamaica

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ABSTRACT. **Formal lithostratigraphic units are herein erected for the Upper Cretaceous succession of the Maldon Inlier, parish of St. James, Jamaica. The lithostratigraphic nomenclature of the Maldon Inlier is reviewed and clarified. New units have been recognized during a re-mapping exercise and these are described. The Woodlands, Maldon (inclusive of Shaw Castle Member), Popkin (inclusive of newly described Abingdon, Tangle River and Banana Ground members), Vaughansfield and Flamstead formations are herein recognised.**

1. INTRODUCTION

The Maldon Inlier, parish of St. James, northwestern Jamaica, exposes rudist-bearing limestones and intervening mudstones with subsidiary sandstones. Although informal names for units in this inlier have been published, there are significant differences between the schemes. In this paper a formal lithostratigraphic scheme is proposed for the pre-Yellow Limestone rocks exposed in the Maldon Inlier.

2. PREVIOUS WORK

Chubb (1958) published a description and map of the succession in the Maldon Inlier. The informal names Woodland, Maldon, Popkin and Vaughansfield series were applied to the geological succession (Table 1). The Maldon and Vaughansfield series were largely composed of rudist-bearing limestones, whereas the Woodland and Popkin series were mainly mudstones.

Atkinson (1969) published a geological map of the Maldon Inlier and recognised three main rudist-bearing limestones (Maldon, Shaw Castle and Vaughansfield limestones in ascending stratigraphic order) separated by mudstones and shales (Table 1). He introduced a new nomenclature for the mudstone units. The term Summerhill Mudstones was introduced for those mudstones below the Maldon Limestone. This made them equivalent to the Woodland Series of Chubb (1958). The unit separating the Maldon and Vaughansfield limestones, Chubb called the Woodland Mudstones. Included in this unit was the Shaw Castle Limestone. Chubb also suggested that the Cretaceous succession in the inlier terminated with a series of sandstones, mudstones and a conglomerate. The conglomerate was not named, but the overlying unit was termed the Maroon Town Mudstones. Atkinson's (1969) geological map has appeared in subsequent publications, including the 1:50,000 scale Jamaican Geological Survey Map (Green and Bateson, 1974; Bateson, 1974) and Sohl's (1998, text-figure 19) posthumous publication, in which it was wrongly attributed to Chubb (1958).

Table 1. Lithostratigraphic nomenclature schemes for the Maldon Inlier

Chubb, 1958	Atkinson, 1969	Chubb, 1960	Chubb, 1971	Scheme used herein	
Vaughansfield Series	Maroon Town Mudstones	Vaughansfield Limestone	Upper Tuffaceous Series	Yellow Lst. Grp.	
Popkin Series	Conglomerate	Popkin Series	Vaughansfield Limestone	Maroon Town Fm.	
Maldon Series	Woodland Mudstones	Maldon Limestone	Shaw Castle Shale	Flamstead Fm.	
Woodland Series	Shaw Castle Limestone	Shaw Castle Shale	Chatsworth Limestone	Vaughansfield Fm.	
	Woodland Mudstones	Chatsworth Limestone	Woodland Shale	Popkin Fm.	Banana Ground Member
	Maldon Limestone	Woodland Shale	Maldon Limestone		Tangle River Member
	Summerhill Mudstones		Summerhill Shale		Abingdon Member
				Maldon Fm. Shaw Castle Mem.	
				Woodlands Fm.	

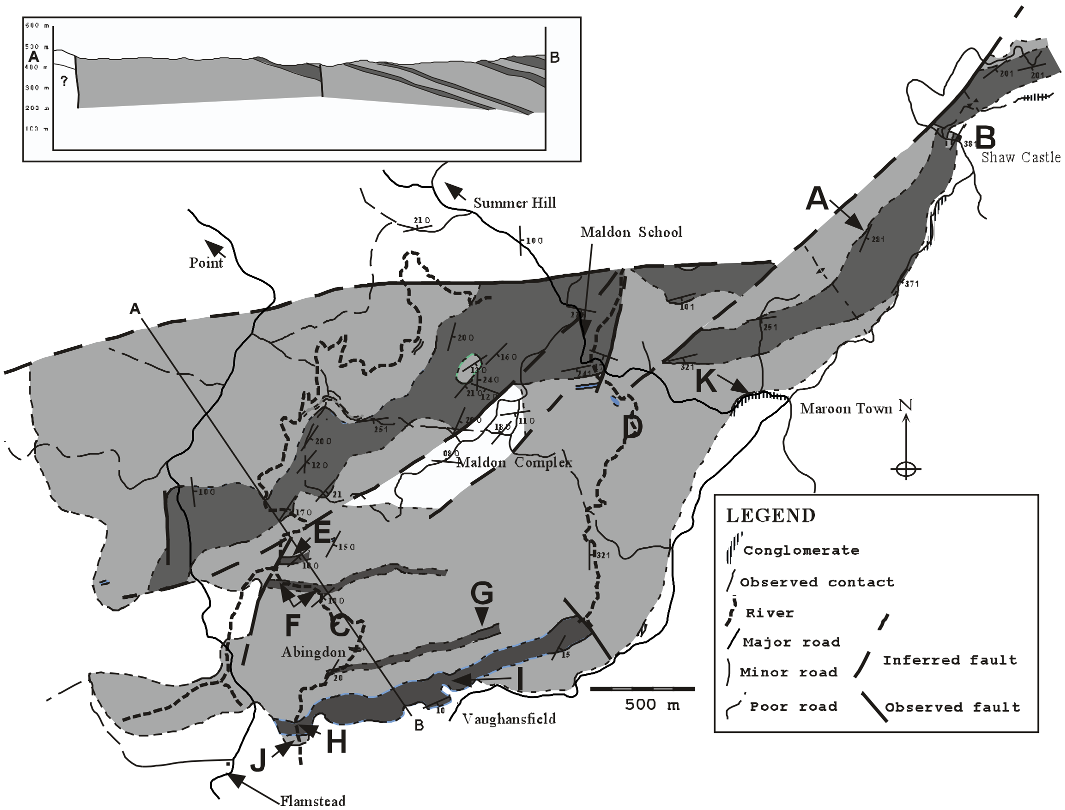

Figure 1. Geological map of the Maldon Inlier, northwestern Jamaica. A, Stratotype of the Woodlands Formation. B, Stratotype of the Maldon Formation at Shaw Castle. C, Reference area for the Popkin Formation at Abingdon. D, Reference area for the Popkin Formation along the banks of the Dundee River. E, Reference locality for the Abingdon Member. F, Stratotype for the Tangle River Member. G, Reference locality for the Banana Ground Member. H, Stratotype for the Vaughansfield Formation. I, Reference locality for the Vaughansfield Formation. J, Reference locality for the Flamstead Formation. K, Reference locality for the Maroon Town Formation.

Chubb (1971, p. 162, table 1) later published a revised version of the Cretaceous succession in the form of a table (Table 1). He listed three limestones within the Maldon Inlier. These were the Maldon, Chatsworth and Vaughansfield limestones in ascending stratigraphic order. The Woodland Shale and Shaw Castle Shale, in ascending stratigraphic order, separated these limestones. Thus the term Summerhill Shale replaced the Woodland Series of his 1958 publication; the Woodland Shale was meant to replace the Shaw Castle Shale. The Popkin Series was in turn replaced by the Shaw Castle Shale (compare Chubb, 1958, with Chubb, 1960, table 1, and Chubb, 1971, table 1).

Meyerhoff and Krieg (1977) reviewed the descriptions of the Maldon Inlier (drawing from published and unpublished material). They published logged sections for the Maldon and Vaughansfield limestones at Shaw Castle and along the Dundee River, respectively. These sections were modified from the field notes of Sohl, Hazel, Kauffman and Coates (see Meyerhoff and Krieg, 1977, fig. 12). The application of the name Maldon Limestone to the section at Shaw Castle is in keeping with the opinion of Coates (*in* Wozab *et al*., 1967) that the Shaw Castle Limestone was correlatable with the Maldon Limestone. They also made note of the observations made by undergraduates of the University of the West Indies (Mona Campus) who had carried out mapping exercises in the Maldon Inlier in 1967. The students noted that many of the limestones were lenticular and could only be traced for short distances. In particular, Boxill (1967, *loc. cit.* Meyerhoff and Krieg, 1977) divided the Popkin Shales into two lenticular members, a lower Maroon Town Shale and upper Chatsworth Conglomerate. This conglomerate was also regarded as part of the Popkin Series by Chubb (1958, p. 10) (see also the section published from Shaw Castle in Meyerhoff and Krieg, 1977, fig. 12). The unconformable relationship between the conglomerate and the older Cretaceous succession in the inlier was shown on Atkinson's map (unnamed conglomerate of Atkinson, 1969, plate 2).

Recent dating of well-preserved calcite from the outer layer of rudists collected from the Vaughansfield Formation indicates a latest Maastrichtian age (Steuber *et al*., 2002). Hitherto, the unit was considered to be of latest Campanian or earliest Maastrichtian age (cf. Jiang and Robinson, 1987)

3. LITHOSTRATIGRAPHY

Detailed field mapping of the Maldon Inlier was carried out during the period from September 1998 to September 1999 using the 1:12,500 Jamaican Survey Department map series as base maps. The new geological map is shown in Figure 1. The lithostratigraphy of the inlier is described below following the guidelines suggested by the International Subcommission on Stratigraphic Classification of the IUGS (Murphy and Salvador, 1999).

3.1. Woodlands Formation

Name. The Woodland Series was introduced by Chubb (1958). It is herein designated the Woodlands Formation, with the formation name changed to reflect the correct geographic spelling.

Description and relationship with other units. The Woodlands Formation represents the oldest lithostratigraphic unit in the Maldon Inlier. It consists of a sequence of mudstones and siltstones. The Woodlands Formation is exposed in two fault-bounded outcrops; one in the eastern 'pot-handle', and a larger one in the north-western corner of the inlier (Fig. 1). The contact with the overlying Maldon Formation is sharp and well exposed at several localities. The unit varies from dark brown to light brown mudstones and siltstones. At least one <3 m thick *Titanosarcolites*-bearing limestone band is present (Fig. 1).

Previous nomenclature. The Woodlands Formation has been referred to as the Woodland Series (Chubb, 1958), the Summerhill Mudstones (Atkinson, 1969), the Summerhill Shale (Chubb, 1971), the Woodland Shale (Chubb, 1971; Hazel and Kamiya, 1993) and the Woodlands Shale (Mitchell and Gunter, 2002).

Stratotype. The stratotype for the Woodlands Formation is designated in an unnamed river at Woodlands (Fig. 1). Access to the stratotype is by a trail only from the minor road that leads north from the junction at Maroon Town. The river exposes the uppermost beds of the Woodlands Formation and limestones of the overlying Maldon Formation (Fig. 2).

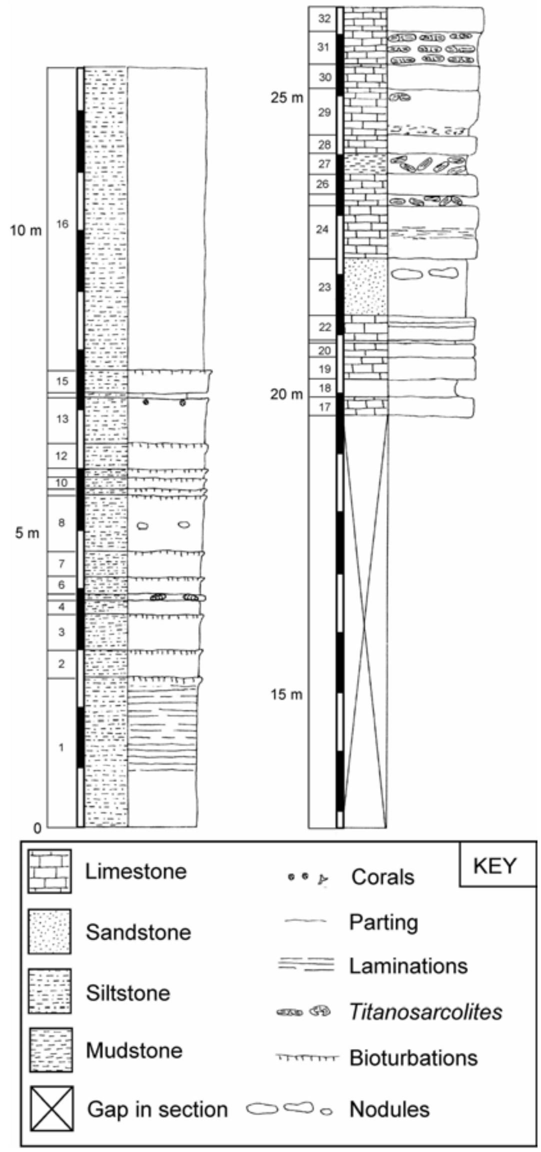

Figure 2. Graphic log of the Woodlands Formation stratotype at Woodlands.

The lower 8 m consists of brown, coarsening upwards mudstone beds 0.1 to 1.6 m thick with bioturbated tops. Prominent marker beds include an 8 cm thick bed with the bivalve *Pinna*, and a layer of carbonate concretions. The overlying 5.3 m of mudstones are undifferentiated. The contact between the Maldon and Woodlands formations is concealed beneath a 7.2 m interval of no exposure. The top 7.5 m of section exposes limestones and calcareous mudstones of the Maldon Formation.

Palaeontology. The formation yields corals, non-rudist and rudist bivalves including *Titanosarcolites* sp., gastropods, echinoids and ostracodes. The formation also yields the foraminifers *Kathina jamaicensis* (Cushman and Jarvis) and *Ayalaina rutteni* (Palmer).

3.2. Maldon Formation

Name. The term Maldon Series was introduced by Chubb (1958) and is based on the name of the district.

Description and relationship with other units. The Maldon Formation consists of a series of bedded, massive and nodular rudist-bearing limestones. Through detailed mapping, the Maldon Formation has been shown to be equivalent to the Shaw Castle Limestone (Coates *in* Wozab *et al*., 1967; Atkinson, 1969) and Chatsworth Limestone (Chubb, 1971). One formal member, the Shaw Castle Member (Shaw Castle Shale of Chubb, 1958 non 1971), is recognised. The contact with the overlying mudstones of the Popkin Formation is sharp.

The Maldon Formation is well-exposed in the vicinity of the Dundee River bridge and northwards beyond the Maldon Schoolyard to the northern termination of the inlier along the Summer Hill to Maroon Town road (Fig. 1). In the Maldon Schoolyard and the nearby Maldon School Cave, specimens of *Titanosarcolites* are preserved in growth position. North of the school, at the road junction, rudist-rich limestones are exposed along a trail leading east from that junction to the Dundee River. In the river, bedded *Titanosarcolites*-bearing limestone is exposed. The western band of the Maldon Formation can be traced from the Maldon Complex (Fig. 1) to the middle of the western border of the inlier; with a general NE-SW strike of the bedding. The Maldon Formation is clearly displaced by a NE-SW trending fault to the northwest of Maroon Town (Fig. 1). This displaced band of the Maldon Formation can be traced to Shaw Castle (Chatsworth).

Previous nomenclature. The Maldon Formation has been referred to as the Maldon Series (Chubb, 1958), the Maldon Limestone (Chubb *in* Zans *et al*., 1959, 1963; Coates *in* Wozab *et al*., 1967; Atkinson, 1969; Chubb, 1971, Meyerhoff and Krieg, 1977; Hazel and Kamiya, 1993; Sohl, 1998; Steuber *et al*., 2002; Gunter *et al*., 2002, Mitchell and Gunter, 2002); the Chatsworth Limestone (Chubb *in* Zans *et al*., 1959; Chubb, 1971) and the Shaw Castle Limestone (Coates *in* Wozab *et al*., 1967; Atkinson, 1969).

Stratotype. The stratotype is herein designated at Shaw Castle (Chatsworth All Age Schoolyard; Fig. 1), where 35 m in the upper part of the formation were logged (Fig. 3). Massive limestones lay below the logged interval, but the boundary with the logged section is unexposed. The lower part of the log represents the Shaw Castle Member. The top of the member is defined by the contact between the shales and the first limestone bed some 14 m above the base of the logged section. The Shaw Castle Member consists of brown shales and is fairly fossiliferous. There is a 10 cm thick coral bed near the base (Fig. 3). The rudist assemblage consists of common *Plagioptychus fragilis* Chubb, *Thyrastylon* sp., *Antillocaprina stellata* Chubb, and rare examples of an undescribed *Antillocaprina*. This assemblage also contains abundant colonial corals. The Shaw Castle Member is overlain by 3 m of interbedded silty limestones and shales. The succeeding 17 m of section exposes limestone beds with intermittent gaps; the lower half comprises silty rudist floatstones with irregular bedding planes; the upper part, more massive nodular bioclastic limestones with rudists (alternating assemblages dominated by "*Radiolites*" *macroplicata* Whitfield and *Titanosarcolites giganteus* (Whitfield)). Other fossils include *Biradiolites jamaicensis* Trechmann, *Chiapasella trechmanni* Mitchell and Gunter, *Plagioptychus* sp., and *Bournonia* sp., spines of *Goniopygus supremus* Hawkins, and corals. The limestones are overlain by 1.4 m of brown weathered mudstones that terminate against a fault.

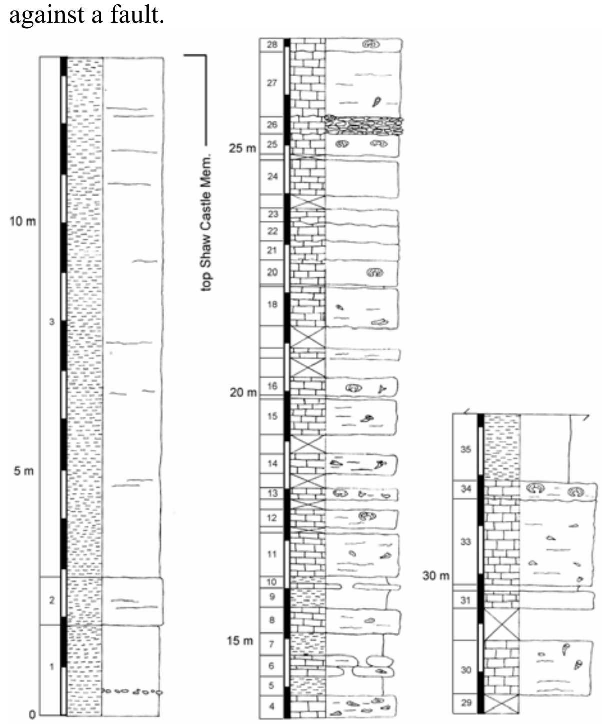

Figure 3. Graphic log of the Maldon Formation stratotype at Shaw Castle. See Figure 2 for key.

The basal part of the Maldon Formation is also exposed above the Woodlands Formation in its type locality (Fig. 3). Rudists are abundant in growth position and as transported assemblages, and include *Thyrastylon* sp. and *Titanosarcolites* sp.

Thickness. Chubb (1958) proposed the Maldon Series was approximately 93 m (304 ft) thick, Atkinson (1969) estimated 18-153 m (60-510 ft) with up to 79 m (260 ft) at Shaw Castle. We estimate the Maldon Formation attains a thickness of 113 m in its western outcrop area based on cross sections.

Palaeontology. The Maldon Formation yields rudists of the *Titanosarcolites* fauna. Mitchell and Gunter (2002) recorded *C. trechmanni* from the Maldon Formation and placed this formation in the *C. trechmanni* biozone. The larger foraminifers *Omphalocyclus maldonensis* Gunter, Robinson and Mitchell and *Orbitoides megaloformis* Papp and Küpper occur within 9 m of the upper boundary of the Maldon Formation, alongside the road, north of the junction with the Maroon Town road (Gunter *et al*., 2002). The formation also yields the foraminifer *Kathina jamaicensis* (Cushman and Jarvis), actaeonellid gastropods, colonial corals, non-rudist bivalves, the brachiopod *Dyscritothyris cubensis* Cooper, echinoids and ostracodes.

3.2.1. Shaw Castle Member

Name. In some older publications (e.g., Sawkins, 1869) an alternative spelling of Shaw Castle (= Schaw Castle) was encountered. On the map of Jamaica compiled in 1887, which remained the main reference map for the island until c. 1958 (E. Robinson, person. commun., 2001), the locality is labelled as 'Schaw Castle'. Both Schaw and Shaw Castle were used on the 1:50 000 geological map for the area (Green and Bateson, 1974). The 'Shaw Castle Limestone' utilized the spelling that has become entrenched in the literature (e.g., Chubb, 1958, 1960, 1971; Atkinson, 1969; Sohl, 1998), whereas the place name retained the older spelling. The entrenched spelling has been adopted as the formal name for this unit.

Description and relationship with other units. This member consists of a series of red mudstones and shales, and is equivalent to the Shaw Castle Shale of Chubb (1958). This member is believed to thin out laterally towards the west. The type section of the Shaw Castle Member is located at Shaw Castle (Chatsworth All Age Schoolyard; Fig. 3).

Thickness. Chubb (1958) quoted a thickness of 41 m (134 ft). We measured 13.2 m at the type locality.

3.3. Popkin Formation

Name. The term Popkin Series was introduced by Chubb (1958). Although the geographic basis for this name remains unknown, it is sufficiently entrenched in the literature to warrant retention.

Description and relationship with other units. The Popkin Formation consists predominately of mudstones, siltstones and sandstones, but also includes several fossiliferous limestone bands. The contact with limestones of the overlying Vaughansfield Formation is sharp. Three rudist-bearing limestone bands are given formal member status here.

Previous nomenclature. The Popkin Formation has been referred to as Popkin Series (Chubb, 1958; Chubb *in* Zans *et al*., 1959), Woodland Mudstones (Atkinson, 1969), Woodland Shale (Chubb, 1971), Popkin Formation (Meyerhoff and Krieg, 1977; Hazel and Kamiya, 1993), and Popkin Shales (Mitchell and Gunter, 2002; Gunter *et al*., 2002).

Reference localities. Two reference areas are here designated (Fig. 1). The first is situated to the north of Vaughansfield known as Abingdon along the course of the Tangle River between the contacts with the Maldon and Vaughansfield formations. Here, all three limestone members in the formation can be identified. The second reference area is located along the Dundee River beginning at its contact with the Maldon Formation and extending south along the river course to a point approximately 540 m south of the Dundee River bridge. This section offers information on the sedimentological and faunal characteristics of the lower half of the Popkin Formation.

Thickness. Chubb (1958) estimated the thickness of the Popkin Series at approximately 189 m (619 ft inclusive of 290 ft (89 m) of conglomerate and 329 ft (100 m) of shale). We estimate that as much as 198 m of the Popkin Formation is exposed in the Abingdon area.

Palaeontology. The formation yields gastropods (including turritellids), rudist and non-rudist bivalves, solitary and colonial corals, foraminifers, brachiopods and ostracodes. Notable fossils include the foraminifers *K. jamaicensis* and *A. rutteni*, the serpulid *Hamulus* sp. and the brachiopod *D. cubensis* (the latter just below the Vaughansfield Formation). All three limestone members contain the rudist *Titanosarcolites*.

3.3.1. Abingdon Member (new name)

Name. The unit derives its name from the geographic name of the area in which it crops out.

Description and relationship with other units. The Abingdon Member is an unbedded limestone. It is exposed as a distinct band (<5 m thick) that has been mapped on a hillside at Abingdon and is terminated to the west by a fault. The lower and upper contacts of this member are poorly exposed.

Reference locality. No loggably sections were identified, and the reference locality is located at the exposure beside the Tangle River in Abingdon (Fig. 1).

Thickness. We estimate a thickness not exceeding 13 m.

Palaeontology. No fossils have been collected from this unit. However, *Titanosarcolites* sp. and *K. jamaicensis* were seen in the field.

3.3.2. Tangle River Member (new name)

Name. The unit derives its name from the Tangle River, although it is exposed in one of its unnamed tributaries.

Description and relationship with other units. The Tangle River Member consists of bedded, nodular rudist-bearing limestones that have minor interbedded calcareous mudstone and siltstone beds. The stratotype is in a tributary to the Tangle River. The upper and lower contacts of this unit are sharp and abrupt, and are defined by the first and last limestone beds, respectively.

East of the stratotype the unit is poorly exposed along the Maldon to Vaughansfield road. The member can then be traced to the east of this exposure through a small banana plot where abundant limestone fragments can be seen in the soil. Further east, the limestone beds of this unit are poorly exposed in the vicinity of a small stream and have a cream to grey appearance. The member could not be traced further east due to dense vegetation cover.

Stratotype. The member is well exposed in a tributary of the Tangle River, between mudstones and siltstones of the Popkin Formation (Fig. 1). Here, the tributary runs along the strike of the beds for a short distance, but runs perpendicular to the strike of the beds at the base and top of the member.

Approximately 16 m was logged at the stratotype (Fig. 4). The succession consists of grey and brown limestones that contain the rudist *Titanosarcolites* sp. (some preserved in growth position) and echinoid spines. The upper 2.7 m of the log consists of bioclastic siltstones typical of the Popkin Formation.

Thickness. A log of 13.2 m through the Tangle River Member has been made at the stratotype.

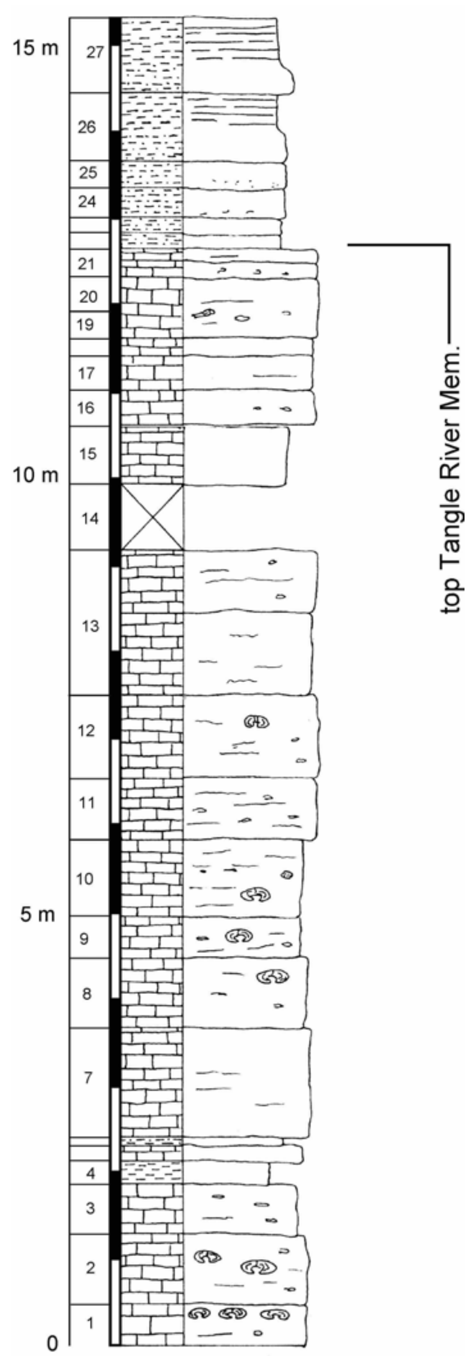

Figure 4. Graphic log of the Tangle River Member stratotype at Abingdon. See Figure 2 for key.

Palaeontology. The unit has yielded a juvenile *Macgillavryia nicholasi* (Whitfield), the only specimen of this species ever reported from the Maldon Inlier.

3.3.3. Banana Ground Member (new name)

Name. From a local name for the locality; no other names are available.

Description and relationship with other units. Poorly-exposed, bioclastic limestones interbedded with limestones containing rudists in growth position. The upper and lower contacts are sharp.

The exposures north of Vaughansfield at the reference section can be traced to similar limestones exposed in the vicinity of the Vaughansfield Formation stratotype. The unit appears to thin towards the west. To the east of the reference locality, this limestone member appears to be affected by the same fault that terminates the Vaughansfield Formation.

Reference locality. The reference locality for this unit is located in the fields north of Vaughansfield (Fig. 1). The lower and upper contacts of this unit are poorly exposed at the reference locality. The boundaries were mapped based on topographic features and the presence of loose limestone blocks.

Thickness. A thickness not exceeding 13 m is suggested at the reference locality.

Palaeontology. The unit yields echinoid spines, corals including *Ovalastrea* sp., and rudists including *Titanosarcolites* sp., *Biradiolites jamaicensis*, *Chiapasella trechmanni* and a novel form of rudist figured previously by Gunter (2002, fig 4.6).

3.4. Vaughansfield Formation

Name. The term Vaughansfield Series was introduced by Chubb (1958) for this limestone unit. The name is derived from the geographic area in which it crops out.

Description and relationship with other units. The Vaughansfield Formation consists of nodular, rudist-bearing limestone, with uncommon thin, intervening mudstones. Bioclastic limestones with clast-supported rudist fragments and echinoid spines are exposed in a sinkhole to the east of the road leading from Maldon to Vaughansfield (Figs 1, 5). The contact with the overlying Flamstead Formation is sharp.

Figure 5. Photograph of bioclastic beds in the Vaughansfield Formation at its reference locality.

Chubb (1958) suggested that the Vaughansfield Limestone may be terminated to the east by a fault or, alternatively, that it was a local lens-shaped reef. During mapping, this termination of the Vaughansfield limestone was observed along the banks of a tributary of the Dundee River. The termination of the limestone beds was abrupt and there was no sign of a gradual lateral change from limestones to mudstones. The correspondence of this abrupt termination to topographic features suggests that the termination is due to a fault.

Previous nomenclature. The Vaughansfield Formation has been referred to as the Vaughansfield Series (Chubb, 1958) and Vaughansfield Limestone (Chubb *in* Zans *et al*., 1963; Chubb, 1971; Meyerhoff and Krieg, 1977; Hazel and Kamiya, 1993; Sohl, 1998; Steuber *et al*., 2002; Mitchell and Gunter, 2002; Gunter *et al*., 2002).

Stratotype. The stratotype for the Vaughansfield Formation is herein designated in the Tangle River to the east of the Flamstead road (Fig. 1). Here, the river runs perpendicular to the strike of the beds, and presents a complete vertical section of the unit (Fig. 6). The Tangle River sinks at the upper boundary of the limestone before re-emerging some distance before a waterfall at the base of the section (Fig. 7). The upper 2.6 m of the Popkin Formation consists of gritty fossiliferous mudstone, which contains calcareous nodules, and the echinoids *Goniopygus supremus* Hawkins (spines and tests) and *Phyllacanthus leoni* (Lambert and Sánchez Roig) (spines and test fragments) in the upper 20 cm. The limestones in the lower 2.2 m of the Vaughansfield Formation contain the rudists

Antillocaprina stellata Chubb and *Titanosarcolites* sp. The succeeding limestones of the formation are separated by bedding planes or thin siltstone intervals, and contain some examples of *Titanosarcolites*.

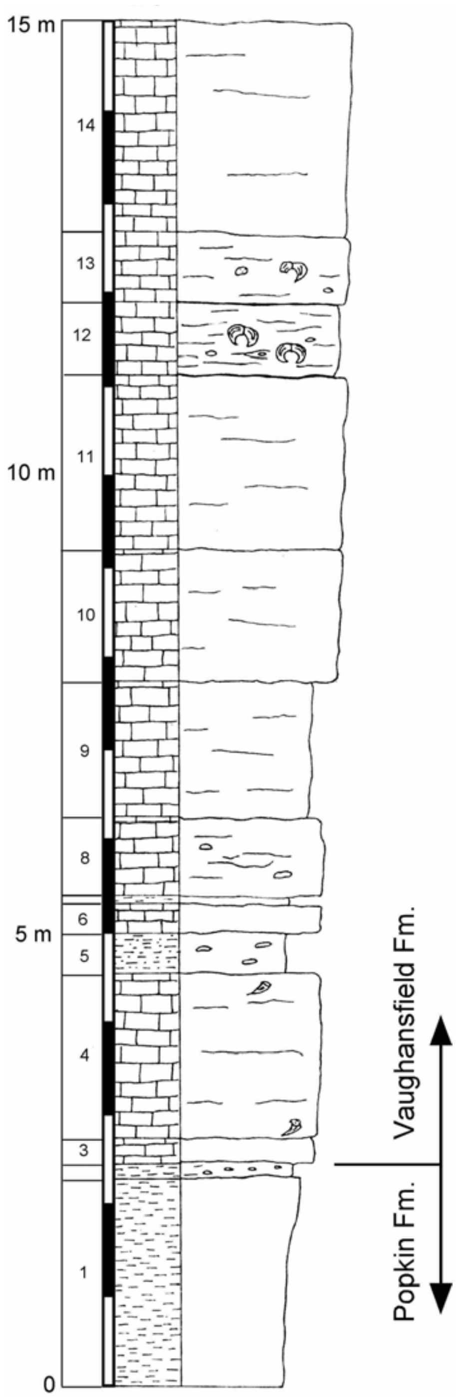

Figure 6. Graphic log of the Vaughansfield Formation stratotype in the vicinity of Flamstead. See Figure 2 for key.

Figure 7. Photograph of limestone beds of the Vaughansfield Formation exposed at the base of the type section.

Thickness. Chubb (1958) suggested a mean thickness for the Vaughansfield Series of 30 m (97 ft). However, this included 19 m (63 ft) of the lower limestone and 5 m (16 ft) of upper limestone separated by 5 m (18 ft) of calcareous clay. Atkinson (1969) estimated a thickness of up to 79 m (260 ft). We have logged 13 m at the stratotype and concur with Chubb (1958) that its thickness probably does not exceed 30 m.

Palaeontology and age. The Vaughansfield Formation yields actaeonellid gastropods, rudists of the *Titanosarcolites* fauna, the foraminifer *Kathina jamaicensis*, ostracodes and abundant colonial corals. The formation also yields *C. trechmanni* and was placed in the *C. trechmanni* biozone by Mitchell and Gunter (2002). The echinoids *Goniopygus supremus* and *Orthopsis milliaris* d'Archiac (identified by S. K. Donovan) are also present. Strontium isotopic dates for samples from the Vaughansfield Formation indicated a numerical age of <65.83 Ma within latest Maastrichtian (Steuber *et al*., 2002).

3.5. Flamstead Formation (new name)

Name. The type locality of this formation is located in close proximity to the settlement of Flamstead.

Description and relationship with other units. Mudstones located stratigraphically above the Vaughansfield Formation. In the vicinity of the stratotype, the Vaughansfield Formation is exposed as a small lenticular outcrop. At this locality, the mudstones are dark brown in appearance. A similar lithology is also exposed to the east of the Tangle River, north of the Vaughansfield to Maroon Town road at Vaughansfield.

Reference Locality. The reference locality for this formation is located at the Vaughansfield Formation stratotype, approximately 30 m east of the Flamstead road in the Tangle River (Fig. 1). This section was chosen despite its limited exposure because of its relative ease of accessibility it best displays the contact with the underlying Vaughansfield Formation. The section comprises less than 12 m of dark brown mudstones which are poorly exposed in the river banks. The contact between the Flamstead and Vaughansfield formations is, however, clearly visible at the point where the Tangle River sinks into the Vaughansfield Formation. The section is insufficiently exposed along the banks to be logged.

Thickness. Only the lower part of this formation is exposed in the inlier. Its minimum thickness is estimated at 13 m.

Palaeontology. No macrofossils have been observed in this unit. Above the Vaughansfield Formation stratotype the unit is weathered and no microfossils have been recovered. However, in its eastern outcrop area at Vaughansfield, the unit yields ostracodes and the foraminifer *K. jamaicensis*.

3.6. Maroon Town Formation

Name. The name is derived from the Maroon Town settlement.

Description and relationship with other units. The base of this unit consists of clast and matrix supported conglomerates (Fig. 8). These grade upwards into mudstones (not mapped in this study) that were described by Atkinson (1969). As previously discussed, the Maroon Town Formation has an unconformable relationship with the units in the inlier and is in turn unconformably overlain by the Yellow Limestone. In the Virgin Valley of the parish of St. James, a similar unit has been identified at the base of the Yellow Limestone. This unit unconformably overlies the Cretaceous succession in the Sunderland Inlier, parish of St. James, and is said to contain Cretaceous limestone boulders and pebble clasts (E. Robinson person. commun., 2003).

Previous nomenclature. This unit has previously been referred to as the Popkin Series (conglomerate) (Chubb, 1958), the unnamed conglomerate and Maroon Town mudstones of Atkinson (1969).

Figure 8. Photograph of conglomerate beds with cobble-sized volcanic clasts at the base of the Maroon Town Formation at its reference locality at Maroon Town.

Reference locality. A reference locality for this formation is located at the road junction just west of Maroon Town (Fig. 1). Here, the conglomerate is unbedded, clast supported and poorly sorted with volcanic clasts that range up to cobble size (Fig. 8).

Thickness. Atkinson (1969) estimated 6-12 m for the basal conglomerates and 69 m for the overlying mudstones and sandstones.

Age. Conglomerate beds observed at the reference locality on a scarp perpendicular to the general strike of the beds, suggest low dip values (<10°). Considering the time required for tectonic adjustment and the age of the Vaughansfield Formation, it is unlikely that the unit is of Cretaceous age. A Paleocene to Early Eocene age is most likely.

Discussion. Atkinson (1969) suggested that the conglomerates represented a tidal channel cut through the rudist 'reefs' of the Maldon Limestone. The lack of diagnostic sedimentary structures and the unconformable relationship of the conglomerates to the whole Cretaceous succession leads us to abandon this interpretation.

4. Conclusion

It is estimated that a thickness of approximately 533 m of Cretaceous succession (excluding the Maroon Town Formation) is exposed in the Maldon Inlier. This consists of two major limestone formations (Maldon and Vaughansfield formations) within a shale dominated succession. The Maroon Town Formation represents an unconformity-bounded succession between the Cretaceous succession and the overlying Yellow Limestone Group.

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