

Sedimentology and stratigraphy of the Lower Cove redbeds in the Cumberland Basin

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Introduction

During 1997, the authors described a problematic interval of redbeds lying stratigraphically above the South Reef of the Boss Point Formation at Lower Cove and below the base of coal-bearing rocks of the Joggins Formation. This was undertaken as a contribution toward an updated sedimentological log of the Joggins section, in collaboration with Martin Gibling, Dalhousie University, and Sarah Davies, University of Edinburgh. The interval constitutes 468 m of strata that coincide with Division V of Logan (1845). The section constitutes the link between the Boss Point and Joggins formations, but its sedimentology reveals lithologic attributes distinct from either of the two.

The following report provides a first summary for a significant portion of the Joggins section. The work to date constitutes a sedimentological framework to which detailed information can be added later. Measurements of paleoflow indicators and a more rigorous examination of the paleontological record, not undertaken because of time constraints, are examples of recommended supplemental data.

The Section

The section occurs along a stretch of Chignecto Bay north of and stratigraphically older than the 'classic' Joggins coal-bearing section (Fig. 1). Along this portion of the greater Joggins section, the cliff face drops in elevation to a few metres in the vicinity of Little River, north to Lower Cove.

Outcrop is encountered mainly within the intertidal zone, although bedrock forms small headlands and bluffs locally, particularly in the north at Lower Cove. Sandstone bodies are best exposed elsewhere as intertidal 'reefs', with mudrocks exposed ephemerally on the lower shore face and best exposed where the cobble shingle has been cleared by weir fishers.

Logan (1845) estimated the thickness of Division V to be 635 m, of which 226 m or 36% of the section was

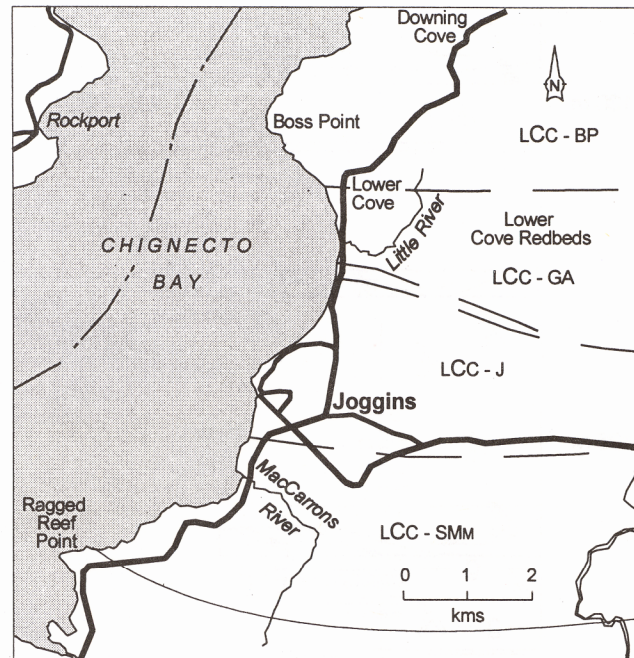


Figure 1. Geological map of the Joggins area.

recorded as 'measures concealed'. Rigorous examination of the intertidal zone resulted in a section log with only 89 m (19%) concealed, the greater part of which occurs in the vicinity of the outwash bars at the mouth of Little River. The total thickness of our measured section (468 m) is significantly less than the 635 m measured by Logan, a fact that doubtless can be attributed to the difficulty in estimating the thickness of concealed and low-lying intervals. The section was logged graphically in the field at a scale of 1:100 and currently is being digitally redrafted using AutoCAD®. A representative portion of the section is depicted in Figure 2.

Sedimentological Overview

The section is dominated by mudrocks (siltstone and claystone), which constitute over 65% of the exposed measured section. The maximum aggregate thickness of sandstone bodies within the redbeds is 134 m; however, many of the bodies are laterally discontinuous across the

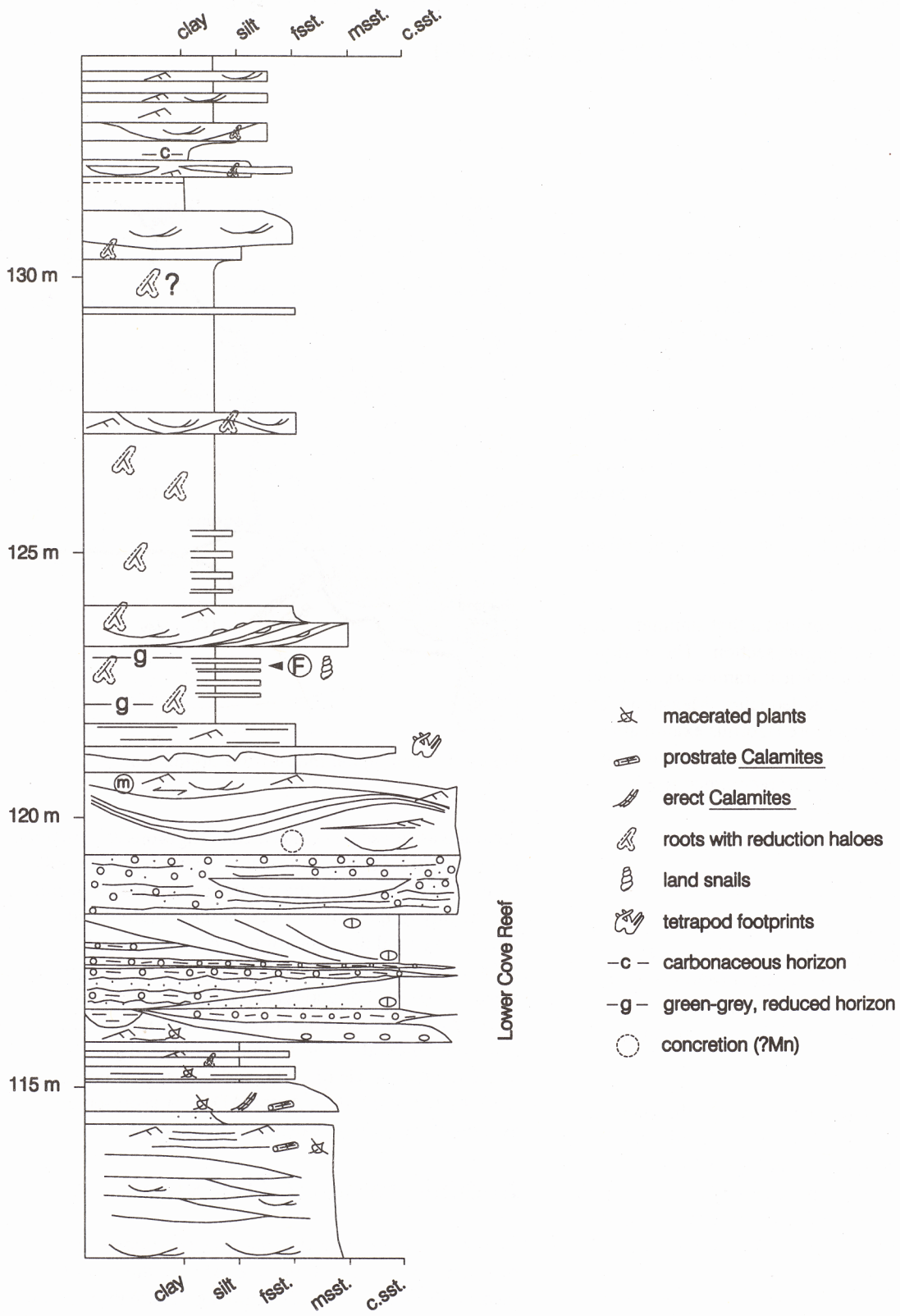


Figure 2. Representative section (from 112-134 m) of the Lower Cove redbeds.

intertidal zone, hence their actual volumetric contribution to this portion of the basin fill is less. Mudrocks are exclusively red with ubiquitous pale grey to greenish mottled root haloes, and calcrete. Coal beds *sensu stricto* are absent within the exposed section, although thin, reduced organic-rich layers persist for tens of metres laterally.

Sandstone bodies seldom exceed 5 m in thickness, with a maximum recorded thickness of 8 m. Bodies were observed to sharply incise mudrocks locally by up to 3.5 m. The lower beds of the sandstone bodies generally comprise trough and planar cross-stratified sets. Sandstone bodies commonly are nested laterally and occur as isolated lenses with abandoned hollow fills within mudrocks. A sinusoidal, concordant sand wave form with an amplitude of 1.5 m and wavelength of 13.4 m occurs within an unusual, 5 m thick sandstone body at 120 m (Fig. 3). The basal 3.5 m of the sandstone body comprise one metre thick cross sets with a matrix composed of mud aggregate granules with red lutite intraclasts.

The strata evoke a significantly water-stressed environment with sudden episodic flood events, and sediment-starved channels with periodic cannibalism of indurated floodplain sediments.

Preliminary Paleontology

The strata generally have a depauperate floral record, which includes the sphenopsid *Calamites cisti* as its most common element, and more rarely *C. suckowi*. The flora include medullosan stems and seeds (charred *Trigonocarpus*) and other indeterminant stems. Lycopoid compressions are uncommon and tend to be concentrated at specific horizons, and include stems of '*Lepidodendron*' and *Sigillaria cf. rugosa* and lycopoid foliage (*Cyperites*).

Faunal occurrences include a green-grey horizon (at 123 m, Fig. 3) rich in the land snail *Dendropupa vetusta*, which is the lowest known occurrence of the fauna at Joggins, hence the oldest occurrence of pulmonate gastropods known. The ichnological record includes vertebrate tracks (cf. *Palaeosauropus* sp. to which the interim working name 'Rex' has been applied by the author in other investigations; at 122 m, Fig. 3) and a *Diplichnites* trail (at 360 m), ascribed to the gigantic invertebrate *Arthropleura*.

Stratigraphic Implications

Logan recognized the distinct lithology of the redbeds at Lower Cove by assigning them to his Division V. Since that time, the strata have been assigned either to the coal-bearing Joggins Formation or to the conglomeratic Polly Brook Formation, albeit with their distinctiveness noted. Shaw (1951) assigned the Lower Cove redbeds to his map unit 10a ("red shale and sandstone"), a distinct subunit of the coal-bearing strata of the Joggins section. Copeland (1959) assigned the strata to his Lower Coarse Facies, and in so doing correlated the Lower Cove redbeds with basin margin conglomerates of the southern and eastern Athol subbasin, now assigned to the Polly Brook Formation (Ryan *et al.*, 1991). The redbed interval subsequently was re-assigned on the map of Ryan *et al.* (1990) to the coal-bearing strata of the Joggins Formation, but their distinctiveness was noted by demarcating the interval with a map boundary and denoting the unit "abundant redbeds". This informal map unit extends inland from the coast at Lower Cove to north of Springhill, some 28 km to the east, where it pinches out between the underlying Polly Brook Formation and overlying coal measures of the Joggins Formation. The Lower Cove redbeds were referred by Ryan and Boehner (1994, their Fig. 2-13) to an informal unit of the Joggins Formation, their Little River Bridge member, although this designation was never formally proposed.

The absence of coal beds and pervasive reddening argue against inclusion of the Lower Cove redbeds in the Joggins Formation as defined by Ryan *et al.*, 1992. The sandstone bodies of the Lower Cove redbed unit stand in marked contrast to the very thick, well sorted, green-grey sandstones of the underlying Boss Point Formation, which were an historic source for grindstones at Lower Cove in the nineteenth century. The Lower Cove redbeds appear to be at least in part stratigraphically equivalent to the Polly Brook Formation conglomerates, which represent alluvial fan deposits on the north piedmont of the Cobequid Highlands massif. Although some evidence of relatively fine extrabasinal lithic clasts occurs within the sequence, the Lower Cove redbeds are distinctly fine-grained in comparison with the Polly Brook Formation.

The Lower Cove redbeds share a similar stratigraphic position and lithologic attributes with redbeds exposed to the west on Cape Maringouin, New Brunswick, and recently named the Grand Anse Formation (Johnson,

1996) of the Cumberland Group. Their assignment to that formation appears to be justified.

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