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Passive margin sedimentation- Low density turbidites of the Meguma Supergroup

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Introduction and Purpose

The Meguma Supergroup was deposited during the Cambrian and Lower Ordovician as shelf and turbidite deposits. A formation associated with the supergroup is the Lower Ordovician Bluestone Quarry Formation. Prior studies of this formation (e.g. Schenk, 1970, Scott, 2003, Jamieson, 2009, White et al.,2007; 2010, Waldron et al., 2015, Pothier et al. 2015) examined the regional geology, micropaleontology, structure and metamorphism of the formation, however previous work done by Fraser and Wach, 2010 observed the internal architecture and facies distributions of the outcrops at Point Pleasant Park as the outcrops are ideal analogues of fine grained turbidites targeted by oil and gas companies. The purpose of the study was to observe the facies vertical and lateral distribution using traditional and new measuring techniques so that results can be used as analogues for current fine grained turbidite deposit targets.

Method

Data were collected at outcrops along the Northwest Arm, Black Rock Beach, the Battery, and Sailors' Memorial Road (Figure 1) to investigate the architecture and facies distribution of the studied sections. Data collection includes traditional methods like measuring and logging sections, paleocurrent measurements from such features as tool marks and current ripples, petrographic analysis, as well as new techniques like scintillometer measurements to create synthetic gamma logs, LiDAR to develop 3D geological models in Polyworks and Petrel.

Results, Observations, Conclusions

The strata comprise mainly quartz, mica, zircon and tourmaline, and shows five lithofacies. These lithofacies make up a cyclic lithofacies association which is separated by sharp or scoured contacts. Scintillometer analysis showed no apparent relationship to lithology, likely due to the moderate metamorphism throughout the Bluestone Quarry Formation. Interpretation suggested that the lithofacies association is characteristic of the Bouma sequence Ta-e and represents low density turbidites (Piper, 1978; Stow, 1980). Current ripples on bedding planes indicate the paleocurrent was towards the northwest. The beds fine and become thinner towards the top of the outcrop and lithofacies like meta sandy-siltstone ripples, and structureless silty slate to slate become more dominant, due to the reduction of sediment supply (Figure 2). Lithofacies and sedimentary structures seen in the outcrop, suggest these sediments were deposited from hypocynal turbidites on the distal overbank and levees of channels (Figure 3). Examples of these types of deposits also in outcrop are seen in the Isaac Formation (Schwarz and Arnott, 2007). Results from the study can be imported into geomodels for simulation and architectural observations can be used to understand facies cycles and distribution for similar formations like

the Montney Formation as core availability and core width limits observing the facies horizontal distribution.

Figures

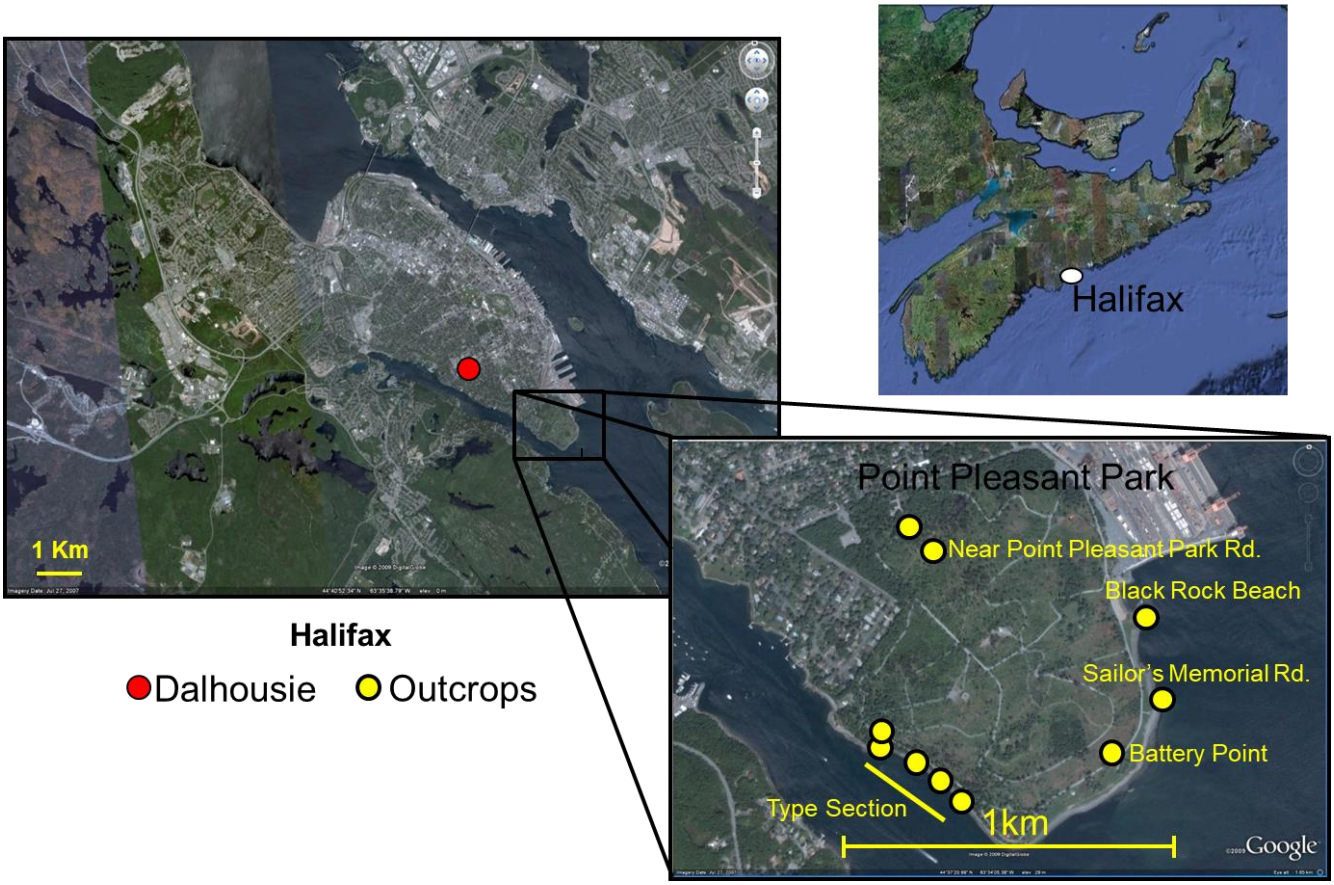

Figure 1: Satellite image of Point Pleasant Park showing the locations. The outcrops are represented in the yellow circles.

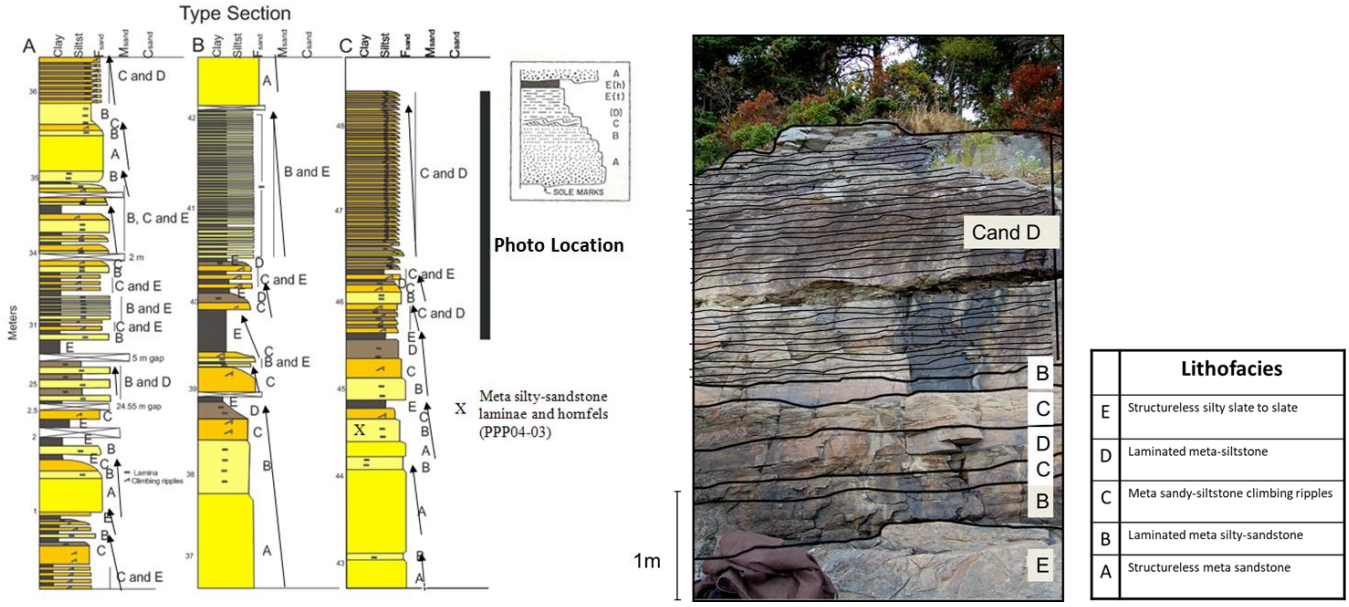

Figure 2: Annotated photo and measured section of the Type Section. The lithology ranges from fine grained meta-sandstone to slate, and contains physical sedimentary structures like climbing ripples and parallel lamina. A the base of the measured section there are intervals of 1.0m thick massive meta sandstone beds followed by 30 cm thick beds of laminated meta sandstone and climbing rippled meta silty sandstone. This segment finishes with laminated meta siltstone and slate. The bedding and laminae sets become thinner, and certain lithofacies become more frequent such as laminated meta silty-sandstone, climbing rippled meta sandy-siltstone, and laminated meta-siltstone lithofacies between 46-46.4 m, and towards the top of the measured section (46.5-48.8m) meta silty-sandstone lamina and meta-siltstone lamina lithofacies dominate. Note gaps in the section at 2.5m, 25.5m, 32m, 38.9, and 42.2m.

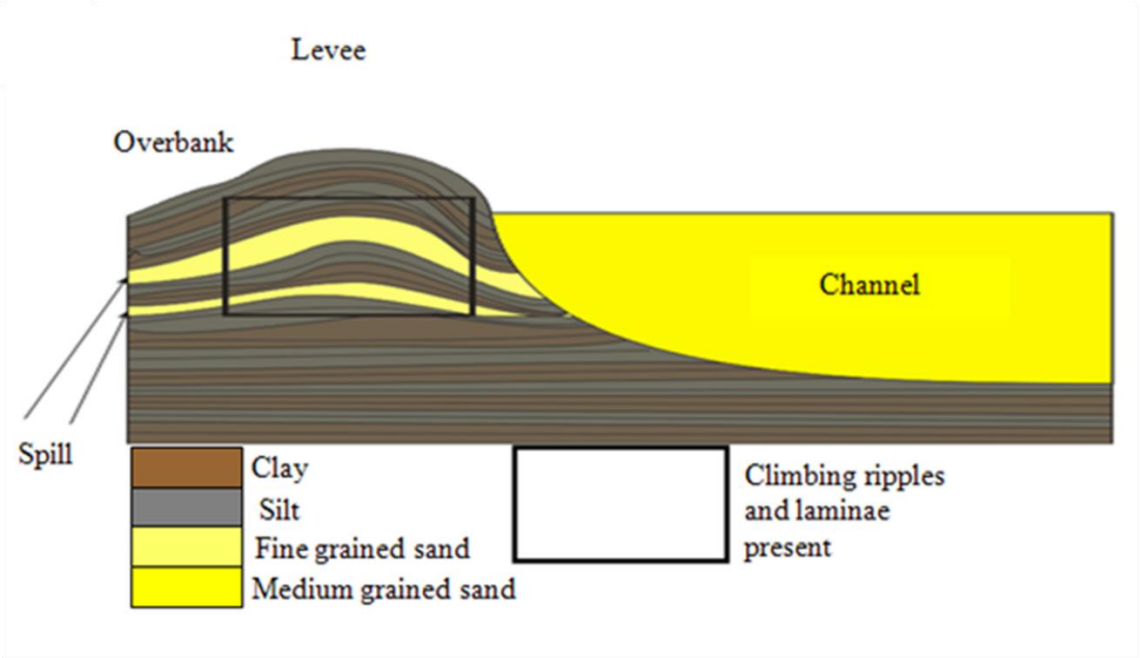

Figure 3: Schematic cross section of levee and overbank deposits adjacent to channel deposits. Deposits mainly made up fine grained laminae and climbing ripples with intermittent massive fine grained sandstone. Flow of turbidite is adjacent to cross section. (Modified from Basu and Bouma, 2000; Roberts and Compani, 1994).

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