

Reservoir characterization and forest density of the Joggins Formation, Joggins, Nova Scotia

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The Carboniferous Joggins Formation outcrops along the shoreline of Chignecto Bay, Nova Scotia, within the Cumberland Basin. The Joggins Fossil Cliffs present a 2D and 3D exposure of the channel and floodplain deposits and preserved fossils of the Joggins Formation. These outcrops demonstrate the stratigraphy of the formation and the preserved flora in the Carboniferous rocks. Within the Joggins Formation, the study focuses on the Coal Mine Point section, which comprises interbedded sandstone, shale and coal seams, with sediment deposition assisted by salt withdrawal from the region, creating accommodation. This study uses LiDAR as a survey technique with spatially- calibrated Differential Global Positioning System (DGPS) to capture high-resolution images of the meanderbelt channel architecture and the fossils of upright lycopsids and calamitaleans. This high-resolution imaging provides a 3D survey of the cliff with details of the channels and the fossil tree trunks. Adding previously acquired surveys of the region allows a time spatial analysis due to cliff retreat, and a 3D model of the study area can be constructed. The model will enable increased understanding on the changing forest density and channel architecture of the Joggins Formation. Scintillometer measurements recorded at outcrop are used to generate a pseudo-gamma log (based on counts per minute, CPM), and permeameter measurements are recorded to better understand permeability of the corresponding lithologies. Integrating the LiDAR imaging, pseudo-gamma log, permeability data and outcrop exposure leads to a 3D depositional model for (1) forest-density, and (2) meanderbelt channel architecture for the strata at Coal Mine Point within the Joggins Formation.