M.Sc. THESIS DEFENCE

by

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"POSTGLACIAL CHRONOLOGY AND GEOHAZARDS OF POND INLET AND ECLIPSE SOUND, NORTHEASTERN BAFFIN ISLAND, NUNAVUT"

PLACE: *The Milligan Room, 8th Floor Biology Wing, LSC, Dalhousie University*

DATE: *Thursday, March 28, 2019*

TIME: *2:30 p.m.*

EXAMINING COMMITTEE:

Dr. Guillaume St. Onge	*Université du Québec à Rimouski*	*External Examiner*
Dr. John Gosse	*Dalhousie University*	*Co-Supervisor*
Dr. Calvin Campbell	*GSC-Atlantic*	*Co-Supervisor*
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PLEASE NOTE: *A copy of the thesis is available in the main Earth Sciences Office*

ABSTRACT

The fjords and inlets of Baffin Island contain a largely untapped postglacial sedimentary archive that records the timing and rates of important Arctic landscape, glacial, and geohazard responses to tectonic and climate change for more than ten thousand years. These are areas of high relief with the potential for submarine and subaerial slope failures. The majority of the population on Baffin Island lives along the coast of these fjords and inlets. Pond Inlet and Eclipse Sound make up a deglaciated seaway between Baffin and Bylot Islands, and the Hamlet of Pond Inlet (pop. 1,617) occurs along the southern coast of Eclipse Sound. Interpreting the complex but valuable sedimentary records there will (1) improve our understanding of the timing and rate of deglaciation and sedimentation rates during postglacial warming in northeastern Baffin Island, and (2) will contribute to the geohazards assessment of northern Baffin Island. Recently acquired acoustic and core data provide the first opportunity to evaluate the depositional processes of this region in detail. High resolution multibeam bathymetric data and sub-bottom profiler data reveal depositional processes at a regional scale. Multiple cores penetrating the upper ten metres of sediment provide the first radiocarbon dates in Pond Inlet that establish rates and timing of key events, and sediment properties to assess slope stability and verify interpretations of the acoustic imagery.

Pond Inlet and Eclipse Sound archive depositional processes from the Last Glacial Maximum (LGM) to present. The multibeam bathymetry reveal the seabed is composed of glacial landforms deposited during the last glacial advance. The acoustic data resolve the upper ~65 m of sediment and reveal that it is composed of ice-contact till, glaciomarine, and postglacial sediments. The uppermost glacial till and overlying deposits are interpreted to be LGM and younger, and the moraine at the mouth of Pond Inlet is interpreted to represent a Younger Dryas re-advance, pinning the geometry and thickness of the Laurentide and regional glacier system at a time for which there is limited constraint. Radiocarbon dates reveal that postglacial sedimentation started after 10.7 ka BP. The postglacial record is vastly dominated by mass wasting events, including mass transport deposits (MTDs) and turbidites that interrupt hemipelagic sedimentation. Over the Late Pleistocene through mid-Holocene, there is a record of one mass wasting event every 1.6 ka, but the frequency increased to one event every 1.0 ka over the most recent 2.9 ka. The magnitudes and rates of mass wasting may be linked to permafrost thawing or the regional high seismic hazard. However, characteristics of the large MTDs and the bounding sediments suggest the MTDs are locally sourced and did not undergo significant transport. An assessment of submarine slope stability reveals that the postglacial sediments are stable under gravitational loading alone and sediments will require an external triggering mechanism to fail. A SPLASH model calculation showed that displacement waves large enough to affect infrastructure (>10 m run-up) at the Hamlet of Pond Inlet could be produced if a subaerial landslide entered the inlet from the southern mountain slopes of Bylot Island. This study addressed a dilemma regarding the position of the Laurentide Ice Sheet (LIS) during the Younger Dryas and reveals frequent slope failures have occurred over the Holocene. A displacement wave hazard does exist for the Hamlet of Pond Inlet, and a full risk analysis of the region is warranted.