Notice of the Final Oral Examination  
for the Degree of Doctor of Philosophy  
of  

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MSc (University of Victoria, 2012)  
BSc (University of Victoria, 2010)  

“Reconstruction of the Late Pleistocene and Holocene Geomorphology of  
Northwest Calvert Island, British Columbia”  

Department of Geography  

Thursday, April 13, 2017  
10:00AM  
University Centre Building  
Room A207a  

Supervisory Committee:  
Dr. Ian Walker, Department of Geography, University of Victoria (Co-Supervisor)  
Dr. Olav B. Lian, Department of Geography, UVic (Co-Supervisor)  
Dr. Daniel Shugar, SIAS, University of Washington in Tacoma (Outside Member)  
Dr. John Clague, Department of Geography, UVic (Additional Member)  

External Examiner:  
Dr. Lionel Jackson, Department of Earth Sciences, Simon Fraser University  

Chair of Oral Examination:  
Dr. Sara Beam, Department of History, UVic  

Dr. David Capson, Dean, Faculty of Graduate Studies
Abstract

This dissertation presents results from a multi-year interdisciplinary study of the late Quaternary geomorphic history of northwest Calvert Island, British Columbia, Canada. There is a considerable knowledge gap in the region pertaining to Cordilleran ice cover and extent as well as landscape response to a uniquely stable relative sea-level history. The objective of this study was to reconstruct this regional landscape response to deglaciation including post-LGM ice cover and extent, relative sea-level changes, coastal landform development, and climate and ecological variance. Methods used to inform this reconstruction included airborne lidar, aerial photography interpretation, sedimentary stratigraphy and detailed sedimentology of samples from shovel pits and lake cores, surficial geology and geomorphic mapping, palaeoecological examinations, and the development of a geochronology using radiocarbon and optical dating. To assist with landscape reconstruction, a new method was developed and used to differentiate littoral and aeolian sands in sediment samples that range in age from mid- to late-Holocene by using modern reference samples. The method utilized a regular optical microscope paired with freely available software (ImageJ) to characterize grain shape parameters. The method was tested on nearly 6,000 sand grains from samples of known and hypothesized depositional settings and was able to correctly identify the depositional setting for 76% of the samples. After testing, the method was used to differentiate littoral and aeolian sands in a number of shovel pit, exposure, and core sediment samples to give context to stratigraphic and geomorphic interpretations. A short-lived Late Pleistocene re-advance of Cordilleran ice occurred in the study area, with radiocarbon ages indicating ice advanced to, and then retreated from, the western edge of Calvert Island between 14.2 and 13.8 cal ka BP, respectively. Sedimentological and palaeoecological information that suggests a cold climate and advancing/retreating glacier as well as lidar remote sensing and field-based geomorphic mapping of moraines in the region provide evidence of the re-advance. After ice retreated from the area, a broad suite of geomorphic landforms developed, including flood plains, aeolian dunes, beaches, spits, marshes, and tombolos. Coastal reworking was extensive, with progradation rates greater than 1 m a⁻¹ occurring in some locations during the Late Holocene. These data provide the first evidence of a major re-advance of the retreating ice sheet margin on the central coast of British Columbia, contribute an important methodology to advance Quaternary reconstructions, and give a unique account of the geomorphic development of a Pacific Northwest coastline that experienced little relative sea-level change over the late Pleistocene and Holocene. Results help fill a spatial and temporal gap in the landscape history of British Columbia and have implications for climate and sea-level reconstructions, early human migration patterns, and the palaeoenvironment of an understudied area of the Pacific Northwest coast of North America.