University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

BRYAN MOOD

BSc (Mount Allison University, 2013)

" Latest Pleistocene and Holocene behaviour of Franklin Glacier, Mt. Waddington Area, British Columbia Coast Mountains, Canada"

Department of Geography

Thursday April 16, 2015
10:00 A.M
David Turpin Building
B215

Supervisory Committee:
Dr. Dan Smith, Department of Geography, University of Victoria (Supervisor)
Dr. John Clague, Department of Geography, UVic (Member)

External Examiner:
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Dr. Michael Whiticar, School of Earth and Ocean Sciences, UVic

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Abstract

Holocene climate variability in the British Columbia Coast Mountains has resulted in repeated intervals of glacier expansion and retreat. Since reaching their late Holocene maximum positions in the late 20th century, glaciers in the region have experienced significant volumetric loss. The subsequent downwasting and frontal retreat has revealed forests buried by glacier advances throughout the Holocene, enabling description of significant intervals of ice expansion using dendroglaciology. This thesis characterizes dendroglaciological evidence as it relates to climate at two scales: (1) at Franklin Glacier in the Mt. Waddington area, and; (2) throughout the Coast Mountains. Dendroglaciological evidence from glacier forefields and lateral moraines in the Coast Mountains provides evidence for at least 11 intervals of glacier activity during the Holocene. The earliest record glacier activity is documented in the Pacific Ranges from 8.5 to 7.8 ka, after which glaciers in this region retreated during the early Holocene warm and dry interval. Following this a glacial advance from 6.7 to 5.6 ka was followed by a subsequent expansion episode from 5.1 to 4.6 ka in response to attendant cool and moist conditions in the Pacific Ranges. After 4.6 ka, glaciers in the Pacific and Boundary ranges advanced at 4.4 to 4.0 and 3.8 to 3.4 ka during intervals characterized wet conditions resulting from an intense, eastwardly positioned Aleutian Low pressure centre. Following 3.4 ka most glaciers retreated before expanded between 3.2 and 2.8 ka, retreated, and then advanced from 2.6 to 2.4 ka. Glacier advances from 1.8 to 1.1 ka occurred in response to a regional cooling event, and proceeded Little Ice Age advances from 0.6 to 0.4 ka. Franklin Glacier is an 18-km long valley glacier that originates below the west face of Mt. Waddington. Radiocarbon-dated wood samples from the proximal faces of lateral moraines flanking the glacier show that it expanded at least nine times since 13 ka. A probable Younger Dryas advance of Franklin Glacier at 12.8 ka followed the late glacial retreat and downwasting of the Cordilleran Ice Sheet from ca. 16.0 to 12.9 ka. During the succeeding early Holocene warm period, Franklin Glacier appears to have retreated significantly, leaving no record of glacial expansion until the mid-Holocene when it repeatedly advanced at 6.3, 5.4, and 4.6 ka in response to cool summer temperatures and generally moist conditions. Downwasting of the glacier surface after 4.6 ka was followed by intervals of expansion at 4.1, 3.1, and 2.4 ka contemporaneous with a period of increased precipitation. Following ice expansion at 2.4 ka into trees over 224 years in age, there is no record of the glacier activity until 1.5 ka when Franklin Glacier thickened and advanced into young subalpine fir trees, reflecting attendant cool and wet environmental conditions. During the Little Ice Age, advances at 0.8 and 0.6 ka preceded a mid-19th to early-20th century advance that saw Franklin Glacier attain its maximum Holocene extent in response to an extended interval of cold temperatures.

The dendroglaciological record at Franklin Glacier is among the most comprehensive recovered from the British Columbia Coast Mountains and showcases the complexity of latest Pleistocene and Holocene glacier behaviour in the region.