Geophysical Research Abstracts
Vol. 20, EGU2018-18874-1, 2018
EGU General Assembly 2018

Timing and Rate Of Deglaciation of the MIS 2 Cordilleran Ice Sheet in Yukon Territory, Canada

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The northern Cordilleran ice sheet (CIS) consisted of a series of quasi-independent ice lobes that coalesced during the last glacial maximum (LGM) to form a continuous carapace of precipitation limited ice over southern Yukon. The NCIS acted as a barrier to human and animal migration through Yukon's interior. Deglaciation of the northern margin of the CIS and its rate of recession from the LGM are poorly understood so timing of potential migration routes are not constrained. To resolve this we use cosmogenic nuclide exposure dating (10Be and 36Cl) on groups of 3-4 glacial erratics to reconstruct the timing and rate of deglaciation. Our sampling concentrated on the St. Elias, Cassiar and Selwyn lobes, as well as independent glaciers from the Ogilvie Mountains.

Boulders sampled up-ice from terminal moraines show that the initiation of deglaciation varied regionally. 36Cl ages from the Ogilvie Mountains indicate that deglaciation initiated by ca 23 ka. 10Be ages indicate deglaciation of the NCIS initiated first in the Coast Mountains and St. Elias lobes at 18.2 and 17.4 ka, respectively. Deglaciation of the Cassiar lobe initiated before 16.4 ka. For the Selwyn Lobe, two sites separated by 150 km returned ages of 15.3 and 16.5 ka.

Rates of deglaciation are best constrained for the Cassiar Lobe with two transects along different flow lines. Multiple valley bottom samples in the mid-deglaciation setting at Whitehorse yielded ages of 13.7 ka, while one boulder from the adjacent ridge top 600 m above is 15.4 ka. In the accumulation zone, ice-free conditions occurred by 12.1 ka. The other transect has higher elevation samples in a mid-deglaciation setting in the Pelly Mountains that indicate deglaciation occurred by 13.7 ka. Samples taken from high elevation and valley bottom sites close to accumulation zones of the Cassiar Lobe yielded ages of 13.4 and 10.8 ka, respectively, indicating ice persisted in valley bottoms much longer than uplands.

These results provide a chronology for the style of deglaciation interpreted from regional mapping throughout Yukon: gradual initial retreat and thinning marked by moraines, followed by rapid downwasting and regional stagnation. Thinning of the ice to expose uplands in the Cassiar lobe was coincident with margin retreat. The increase in rates of deglaciation after 14 ka fits well with mapped evidence of regional stagnation. Early animal, and possibly, human migrants could have traveled along the uplands as these became ice free first. Early deglaciation of the Ogilvie Mountains may be a result of moisture starvation due to the Laurentide Ice Sheet reaching its all time maximum in the western NWT.