Holocene glacier fluctuations in Garibaldi Provincial Park, southern Coast Mountains, British Columbia

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Glacier fluctuations of the last 10,000 years have been reconstructed in Garibaldi Provincial Park in the southern Coast Mountains, British Columbia, from historical documents, dendrochronologic and lichenometric dating of moraines, and radiocarbon dating of fossil wood in glacier forefields. Six major periods of glacier advance are recognized: 7700-7300, 6400-5100, 4300, 4100-2900, 1600-1100 ¹⁴C years BP, and the last millennium. Evidence for each of these six periods was found in the forefield of Sphinx Glacier, the only glacier in western North America with so complete a record. Evidence for each period, except the 1600 ¹⁴C years BP event, was found at two or more sites, showing the regional significance of the advances. The data demonstrate that the Little Ice Age in Garibaldi Park began as early as AD1000. The earliest maximum was achieved in the 12th century, followed by recession until sometime in the 14th century. Several glaciers advanced into forests in the 14th century, culminating with the construction of moraines in the late 17th, early 18th, 19th, and early 20th centuries. Helm Glacier provides a near complete record of fluctuations since the 14th century. Glaciers receded between the 1930s and 1960s at average annual rates of about 30 m. Between the 1960s and 1980s, glaciers advanced up to 300 m, but since then they have receded at annual rates of 5-10 m. Ice cover has decreased by about 240 km² since the Little Ice Age maximum, with most of this loss occurring after the 1920s. Some small glaciers in the Park have already vanished, and more are likely to disappear if the current trend continues. The record from Garibaldi Park is broadly synchronous with records of glaciers throughout the world, suggesting a global forcing mechanism. Hemispheric temperature change can explain glacier behaviour during the last millennium. The Garibaldi record shows a relation to reconstructed Holocene sunspot activity, suggesting that changes in solar output play a significant role in global climate change.