Geophysical Research Abstracts
Vol. 18, EGU2016-9162, 2016
EGU General Assembly 2016

Coeval fluctuations of the Greenland Ice Sheet and a local ice cap during the Younger Dryas: implications for late-glacial climate

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Although the Younger Dryas (YD) has been recorded in ice cores atop the Greenland Ice Sheet, past glacier extents on Greenland dating to the YD are rare. In part, this is due to much of the Greenland Ice Sheet being located offshore until early Holocene time. The Scoresby Sund region (~71°N, 26°W) of central East Greenland, however, is one of only a few locations where the margins of the Greenland Ice Sheet and glaciers independent of the ice sheet were located at least partially on land by late-glacial time.

In this region, two distinct sets of moraines, known as the inner and outer Milne Land Stade moraines, have been defined and mark a significant readvance or stillstand during deglaciation from the last glacial maximum. Previous work has dated these moraines to late-glacial and early Holocene time. We present a new 10Be chronology on fluctuations of both the Greenland Ice Sheet and the adjacent Milne Land ice cap from the type locality of the Milne Land Stade moraines in Milne Land.

10Be ages of boulders on bedrock distal to the inner Milne Land Stade moraines range from 12.3 to 11.5 ka and indicate that both ice masses retreated during the YD, likely in response to rising summer temperatures. Since Greenland ice-cores register cold mean annual temperatures throughout the YD, these ice-marginal data support climate conditions characterized by strong seasonality. The mean ages ($\pm$ 1σ uncertainty) of the inner Milne Land Stade moraines date to 11.4 $\pm$ 0.8 ka (Greenland Ice Sheet) and 11.4 $\pm$ 0.6 ka (ice cap) indicating that they were formed during Preboreal time or at the end of the YD. Based on these coeval moraine ages, we suggest that both ice masses responded to climate conditions acting on the ice margins, specifically ablation. Moreover, our data show that the ice sheet responded sensitively (i.e. on the same time scale as a small ice cap) to late-glacial and early Holocene climate conditions.