Dynamics of and controls on post-Younger Dryas retreat of a Bothnian Sea ice stream

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The Gulf of Bothnia has variably played host to interior portions of the Fennoscandian Ice Sheet; the onset, trunk and retreat zones of Baltic and Finnish ice streams; and marine ice sheet retreat and the subsequent development of an 'inland' marine basin. These glacial dynamics and environments have, hitherto, been inferred from terrestrial, peripheral evidence. The Gulf of Bothnia itself has been little investigated and its glacial geological archives are virtually unknown.

Recent acquisition of high resolution multibeam echo-sounding data across the Gulf of Bothnia reveals, for the first time, the glacial landforms associated with flow and retreat of ice through the basin. A late-stage ice stream, with onset over Kvarken and the Västerbotten coast, flowed southward through the Bothnian Sea in a narrow corridor of fast flow. A vast field of crevasse squeeze ridges indicates ice flow under high extension, which likely enabled large supraglacial melt volumes to penetrate to the bed and develop an extensive, channelised and well-connected basal hydrological network. Stimulated by our geomorphological observations, we use a physically-based numerical ice flowband model (Nick et al., 2010) to examine the sensitivity of ice retreat to atmospheric warming (surface melt), calving and sea level change. We further explore the coupling between rapid extensional ice flow, basal crevassing and ice margin stability during deglaciation of the Bothnian Sea.

References:

Nick, F.M., van der Veen, C.J., Vieli, A. & Benn, D.I., (2010), A physically based calving model applied to marine outlet glaciers and implications for the glacier dynamics, *Journal of Glaciology*, 56 (199), 781-794.