The Svalbard Barents Sea Ice Sheet deglaciation and its contribution to meltwater pulse 1a

Daniel Nothaft[1], Tobias Koffman[2,3], Joerg Schaefer[1,2], Nicolás Young[2,4], Anne Hormes[5], Jason Briner[4]

[1]Department of Earth and Environmental Sciences, Columbia University, New York, NY 10027, USA, [2]Lamont-Doherty Earth Observatory, Palisades, NY 10964, USA, [3]School of Earth and Climate Sciences and Climate Change Institute, University of Maine, Orono, ME 04469, USA, [4]Department of Geology, University at Buffalo, Buffalo, NY 14260, USA, [5]Department of Geology, The University Centre in Svalbard, 9171 Longyearbyen, Svalbard, Norway

Pinpointing the sources of meltwater pulse (MWP) 1a—the most abrupt period of sea level rise during the last glacial termination—remains one of paleoclimatology's greatest challenges, with implications for the understanding of rapid climate change, isostatic rebound, and past ocean circulation. Here, we present a detailed geomorphological map of a southern region of Svalbard, Norway, annotated with relevant glacial features. This mapping allows us to make inferences about historic ice sheet thickness, flow rate, and erosivity. Raised beaches at an altitude of 40m indicate an ice sheet thickness of 1-2km during the Last Glacial Maximum, and the absence of glacially smoothed features at higher elevations, despite an abundance of such features in nearby valleys, suggests a transition from warm-based, erosive ice below to cold-based, non-destructive ice at higher elevations. These geomorphological observations will aid in interpreting a soon-to-be published ^{10}Be chronology of this study area, where no cosmogenic nuclide exposure data has yet been produced. Together, these data will enable us to constrain ice sheet volume change over time in southern Svalbard. If the Svalbard Barents Sea Ice Sheet (SBSIS) did indeed contribute largely to MWP-1a, then we would expect exposure dates from sites differing in elevation by 100m or more to fall within a 500-year range, centered around 14ka. However, it is important to first assess the likelihood of the existence of a non-erosive ice sheet because cosmogenic nuclides may be inherited from prior interstadials when the bedrock was deglaciated, if not "reset" by erosion, resulting in erroneously old exposure dates. Expeditions to collect samples for exposure dating at other field sites in southern Svalbard, scheduled for the late-summer 2014 field season, will help to further inform our understanding of SBSIS deglaciation and the enigmatic MWP-1a.