FJORD SEDIMENTATION ASSOCIATED WITH A SUBMARINE MELTWATER JET AND PLUME DISCHARGING FROM KRONEBREEN GLACIER, KONGSFJORDEN, SVALBARD, NORWAY

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Kronebreen is a fast flowing (e.g. Hagen, 2003), but actively retreating, tidewater glacier that terminates at the head of Kongsfjorden in Western Spitsbergen, Svalbard, Norway. Currently, one main subglacial meltwater conduit marked by terminus embayment forcefully releases fresh water into the fjord at the ice cliff. Basal meltwater and debris, evident from very high suspended sediment concentrations of up to 0.22 g L^{-1} (mean conc. at ≥ 10m depth = 0.1 g L^{-1}) rapidly exit the glacier, forming a density-controlled turbid upwelling from the grounding line at about 60 m depth. Sediment, as coarse as fine sand, is actively transported to the fjord surface and then quickly falls out of suspension. Silt and clay, however, spread laterally above the pycnocline at 10-12 m depth and is transported down-fjord. At about 240 m from the ice cliff and near the meltwater upwelling, the minimum measured sediment mass accumulation rate is 39.62 ± 0.01 g cm^{-2} a^{-1} (0.66 g cm^{-2} d^{-1}; 5.0 mm d^{-1} vertical dry accumulation rate), and the rate decreases with distance from the ice cliff. Gravity cores taken at distances 630 m and 970 m from the calving margin indicate turbidity current activity beyond the modern morainal bank and adjacent subaqueous grounding-line fan; the base of each turbidite is marked by an increase in mean grain size coincident with an increased magnetic susceptibility. Mapping of the ice margin in 2005 indicates a slowing ice margin retreat rate (21 m a^{-1} between 1990 and 2005) in comparison with recent decades. This slowing trend may indicate increased overall ice flow rate or the possibility of the glacier beginning to pull out of the fjord. Our field work was conducted in July 2005 as part of the Svalbard REU (Research Experience for Undergraduates) program funded by the US National Science Foundation. The research is aimed at using glacimarine sedimentation as a proxy for modern climate change. Additionally, because of polar amplification in the climate system (Overpeck et al., 1997), studies of regional change expressed in glacial processes throughout the Arctic region are of interest for understanding the heterogeneous impacts of contemporary change. Field methods included use of suspended sediment traps, CTD/OBS instrumentation, water sampling, gravity and box coring, sub-bottom profiling, and iceberg sampling. Our sediment traps measured the highest sedimentation rates recorded in the fjord, but comparison between our measurements and previous studies is problematic for various reasons. However, measured sedimentation rates confirm these glaciers lie on a climatological spectrum between fully cold-based glaciers of Antarctica and warm-based glaciers of Alaska today.

REFERENCES:

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