

Iron and macronutrient distributions near the fronts of marine-terminating glaciers in Inglefield Gulf, northwestern Greenland

*NAOYA KANNA¹, Shin Sugiyama², Takuto Ando¹, Izumi Asaji^{3,2}, Yoshiki Fujishi^{3,2}, Jun Nishioka²

1. Arctic Research Center, Hokkaido University, 2. Institute of Low Temperature Science, Hokkaido University, 3. Graduate School of Environmental Science, Hokkaido University

The Greenland Ice Sheet drains freshwater into the ocean through land- and marine-terminating glaciers. Runoff from land-terminating glaciers is assumed to be iron (Fe) and silicate source to the ocean. However, influence of discharge from marine-terminating glaciers on Fe or macronutrient enrichment is poorly understood due to the difficulty of oceanographic observations in a proglacial fjord. Here we present Fe and macronutrient dataset obtained in Inglefield Gulf region of northwestern Greenland, which is fed by ~10 marine-terminating glaciers.

In the summers of 2016-18, we collected meltwater samples on Bowdoin Glacier, one of marine-terminating glaciers feeding Inglefield Gulf. Seawater was sampled in Inglefield Gulf with acid-cleaned Teflon-coated Niskin-X samplers and a Teflon coating messenger suspended on a Kevlar wire. Dissolved Fe (DFe, passes 0.2 μm acid-cleaned filters) in the seawater samplers was pre-concentrated using NOBIAS Chelate PA-1 resin (Hitachi High-Tech. Corp.). The DFe in the seawater and the glacial meltwater were analyzed with and without pre-concentration on a Graphite Furnace Atomic Absorption Spectrometer (Hitachi High-Tech. Corp.). Macronutrient in these water samplers was analyzed using an auto-analyzer (QuAatro, BL TEC Inc.) with a continuous flow system. Near the terminus of three marine-terminating glaciers (Melville, Sharp, and Hart Glaciers), relatively cold (1~2°C) and fresh (as low as 28) waters were distributed in the upper 50 m. We deduce that the water masses in the upper 50 m have been modified by interaction with these glaciers, as previously reported. The DFe in the glacially modified waters ranged from 1.5 to 4.3 nmol/kg. On the Bowdoin Glacier, DFe in the meltwater ranged from 15.6 to 636 nmol/kg, with an average of 197 ± 179 nmol/kg ($n = 13$). The glacial meltwater was significantly enriched in DFe, and thus discharge from marine-terminating glaciers is a potentially important DFe source of the glacially modified waters. The DFe:nitrate (NO_3^-) ratios in the glacially modified waters varied from 0.7 to 147 mmol/mol, which were notably higher than phytoplankton cellular Fe:N ratios (~0.02 mmol/mol, Sunda and Huntsman, 1995). This suggests that phytoplankton in the glacially modified waters were under Fe replete conditions in Inglefield Gulf.

Keywords: Greenland, Marine-terminating glacier, Nutrient, Iron