

The sources of nitrogen and its effect on microbes on glacial snow and ice in the northwest Greenland

*Nozomu Takeuchi¹, Nobuhito Ohte², Naoko Nagatsuka³, Jun Uetake³, Sota Tanaka¹, Yukihiro Onuma¹

1.Chiba University, 2.Kyoto University, 3.National Institute of Polar Research

The quantity and distribution of insoluble impurities are one of the most significant factors to determine surface albedo and have been reported to affect substantial melting of glacier ice and snow. Supraglacial impurities usually consist of inorganic and organic material accreted on the ice surface by wet precipitation or aeolian deposition. Microbes and organic matter are also dominant biotic constituents of supraglacial impurities. Microbes include cold-tolerant snow and ice algae, cyanobacteria, and heterotrophic bacteria, and they can grow and proliferate on the melting snow or ice surfaces. These microbes and their derivative organic matter often aggregate with mineral particles and form spherical granules called cryoconite. Cryoconite and some pigmented algae usually display a higher light absorbency (i.e. dark colored) compared with pure snow and ice, thus they can efficiently reduce surface albedo of snow and ice. Nitrogen is one of the important nutrients supporting growth of such microbes, however, information on their sources and dynamics on the glacial systems is still limited. We report soluble nitrogen concentrations and the nitrate stable isotopes (^{18}O and ^{15}N) in snow, ice, and meltwater collected in the north-west Greenland Ice Sheet. Nitrate was contained in both of snow and glacial ice. O and N isotopes of the nitrate showed that nitrate in snow is mostly supplied from atmosphere derived from natural origin, while that in glacial ice is from anthropogenic origins. Nitrogen isotope in organic fraction in the impurities coincided to that of anthropogenic nitrogen, suggesting that that microbes on the glacier used mainly anthropogenic nitrogen.

Keywords: Greenland, microbe, nitrogen