Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

HTT32-P12 Room:Convention Hall Time:May 23 18:15-19:30

Variations in Sr and Nd isotopic ratios in cryoconite on glaciers in Asia, Alaska, and Greenland

Naoko Nagatsuka[1*], Takanori Nakano[2], Nozomu Takeuchi[3]

[1]National Institute of Polar Research, [2]Research Institute for Humanity and Nature, [3]Chiba University

Variations in Sr and Nd isotopic ratios of cryoconite on glaciers in Asia, Alaska, and Greenland

Recent shrinkages of glacial mass are not only due to global warming, but also possibly to accumulation of cryoconite on the glacial surface. Cryoconite is a biogenic surface dust consisting of organic matter mainly derived from living microbes on the glaciers, and mineral particles originated from basal till and/or wind-blown dust. Since cryoconite is dark color, it can reduce surface albedo of glaciers and accelerate their melting. Thus, it is important to understand their sources and formation process on the glaciers.

The characteristics of cryoconite vary among geographical locations. For example, there are small amounts of cryoconite on Arctic glaciers and their glacial surface is clean. In contrast, large amounts of cryoconite accumulate on Asian glaciers and their glacial surface appears very dirty. These differences in cryoconite are likely to affect on surface albedo and melting of each glacier. However, the formation process of cryoconite, especially origins of minerals and production process of organic matters are still not well understood.

Stable isotopic ratios of strontium (Sr) and neodymium (Nd) provide a means of identifying sources of substances and have been commonly used in loess or sediment studies. Furthermore, Sr isotope has been used as a tracer of Ca ion in studies of geochemical process, because its chemical characteristics are similar to Ca. Thus, Sr in organic matter including such organisms on the glacier may reveal their nutrient sources and ecology of them. In this study, we analyzed Sr and Nd isotopic ratios of four mineral and organic fractions in cryoconite on Asian and Polar glaciers. Based on the isotopic ratios, we identified origins of minerals in cryoconite and mineral sources used as nutrients by microbes on the glaciers.

Sr and Nd isotopic ratios in the mineral fractions, especially silicate minerals, which are major components of mineral particles, vary significantly among the glaciers. Cryoconite on Asian glaciers showed higher Sr and lower Nd ratios in the north and also showed little variation within a glacier. On the other hand, those on Alaskan glacier showed lower Sr and large spatial variation in Nd on a glacier. Cryoconite on Greenlandic glaciers showed further high Sr and low Nd than the other glaciers. This suggests that origins of silicate minerals in cryoconite are substantially different among the glaciers. Compared with the isotopic ratios of silicate minerals in moraine, desert, and loess reported over the regions, those in cryoconite on Asian, Alaskan, and Greenlandic glaciers were close to those in respective regions. This result indicates that silicate minerals in cryoconite were derived from surrounding the glaciers. The Sr isotopic ratios of organic matter in cryoconite also varied among the glaciers. They may reflect the minerals used by glacial microbes as nutrients.

Keywords: Sr-Nd isotope ratio, cryoconite, microbes on glaciers