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The compostion of mineral particles on snow surface and their possible effect on microbes in Tateyama Mountains, Japan

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Snow algae are autotrophic microbes and play an important role as primary producers in food chain of glaciers and snowfield. Although their reproduction requires nutrients, snow and ice is extreamly poor in nutrients. One of the possible sources of nutrients is mineral particles blown by wind and deposited on the snow. They may contain variable elements and provide nutrients for snow algae. However, we scarcely know about the relationship between mineral particles and snow algae. In this study, we described spatial and seasonal variations in mineral particle composition and snow algae on the snow surface in the Tateyama Mountains, Japan. We discussed the possible effect of mineral particles on snow algae.

Tateyama Mountains are located in the middle-north part of Japan ranging from 2000 ? 3000 m above sea level and have heavy snow fall in winter due to strong monsoon wind from Siberia. The snow starts to thaw in April and remains until late summer as perennial snow patches in some valleys. Kosa eolian dust is known to be blown from Chinese deserts and deposited on the snow every spring. Also, snow algal bloom is often observed as red-colored snow in summer. Samples were collected from the snow surface during summer in 2008 - 2011 at four different sites (A ? D) in this area. We analyzed them by X-ray diffractometer (XRD) and inductively coupled plasma (ICP) to obtain elements and composition of mineral particles, and we examined them with microscope to describe structure of snow algal community.

XRD analysis revealed mineral particles on the snow surface were mainly composed of quartz, plagioclase, hornblende, mica, chlorite, and amorphous. In April, mineral compositions of all sites were almost similar to that of Kosa eolian dust, indicating that these mineral particles were derived from Chinese arid regions. After May, the mineral compositions changed according to sites. The proportion of hornblende at the site C significantly increased. Since the site C was located near geological features mainly composed of hornblende, the supply of mineral particles from local sources is likely to increase after snow began to disappear. These results indicate mineral particles on the snow surface were blown from distant Chinese deserts in April when snow covered entire ground surface, and they may change to be supplied from the local exposed ground surface after May.

ICP analysis revealed mineral particles at the site C contained significantly more manganese than the site D.

Microscopy revealed that algal community structure was different among study sites. The community structure at the site C showed the cyanobacteria were dominate, and that at the site D showed green algae were dominate. Mineral particles at the site C contained more hornblende and manganese than the site D. Hornblende contains Fe and/or Mg. Fe, Mg, and manganese are essential trace elements for plants. This suggests that mineral particles may affect algal community.

In order to reveal direct relationship between mineral particles and snow algae, further analysis is necessary such as electron microscope.

Keywords: mineral particles, snow algae