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Eutrophication trends of Japanese mountain lakes inferred from sedimentary diatom assemblages

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In recent years, atmospheric pollution caused by fossil fuel burning is growing due to economic development in East Asian countries. Japan, which is located downwind, concerns about the transboundary atmospheric pollution which causes human health damage and environmental and ecosystem deteriorations. However, studies on effect on mountain lake ecosystems are very rare in Japan. We have studied temporal changes in Japanese mountain lake ecosystems based on paleolimnological approach to elucidate long-term effects on the transboundary atmospheric pollutant depositions on mountain lake ecosystems. Recent analyses in mountain lake sediments from Tohoku, Hokkaido, and Hokuriku indicated that phytoplankton and zooplankton communities have changed in 1980s together with increasing coal burning in china and enhanced accumulation of coal-derived heavy metals in the studied lakes (Kuwae et al., 2013; Tsugeki et al., 2012). However, it is still unclear what hydrological factors associated with enhanced atmospheric pollutant depositions to the lakes have induced the changes in the plankton communities.

In this study, we examined diatom assemblages in core sediments collected from mountain lakes of Niseko-Ohnuma and Lake Rausu in Hokkaido, Mikuriga-Ike in Toyama prefecture to elucidate changes in nutrient level and pH in the lake waters associated with enhanced atmospheric pollutant depositions. In Niseko-Ohnuma diatom analysis showed changes in assemblages from acidophilous and oligotrophic taxa to neutrophil and mesotrophic taxa in 1980s. In Mikuriga-ike, the result shows that oligotrophic taxa decreased and mesotrophic taxa increased after the 1990. Meanwhile, in Lake Rausu, diatom assemblages showed minor changes around 1980s.

These observations indicated that the increases in phytoplankton and zooplankton in mountain lake ecosystems reported previously resulted from increased levels of nutrients in lake waters. Our results supported the hypothesis that enhanced atmospheric nutrient depositions after 1980s may result in eutrophication in the mountain lakes and impact the lake ecosystems.

Keywords: eutrophication, Japanese mountain lakes, diatom assemblages, recent past