

Isotopic study on seasonal nitrogen dynamics at Lake Biwa

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To clarify nitrogen dynamics in Lake Biwa, we measured the concentrations of nitrogen compounds and their nitrogen stable isotopic ratios in 14 depths in north basin of Lake Biwa. In the lake, particulate nitrogen (PN), such as phytoplankton, is generally decomposed to dissolved nitrogen (DN); in order of dissolved organic nitrogen (DON), ammonia nitrogen (NH_4^+) and nitrate nitrogen (NO_3^-). These dissolved nitrogen compounds are taken up by phytoplankton again, and the nitrogen circulation in the lake is established. To predict the water quality in future, it is necessary to understand the nitrogen cycle in the lake, as well as nutrient load to the lake.

In this study, we collected lake water sample at 14 depths in north basin of Lake Biwa (water depth is 90 m) in 1-2 months interval. The lake water sample was analyzed for the concentration of PN, PC, DN, NO_3^- , NO_2^- and NH_4^+ , $\delta^{15}\text{N}$ of PN, DN and NO_3^- .

NO_3^- concentration was lower in the surface layer (0-20m), and higher in the deep layer (20-90m) during the stratification period, whereas NO_3^- concentration was constant in all layers during the circulation period. PN concentration also increased in the surface layer from April to June, decreased sharply in July. These indicate that phytoplankton which grew on the surface layer from April to June used NO_3^- , thereafter, NO_3^- was depleted after June, then, phytoplankton decreased after July respectively. On the other hand, NO_3^- concentration is considered to be increased by decomposition of the precipitated PN from surface layer. It is considered that the NO_3^- concentration became constant in all layers because of mixing of deep layer and the surface layer.

The weighted average $\delta^{15}\text{N}_{\text{DN}}$, $\delta^{15}\text{N}_{\text{NO}_3^-}$ in the unit water columns decreased about 3‰ in the circulation period, in the circulation period, then, increased during the stratification period. The decrease of $\delta^{15}\text{N}_{\text{DN}}$, $\delta^{15}\text{N}_{\text{NO}_3^-}$ at the water column during circulation period can not be explained by mixing of deep layer and the surface layer. We will discuss the mechanisms of $\delta^{15}\text{N}_{\text{DN}}$, $\delta^{15}\text{N}_{\text{NO}_3^-}$ decrease during circulation period in the presentation.

Keywords: nitrogen dynamics, nitrogen isotope, seasonality