

Nitrate isotope distributions in the eastern Indian Ocean

*Chisato Yoshikawa¹, Akiko Makabe¹, Yohei Matsui¹, Takuro Nunoura¹, Naohiko Ohkouchi¹

1. Japan Agency for Marine-Earth Science and Technology

Nitrogen isotopic composition of nitrate ($\delta^{15}\text{N}_{\text{Nitrate}}$) is widely used as a tracer of ocean-internal nitrogen cycling (consumption and regeneration) and ocean-external nitrogen inputs and losses (N_2 -fixation; fixation of N_2 gas into bioavailable nitrogen such as ammonia by diazotrophs, and denitrification; microbial respiration using nitrate as an electron acceptor). When the phytoplankton assimilates nitrate, nitrogen isotopes are fractionated. A $\delta^{15}\text{N}_{\text{Nitrate}}$ value increases, in conjunction with nitrate depletion, due to an isotopic effect during nitrate assimilation by phytoplankton. When denitrification occurs in the water column, a $\delta^{15}\text{N}_{\text{Nitrate}}$ value extremely increases due to a strong isotopic effect. N_2 -fixation produces fixed nitrogen with a $\delta^{15}\text{N}$ value of $\sim 0\%$, as nitrogen fixers take up N_2 gas with little isotopic effect. This fixed nitrogen with low $\delta^{15}\text{N}$ value is eventually converted into low- $\delta^{15}\text{N}_{\text{Nitrate}}$ through degradation of nitrogenous organic compounds called remineralization and subsequent nitrification. Those signatures of $\delta^{15}\text{N}_{\text{Nitrate}}$ in the euphotic zone are conserved in nitrogenous organic compounds and transfers to the sinking particles and deep-sea sediments. Here we determined $\delta^{15}\text{N}_{\text{Nitrate}}$ and $\delta^{18}\text{O}_{\text{Nitrate}}$ along 110°E in the eastern Indian Ocean during the cruise MR15-05 of R/V *Mirai*. The nitrate concentrations were below $0.1 \mu\text{M}$ in the surface water of the whole area. The $\delta^{15}\text{N}_{\text{Nitrate}}$ values are expected to increase toward the surface, in conjunction with nitrate depletion. Furthermore, if nutrient uptake by phytoplankton and remineralization occur with Redfield proportions, and if external nitrogen inputs/output do not occur, then a N^* value should be $\sim -2.9 \mu\text{M}$. However, in this study area, the $\delta^{15}\text{N}_{\text{Nitrate}}$ value decreased to 4.0% and the N^* value increased up to $-1.3 \mu\text{M}$ toward the surface. These features suggest that the surface water of this study area is affected by N_2 -fixation. In the presentation, we will discuss the nitrogen cycle of the eastern Indian Ocean in more detail by using the $\delta^{18}\text{O}_{\text{Nitrate}}$ values.

Keywords: Marine nitrogen cycle, Nitrogen isotopes, Eastern Indian Ocean