

Nitrogen isotopic record of chlorophylls as a tool for understanding of nitrogen dynamics in the oceanic photic zone

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Nitrogen isotope record of chlorophylls has a large potential as a tool for reconstructing the nitrogen cycle and its dynamics in the photic zone. In this study, we determined the nitrogen isotopic compositions of chlorophyll *a* ($\delta^{15}\text{N}_{chl}$) and pheophytin *a* ($\delta^{15}\text{N}_{Phe}$) as well as nitrate ($\delta^{15}\text{N}_{NO_3}$) collected from two sites (S1 and K2) in the northwest Pacific as a case study. Both chlorophyll *a* and pheophytin *a* were extracted from the particulate organic matter (POM) and purified by the fraction collector of high-performance liquid chromatography. The nitrogen isotopic composition of the isolated chlorophylls was determined by our ultra-sensitive elemental analyzer / isotope ratio mass spectrometry. The estimated isotopic fractionation associated with the chlorophyll synthesis is -7.9 ‰ to -13.1 ‰, confirming the previous studies. However, the $\delta^{15}\text{N}$ of POM is not consistent with those of chlorophylls, suggesting that the POM from both sites is a mixture of phytoplankton and other materials like detritus of zooplankton. The $\delta^{15}\text{N}_{chl}$ value provides pure $\delta^{15}\text{N}$ signature of phytoplankton, which is crucial for better understanding of nitrogen dynamics in the surface ocean. Chlorophylls are also buried and preserved in the sediments for long, and thus useful for the reconstruction of nitrogen cycle in the surface ocean in the geological past. In this presentation, we will summarize the evidence and discuss advantages and pitfalls of this tool for the future use in the oceanography and paleoceanography.

Keywords: nitrogen isotope, oceanic photic zone, nitrogen dynamics, photosynthetic pigments, nitrate