Heterotrophic sources for dissolved organic nitrogen in the oligotrophic ocean indicated by nitrogen isotopic analysis of individual amino acids

Y. T. YAMAGUCHI[1,2]* AND M. D. MCCARTHY[1]

[1]University of California, Santa Cruz, Santa Cruz, CA 95064, USA (*correspondence: y.t.yamaguchi@gmail.com)

[2]The University of Tokyo, Tokyo 113-0033, Japan

Dissolved organic nitrogen (DON) plays the roles in N cycling and ecosystem in the upper ocean. This study explores the use of nitrogen isotopic analysis of individual amino acids ($\delta^{15}N_{AA}$) of coupled DON and particulate organic nitrogen (PON) samples as a new approach to examine relative sources, transformation processes, and potential coupling of the main detrital organic nitrogen form in the ocean water column. We measured $\delta^{15}N_{AA}$ distributions in high-molecular-weight DON (HMW DON) and suspended PON in the North Pacific Subtropical Gyre (NPSG) from surface to mesopelagic depths. A new analytical approach using HPLC purification of amino acids achieved far greater $\delta^{15}N_{AA}$ measurement precision for DON than earlier work, allowing us to resolve previously obscured differences in $\delta^{15}N_{AA}$ signatures, both with depth and between ON pools. The $\delta^{15}N_{AA}$ values of both surface and mesopelagic HMW DON suggest mainly heterotrophic sources, with the mesopelagic HMW DON bearing signatures of far more degraded material. These results contrast with a previous proposal that DON $\delta^{15}N_{AA}$ patterns are essentially "pre-formed" in the surface ocean, undergoing little further change with depth. Together with the results of amino acid enantiomers (D/L), these results suggest that heterotrophic bacteria are the main sources for DON at both surface and mesopelagic depths in the oligotrophic ocean.