

Enantiomer-specific (D/L) nitrogen isotopic composition of amino acids in high molecular weight dissolved organic matter in seawater

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Amino acids (AA) are the major nitrogenous component of marine dissolved organic nitrogen (DON) that can be recovered at the molecular level. Biomarker data indicates that bacteria are important sources for marine DON, in particular based on high D/L AA ratios. While D-AA predominantly derive from Bacteria (heterotrophic and/or autotrophic), L-AA sources include Bacteria, Eukarya, and Archaea. Contribution from each source currently remains uncertain.

Here we introduce enantiomer-specific $\delta^{15}\text{N}$ analysis of alanine, as a new approach to constrain DON sources. We hypothesize that if L-AA are derived from multiple sources, D vs. L alanine should show significant $\delta^{15}\text{N}$ heterogeneity. We analyzed HMW-DON collected in the North Pacific Subtropical Gyre and the Gulf of Mexico.

In each region, $\delta^{15}\text{N}$ of D-alanine and L-alanine were identical, within analytical error. This suggests that D-alanine and L-alanine, and by extension the AA pool, has predominantly bacterial sources in both ocean basins. In addition, the $\delta^{15}\text{N}$ values of alanine were significantly different in the Atlantic vs. Pacific, supporting the view that DON cycles independently in major ocean regions.