N biogeochemistry of the western Arctic Ocean evidenced by coupled nitrate N and O isotope ratios

J. Granger[1], D. M. Sigman[2]
[1]*University of Connecticut, Groton, CT USA*
[2]*Princeton University, Princeton, NJ USA*

We present measurements of the natural abundance nitrogen (N) and oxygen (O) isotope ratios of nitrate ($^{15}N/^{14}N$ and $^{18}O/^{16}O$) from water-column depth profiles collected along a south-north transect in the Beaufort Sea, as part of the Canadian IYP-GEOTRACES cruise aboard the Admunsen in August-September 2009. The data show a clear distinction of nitrate from Atlantic *vs.* Pacific provenance. A substantial *maximum* in nitrate $\delta^{15}N$ of 8‰ is evident in Pacific water, associated with nutrient maximum in Bering Sea Winter Water (BSWw). The relative ^{15}N-enrichment relative to the open Pacific end-member likely from benthic denitrification on the Bering and Chukchi shelves. A coincident *minimum* in nitrate $\delta^{18}O$ (~0.1‰) signals that 100% of Pacific Halocline nitrate is remineralized. Below the Pacific Halocline, the $\delta^{15}N$ in Atlantic-derived waters is analogous to values observed in the North Atlantic ($\delta^{15}N$ ~ 5‰). However, O isotope ratios (1.7‰) are lower than reported at the subsurface and mid-depths in the North Atlantic basin, suggesting substantial subsurface remineralization of nitrate in the Greenland and Norwegian Seas prior to entry of Atlantic waters into the Arctic basin at Fram Strait. A slight $\delta^{15}N$ enrichment of ~0.2‰ in Canada Basin Deep Water may signal the long-term export of organic material deriving from nitrate in the Pacific halocline, or from nitrate entrained to depth by ice-derived brines formed on western Arctic shelves. Nitrate isotope ratios thus provide a unique hydrographic tracer of water masses in the Arctic, and offer integrative insights of N biogeochemistry therein.