SESSION: Oceans 3 (Chairs: Sarah Fawcett & Susanne Fietz)

MARS Themes:

Oceans and marine ecosystems under global change

Ecosystems, biodiversity and biodiscovery

Title:

Nitrification in the Southern Ocean: controls, kinetics, and biogeochemical implications

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Abstract:

Across the wintertime Southern Ocean, nitrification is the dominant biological process acting on mixed-layer nitrate, producing enough newly-nitrified nitrate to support all phytoplankton growth in winter and some in the following spring. We have shown that the two steps of nitrification are decoupled in this region, with nitrite oxidation emerging as rate-limiting. Nitrifiers appear to have a higher affinity for ammonium (K_m=28-137 nM) than nitrite (K_m=134-403 nM), with nitrite oxidizers apparently requiring a minimum nitrite concentration of ≥115 nM to produce nitrate. This latter trait may help to explain the Southern Ocean's perennially elevated mixed-layer nitrite concentrations (150-200 nM). Curiously, despite active ammonium uptake and oxidation, ammonium concentrations remain elevated (0.5-1 µM) throughout the winter mixed layer of the polar Southern Ocean. Ammonia oxidation is apparently saturated at low substrate concentration, with the maximum rate of ammonia oxidation remaining near-constant regardless of ammonium concentration, temperature, or light. This finding, along with the results of laboratory experiments conducted by others, led us to hypothesize that ammonia oxidation may be sensitive to iron availability. To test this hypothesis, we recently conducted iron addition experiments using seawater collected at the base of the winter mixed layer across the Southern Ocean. Our preliminary results suggest a modest response of ammonia oxidation rates to iron addition and that the *in-situ* ammonia oxidizers can use the exogenous siderophore, desferrioxamine B. We also investigated changes in ammonia oxidizer community composition in response to iron; our rate data will be interpreted in the context of these results.

Format:

Poster

Keywords: (add ; between keywords)

Nitrification, nitrogen and iron cycling, microbial community function, kinetics