Subantarctic Mode Water (SAMW) Cruise Report

\*summary paragraph at bottom\*

**Pre-cruise preparation**:

A cooler of 64 empty 500-mL FPE bottles with four blue ice packs was shipped out for SAMW cruise sampling. Bottles were cleaned by soaking in 1% CitradTM in Reverse Osmosis (RO) water for at least a week, then rinsed with RO water, acid-cleaned in 10% trace metal grade (TMG) hydrochloric acid (HCl; Fisher) for at least a month, and then rinsed and filled with Milli-Q water (18.2 MΩ·cm) for storage prior to shipment.

*\*How were Pete’s 1-L FEP bottles cleaned?*

**Sample collection**:

* Nine samples of 490 mL of 0.4 μm filtered seawater in FPE bottles for the depth profile at station 5 on 1/30/2020
  + Actual depths were 26 m, 36 m, 45 m, 111 m, 182 m, 272 m, 355 m (SAMW)
    - At the SAMW depth, two samples were taken from Niskin 1 (for 0.22 μm Acropak vs Isopore 0.4 μm PCTE filter comparison), and one sample was taken from Niskin 2
* Eighteen samples of 490 mL of 0.4 μm filtered seawater in FPE bottles were collected at the t = 0 hrs timepoint in incubation A (1/30/2020 sampled from cubitainers 13:00 to 18:10)
* Six samples of ~980 mL of 0.4 μm filtered seawater in Pete’s FEP bottles were collected at the t = 45 hrs timepoint in incubation A (2/1/2020 sampled from cubitainers 14:15 to 16:32)
* Eighteen samples of 490 mL of 0.4 μm filtered seawater in FPE bottles were collected at the t = 117 hrs, final timepoint in incubation A (2/4/2020 sampled from cubitainers 14:25 to 16:26)
* Six samples of 490 mL of 0.4 μm filtered seawater in FPE bottles for the depth profile at station 18 on 2/5/2020
  + Actual depths were 22 m, 39 m, 61 m, 104 m, 169 m, and 524 m (SAMW)
* Six samples of 490 mL of 0.4 μm filtered seawater in FPE bottles were collected at the t = 0 hrs timepoint in incubation B (2/5/2020 sampled from cubitainers 21:19 to 23:59)
* Six samples of 490 mL of 0.4 μm filtered seawater in FPE bottles were collected at the t = 91 hrs timepoint in incubation B (2/9/2020 sampled from cubitainers 18:29 to 20:40)

Note: All sample bottles were rinsed with sample seawater prior to filling. All samples were stored frozen at -20 degrees C in the R/V Thomas G. Thompson’s freezer.

**Total samples**:

* FPE bottles (500-mL): 63
* FEP bottles (1-L): 6

**Incubation treatments** (6 total, replicated 3 times each in cubitainers):

control, +nitrate, +SAMW, +silicate, +silicate and iron, +iron

**Preliminary data**: see Kristie’s report of preliminary macronutrient data for incubations A and B

**Future data to expect**: Iron speciation and development of a method for iron-binding ligand structural characterization

**Summary paragraph**:

Iron (Fe) limits ~40% of the primary production of small phytoplankton globally (Moore et al. 2004). Organic ligands in seawater increase Fe solubility, so that it stays dissolved in the water column where phytoplankton reside. However, it remains unclear which types of phytoplankton can take up Fe-bound ligand complexes to obtain the Fe they need to grow and what types of ligands those are, given different nutrient conditions. Therefore, Shannon collected samples to track changes in dissolved (<0.4 μm) Fe speciation in all treatments throughout incubations A and B. Water column profile samples were also collected for the two corresponding trace metal casts, to give some context for the incubation seawater used. The conditional stability constants and concentrations of Fe-binding organic ligands will be measured using competitive ligand exchange adsorptive cathodic stripping voltammetry (CLE-AdCSV) at the University of South Florida in St. Petersburg, FL. The conditional stability constants will be used to classify the data into strong and weak ligand classes. Shannon and Dr. Morton will also work together to develop a method to characterize the physical structures of the Fe-binding ligands found in a subset of the samples. This method development will be performed at the National High Magnetic Field Laboratory in Tallahassee, FL.

**References**:

Moore, J. K., S. C. Doney, and K. Lindsay. 2004. Upper ocean ecosystem dynamics and iron cycling in a global three-dimensional model. Global Biogeochemical Cycles **18**. doi: 10.1029/2004gb002220