Beaufort Gyre Exploration Project: Dispatch 20: Tamara’s Oxygen Shack
Hugo Sindelar
September 26, 2018

Location: 71° 57’ N 150° 16’ W

Weather: -2°C (28°F), Partly cloudy, occasional light snow, seas moderately choppy, Northwest winds at 11 knots, seawater temperature -0.6°C (30.9°F)

Sea Ice: Scattered for a brief period, but otherwise none

On a ship the size of the CCGS Louis S. St-Laurent, there are plenty of working spaces that are tucked away and hard to find. One such place is Tamara’s Oxygen Shack. Not to be confused with your favorite quick-bite eatery, Tamara’s Oxygen Shack is actually a critical chemistry lab onboard. In it, Tamara Fraser measures dissolved oxygen using a wet chemistry method called a Winkler titration.

In this method, chemicals called pickling reagents are added to the water samples immediately after they are taken from the CTD rosette. These chemicals react with the dissolved oxygen and “lock” it into the sample. This prevents any dissolved oxygen from entering or exiting the sample before it is analyzed. Each sample is then stoppered to keep atmospheric oxygen from “contaminating” the sample. Right before analysis, Tamara adds sulfuric acid (H$_2$SO$_4$), which reacts with the “pickled” sample forming a yellow color based on the amount of dissolved oxygen present. The sample is then placed into an automatic titrator, which performs a much fancier version of those titrations we all did in high school or college chemistry. The titrator adds the final chemical, sodium thiosulfate, until all the color has disappeared. The machine actually measures the color in the ultraviolet spectrum of light, so it is incredibly accurate. Using this method, the dissolved oxygen in the samples can be measured down to three decimal places!

Tamara performs her titrations primarily as a way of checking on the health of the CTD rosette’s onboard dissolved oxygen sensor. The oxygen sensor can sample multiple times a second as the rosette descends, so it provides higher resolution data. But a lot can go wrong when you are sending an instrument to the bottom of a very deep ocean. It is important to have a way to ensure that your oxygen sensor is functioning correctly. In addition, the Arctic Ocean has a relatively stable dissolved oxygen profile (how it changes with depth). This allows scientists to have a relatively good estimate of what the dissolved oxygen should be at each depth. If one of Tamara’s samples is not within the expected range then it can be a clue that something is amiss on the CTD rosette.

Tamara measures dissolved oxygen because it is an important parameter for assessing ocean function. Remember phytoplankton from a previous dispatch? The tiny plants of the ocean? Well, as they photosynthesize, they produce oxygen. In fact, phytoplankton are actually responsible for more oxygen in the air than terrestrial plants. The next time you get a breath of clean mountain air or salty beach winds you can thank them. Measuring dissolved oxygen helps scientists track this ocean productivity. Dissolved oxygen is also what fish “breathe” with their gills, so having an adequate amount is important for the ocean ecosystem. Finally, dissolved oxygen is often different across the different layers of the ocean. Tracking it can give scientists a window into how these different layers interact. That’s your dissolved oxygen primer!

Just your usual quick cruise update: We are currently completing the BL line as efficiently as we can. The JOIS team is in full “go” mode as casts and samples are coming fast and furious.

Last updated: September 28, 2018