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Beaufort Gyre Exploration Project: Dispatch 17: Science Program

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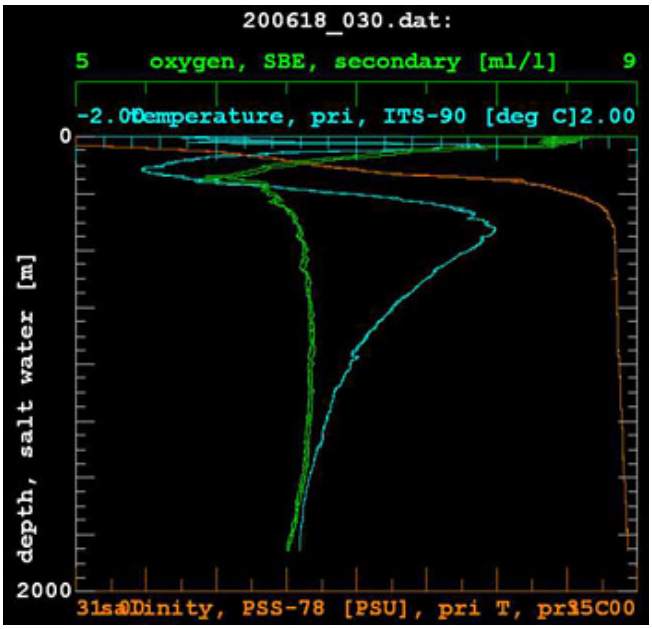
We are collecting many types of data on this cruise. We are taking measurements from the sea floor, the water, the ice and the air, both physical and biological. From all of these data we will be able to draw conclusions on the many different questions we are asking. It is good to take time during the cruise to assess the quality of the data being collected. This helps insure all the instruments are working properly. It is also helpful to meet as a group to compare results. These discussions can point out problems that need correcting (for example multiple bad samples would show a Niskin Bottle is not closing properly) and they can also point out interesting finds that may change the way or where we collect the data. During Wednesday's discussion we decided that it would be beneficial to take water from another depth in the lower halocline, one that we have been skipping over.

The CTD, an instrument named after the three primary measurements it collects (Conductivity, Temperature and Depth) is the backbone of all the seawater measurements. From these properties we calculate salinity (or roughly the amount of salt in the water) and density which can then be used to calculate the water's movement. The measurements are taken continuously as the CTD is lowered from the surface to just a few meters above the ocean floor, so we have a very good picture of what the entire water column looks like. The 24 Niskin bottles on the rosette are sent down open, and are closed on the way back up, one at a time, each at a different depth, trapping 10L of water in each bottle. We analyze the water in the Niskins back in the lab for all sorts of properties. Beneath the surface, the conservative water properties like temperature and salinity, can only change by mixing or diffusion. This allows us to track the path of water by following its unique signature of temperature, salinity, and other geochemical properties. Non-conservative properties tell us about processes occurring in the water. For example, growing phytoplankton add oxygen and use nutrients whereas decomposing materials use oxygen but release nutrients into the water.

What water masses are we focusing on in the Arctic? Looking at temperature you can easily see that water has come from the Pacific through the shallow Bering Strait. Near the surface is the warm summer water and below this is the denser (colder and saltier) winter water. Beneath the waters from the Pacific, we see the temperature rise again. This water has come all the way from the Atlantic traveling counterclockwise around the Arctic to our area of study. Warmer water is lighter than cold water so it is curious to see this temperature increase below the cold Pacific water. This increase is small though, less than 3 °C (about 5 °F), but salinity increases quite a lot. In the Arctic, density is controlled primarily by salinity.

Versatility is important when you are out in the field. You just never know what may happen so it is good to bring out tools and spares just in case… We use the rosette for the water measurements but if we can't use this system we have a backup. Today we have been using our backup, a different CTD that records its data internally. This means we can hang this CTD off any wire or rope anywhere on the ship unlike the primary system that needs to be lowered using the one winch with conducting wire (for power and data). We've been using the internally recording CTD from the foredeck and instead of a rosette full of Niskin bottles, Hugh MacLean (IOS) attaches single bottles to the wire. A weight, called a messenger, is hooked onto each bottle as its put on the wire. When the CTD has been lowered to its deepest point, Hugh attaches one last messenger to the wire and lets it go. It runs down the wire until it

Science discussion in the boardroom. Michiyo Kawai (IOS) points out an interesting feature in the newly acquired data. *Photo by Sarah Zimmermann, IOS.*



An example of the data measured by the CTD as displayed on the computer screen after a cast. Depth is the Y-scale, temperature is plotted in blue, salinity in orange, and oxygen in green. *Plot by Sarah Zimmermann, IOS.*

Hugh MacLean connects a 1.2 L Niskin bottle to the wire to collect water samples the old-fashioned way. *Photo by Sarah Zimmermann, IOS.*

bangs into the first bottle, pushing a pin that releases the spring loaded bottle caps, closing the bottle. Besides the bottle caps, it also releases the messenger that was hooked onto that bottle, allowing it to fall to the next bottle, continuing the domino effect of closing all the bottles. This clever system allows all the bottles to be closed using only standard wire. This is the way all water used to be collected before the current combination of the conducting wire, electronic water sampler and computer.

Last updated: September 6, 2013

Jennifer Jackson prepares sample flasks for drawing water from the Niskins. *Photo by Sarah Zimmermann, IOS.*

The author monitoring the real time data being sent up the wire from the underwater instrument during a CTD/rosette cast. *Photo by Rick Krishfield, WHOI.*

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