Journal 22
Tuesday

```
1.  012200Z February 05
2.  Position: Lat: 54-00.3S, LONG: 150-00.0W
3.  Course: On Station
4.  Speed: 10.2 kts
5.  Distance: 92.6 NM
6.  Steaming Time: 09H 06M
7.  Station Time: 14H 54M
8.  Fuel: 3,137 gals
9.  Sky: St 8
10. Wind: 280-T, 25 Kts
11. Sea:  280-T, 5-7 Ft
12. Swell: 270-T, 8-14 Ft
13. Barometer: 1007.2 mb
14. Temperature: Air: 9.5 C, Sea: 5.0 C
15. Equipment Status: Normal
16. Comments: none
MASTER, R/V ROGER REVELLE
```

Weather is still a little rough out here today, but it has calmed down somewhat and the sea surface temp has dropped several degrees since yesterday. Its real challenge in the staging bay when sampling between the wind and the water sloshing in around you. We will do another broadcast today with Dr. Measures and Chief Engineer Paul Mauricio, hopefully we will be joined by Captain Dave Murline. We will be broadcasting from the computer lab and have an auxiliary camera looking out from the porthole. My students have just finished a lab on icebergs and have been looking at a website by the National Ice Data Center and looking at the ice shelf images to get an idea of how close we are. One of the students questions was whether we had seen any ice yet. Captain Murline said that we hadn't and he was not sure how soon or if we would. Of course having said that about a half an hour after we finished our broadcast, we had the first distant sighting of an iceberg.

Dr Swift and Dr Theiss at the winch console directing the CTD cast from the computer lab. Note Dr Swift is discussing the water column profile being generated by the CTD as it goes down. They are looking at pressure, salinity and temperature as well as monitoring depth.

While on the cruise we have an internal website where the daily and total cruise data are posted and shared as well as maps of casts.

Paste Webshot attachment here of P16S

Dr. Measures again shared with another class that he is doing his sampling for trace metals; aluminum and iron. These metals come primarily from dust blown off of continents and the aluminum is used to trace where the dust is coming from and how much is being deposited. In this area we are quite a ways away from land so there is not much dust deposition. So why would iron be important in the ocean? Lets go back a little.

In the 1840's Chemist Justis Leibig of Giessen, Germany, was working on fertilizers for plants, and figured out what he called "The Law of the Minimum". Plants need a long list of nutrients in order to survive. If any one of the nutrients was missing, growth would be stunted or the plant would die.

John Martin, an oceanographer from the Moss Landing Marine Lab near Monterey, CA recalled Leibig's "Law of Minimum" while studying single celled plants living in the ocean. These tiny floating plants, called phytoplankton, with houses of silica (glass) need many of the same nutrients as the land plants studied by Leibig 150 years before.

Insert image of phytoplankton (diatoms)

Many of the nutrients are metals that plants require only in small amounts. Dr. Martin's scientific specialty was the ultra-sensitive testing for the amounts of metals in the ocean **(that's what Dr. Measures and his group are doing with us on P16S)**. While studying water samples from the Gulf of Alaska, he noticed a large area of the open ocean that was like a desert. There was almost no life, but especially very few plants which are the basis for the food chain. The major plant nutrients, nitrogen and phosphorous, were present as well as adequate sunlight, which should have provided for plankton growth. His check of metals used by plants showed that there was almost no iron. As a quick test he took two bottles of the Alaska water and added iron to one and kept the second for a control. In four days the water with the added iron had turned green. The phytoplankton had grown and produced nine times as much chlorophyll. This simple test told him he was on the right track. About 20% of the world's oceans are "biological deserts" , with an abundance of basic nutrients, but a shortage of iron and had only a minimum amount of phytoplankton.

So what do these little guys have to do with global climate you are probably wondering, since that is what Dr. Measures was discussing? So glad you asked. Well, these tiny plankton use CO2 from the air and surface water for photosynthesis to grow and reproduce. So the more Co2 taken out of the atmosphere the cooler the climate will become. As these plankton die they sink to the floor of the ocean and take the CO2 with them. By taking the CO2 out of the air and upper ocean water, they would decrease the greenhouse effect and slow down global warming. There is a theory that some of the ice ages may have been caused by increase is dust in the ocean and the extra iron stimulated plankton growth and cooling the atmosphere enough to send us into an ice age.

Now the sampling out here includes many different nutrients and the profiles we are seeing are due to some of these interactions. As Dr. Swift describes: " Where phytoplankton thrive they use up dissolved nutrients (such as nitrate, phosphate and to some extent silicate) and produce oxygen . So the surface water can become very low in nutrients and very high in oxygen. When these and other organisms die and decay , the process yields nutrients, which redissolve and uses up oxygen. This decay often takes place in subsurface waters, and so subsurface waters under and/or downstream from some productive regions can become very high in nutrients and very low (near zero concentrations) in dissolved oxygen. Mostly the silaceous organisms (diatoms) thrive in cold waters and so are more common in polar waters, where their exoskeletons rain out of the upper layer to redissolve underneath or to join the sediment, which also redissolves into the ocean waters."

As you can see the substances dissolved in the water column can tell us much of what is happening in the biology of the water column.

Figs of world ocean SiO3, NO3, Oxygen, Temperature from Java Ocean Atlas