Log 4 Monday

052200Z September 2005
2. Position: Lat: 12-39.5N LONG 149-06.0W
3. Course: 134-T
4. Speed: 10.6 kts
5. Distance: 253.5 NM
6. Steaming Time: 24H 0M
7. Station Time: 0H 0M
8. Fuel: 5167 gals
9. Sky: Ptly Cldy; Ci, Cu, Sc
10. Wind: 070-T, 25 kts
11. Sea: 070-T, 5-7 ft
12. Swell: 080-T, 7-10 ft
13. Barometer: 1009.2 mb
14. Temperature: Air: 28.2 C, Sea: 27.4 C
15. Equipment Status: No change.
16. Comments: Enroute to 1st station.

MASTER, R/V ROGER REVELLE

Weather is still a little rough, but the ocean looks beautiful. We are going to start presentations today from the various scientists on the cruise about the data that was collected on the cruise last year. During the presentations the scientists will be going over what they learned last year and what they hope to accomplish this year. I am going to try to put their powerpoints in my log or as attachments , with some brief explanations that my students hopefully, will understand. As a little more backround though I will spend the next 3 logs giving a little extra information as a basis for the talks. I have taken most of my information from SeaWiFs and NASA and have notated the website so that you can go there for additional information. I would also recommend going to :
http://www.bigelow.org/education.html
For both their educational programs as well as to order their award winning CD: "Phytopia"!!!!

I want to talk a little bit about Ocean Color as we are looking at phytoplankton growth out here. What is Ocean Color?

We see color when light is reflected by objects around us. White light is made up of a spectrum or combination of colors, as in a rainbow. When light hits the surface of an object, these different colors can be reflected or absorbed in differing intensities. The color we see depends on which colors are reflected and which are absorbed. For example, a book that appears red to us absorbs more of the green and blue parts of the white light shining on it, and reflects the red parts of the white light.

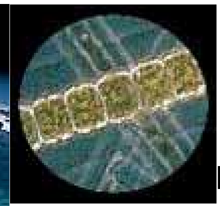
When we look at the ocean from space, we see many different shades of blue. Using instruments that are more sensitive than the human eye, we can measure carefully the fantastic array of colors of the ocean.

Different colors may reveal the presence and concentration of phytoplankton, sediments, and dissolved organic chemicals. Phytoplankton are smaIl, single-celled ocean plants, smaller than the size of a pinhead. These plants contain the chemical chlorophyll. Plants use chlorophyll to convert sunlight into food using a process called photosynthesis. Because different types of phytoplankton have different concentrations of chlorophyll, they appear as different colors to sensitive satellite instruments such as the Sea-viewing Wide Field-of-View Sensor (SeaWiFS). Thus, looking at the color of an area of the ocean allows us to estimate the amount and general type of phytoplankton in that area, and tells us about the health and chemistry of the ocean. Comparing images taken at different periods tells us about changes that occur overtime.

If someone were to ask you what the color of the ocean was, chances are that you would answer that is was **blue**......and for most of the world's oceans, your answer would be correct. We see color when light is reflected by the things around us. White light is made up of a spectrum or combination of colors, as in a rainbow of many different wavelengths. The longer wavelengths of light are red, the shorter wavelengths, blue.

The order of the colors in the rainbow - **Red, Orange, Yellow, Green, Blue** and **Violet** reflect (no pun intended) the order of their wavelengths from longest to shortest. When light hits the surface of an object, these different colors can be reflected or absorbed in differing intensities depending on the unique properties of the material on which the light is shining. The color we see depends on which colors are reflected and which are absorbed. For example, a book that appears red to us absorbs more of the green and blue parts of the white light shining on it, and reflects the red parts of the white light.

The same applies to the ocean. When sunlight hits the ocean, some of it is reflected back directly (sunglint), but most of it penetrates the ocean surface and interacts with the water molecules that it encounters. Most of the light that is scattered back out of clear, open ocean water is blue while the red portion of the sunlight is quickly absorbed very near the surface. However, there are many things in addition to just water molecules in the ocean and these things can change the color that we see. In coastal areas, runoff from rivers, resuspension of sand and silt from the bottom by tides, waves and storms and a number of other things can change the color of the near-shore waters.



However, for most of the world's oceans, the most important things that influence its color are **PHYTOPLANKTON**. Phytoplankton are very small, single-celled plants, generally smaller than the size of a pinhead that contain a green pigment called *chlorophyll*. All plants (on land and in the ocean) use chlorophyll to capture energy from the sun and through the process known as **photosynthesis** convert water and carbon dioxide into new plant material and oxygen. Although microscopic, phytoplankton can bloom in such large numbers that they can change the color of the ocean to such a degree that we can measure that change from space.

The basic principle behind the remote sensing of ocean color from space is this; The more phytoplankton in the water, the greener it is....the less phytoplankton, the bluer it is. Pretty simple really.
This information and images came from the SeaWiFS webpage, for more information and lesson plans go to:

http://oceancolor.gsfc.nasa.gov/SeaWiFS/TEACHERS/sanctuary_3.html

Now …about Plankton and why do we care about them……

Now that we understand the basic principle behind ocean color remote sensing, it is very important to realize that phytoplankton do a great deal more for us than just give the ocean a nice green color. There are at least five main points about phytoplankton that we need to understand:

Phytplankton represent the first link in the marine food chain

Like the grass of the fields and the leaves on the trees, most life on earth ultimately depends on plants for nourishment. In the ocean, microscopic animals called *zooplankton* graze on the pastures of plankton. These little animals are ultimately eaten by larger zooplankton, by fish and as amazing as it may sound, by the largest creature of all - the blue whale.

Just like plants on land, phytolankton require light, water, carbon dioxide and nutrients to grow

There is never a shortage of water in the ocean and generally, there is ample light for phytoplankton to grow in the surface waters. Carbon dioxide is plentiful in the ocean and whenever the supply in the surface waters goes down because the phytoplankton have used it during photosynthesis, it is replenished from the atmosphere above. In the ocean, the major limiting factor regulating phytoplankton growth is the availability of nutrients. Nutrients (nitrates, phosphates, silicates, etc.) are found in great quantities in the deeper, colder depths of the ocean. Whenever those waters are brought near the surface, the oceans are essentially fertilized (just like you do to your lawns to green them up) and the plankton bloom.

The patterns of distribution of phtoplankton that we observe are related to both physical and biological processes

Following on what was just said, wherever mixing takes place in the ocean, or where currents bring the colder, nutrient-rich waters up from the depths, the surface waters will be enriched with added nutrients which may stimulate phytoplankton growth. In looking at the large-scale distributions of phytoplankton in the ocean, we can see how closely they are related to areas where nutrients are being supplied to the surface waters.

Phytoplankton play a keyrole in the ecology in the marine ecosystem and changes in their patterns of distribution and abundance can effect the whole ecosystem

Because the animals all the way up the food chain ultimately depend on the supply of phytoplankton at the base, if the plankton disappear, the chain is broken and eventually the animals will suffer. Life in the ocean is a delicate balance between the physical conditions that set the stage for life to exist, and the ability of life to act upon that stage.

Phytoplankton have a major role in the global carbon cycle

Although phytoplankton account for approximately 50% of the photosynthesis on this planet, over 99.9% of all the carbon dioxide that has been incorporated into living things over geologic time is buried in marine sediments, indicating that phytoplankton play a very important part in regulating the amount of carbon in the atmosphere.

However, not all phytoplankton are green. They come in a variety of shapes and colors and while most of them are harmless, some can bloom in such large numbers and produce toxins that can be quite harmful to marine life and in some cases, to humans as well. When phytoplankton growth is stimulated by an overabundance of nutrients from sources such as sewage discharge or runoff of agricultural fertilizers used on land, the consequences can be quite serious. Dense blooms of phytoplankton can essentially block sunlight from reaching the bottom in shallow areas of bays or estuaries and can cause the massive decline in the Submerged Aquatic Vegetaion (SAV) that has been taking place in places like Chesapeake Bay. These grasses are vital nursery grounds for many species of fish and invertebrates and their loss can have dire ecological results. In addition, when these blooms die and the plankton sink to the bottom, bactierial decomposition of all this organic matter essentially strips the water of oxygen. Fish, shellfish and most other living things require oxygen to survive and decaying phytoplankton blooms have been the cause of many massive fish kills over the years. Of the phytoplankton that can be directly harmful on their own, the most commonly known form of these, dinoflagellates, are the source of **red tides**.

More Information:

1. **What are Phytoplankton- an article from the Earth Observatory**
2. **Diatom Home Page - Indiana University**
3. **ALGAE - Smithsonian Institution**
4. **Diatom Collection - California Academy of Sciences**
5. **The Harmful Algae Page - Woods Hole Oceanographic Institution**

Information from the SeaWiFs homepage

So how does the Carbon cycle come into this?

Besides acting as the first link in the food chain, phytoplankton are a critical part of ocean chemistry. The carbon dioxide in the atmosphere is in balance with Carbon dioxide in the ocean. During photosynthesis phytoplankton remove carbon dioxide from sea water, and release oxygen as a by-product. This allows the oceans to absorb additional carbon dioxide from the atmosphere. If fewer phytoplankton existed, atmospheric carbon dioxide would increase.

So what else is happening out here? Well, I was walking around the ship and passed the door to the engine room……

Arrrrrghhhhh….we have Pirates below!!!!!!

Here is one now:

Actually this is Eric Magellan, a Wiper in the Engine room

We will have some more pics of the engine room and her crew to come……oh and we get pirate training out here too……does that mean they are going to train us to be pirates????? Will I come back looking like Johhny Depp?????? Stay tuned!