Quick look at data from depth profiling deployment on January 25, 2014

We anchored off Sea Fan Grotto (33^{o} 26.738N, 18^{o} 28.483W). Seas were calm at perhaps 1 ft. and there was no wind. We started preparing the sonde at 9:29 am PST and had it in the water at 9:49. The sonde was programmed to sample every 30 seconds and made temperature, conductivity, chlorophyll, pH and dissolved oxygen measurements. The calibration effort the week before did not refurbish the oxygen sensor due to lack of materials.

Attached to the sonde cage was a Sensus Ultra dive logger that recorded temperature and pressure every 10 seconds. The SU starts recording at 5 ft depth and will stop recording after a fixed number of samples above 5 ft. The sonde was deployed with a marked rope and dropped from the stern of the boat. The intent was to lower the sonde to predetermined depths: 20 ft, 40 ft, 60 ft, 80 ft and 100 ft, lingering for 5 minutes at each depth both on descent and ascent as determined by watch.

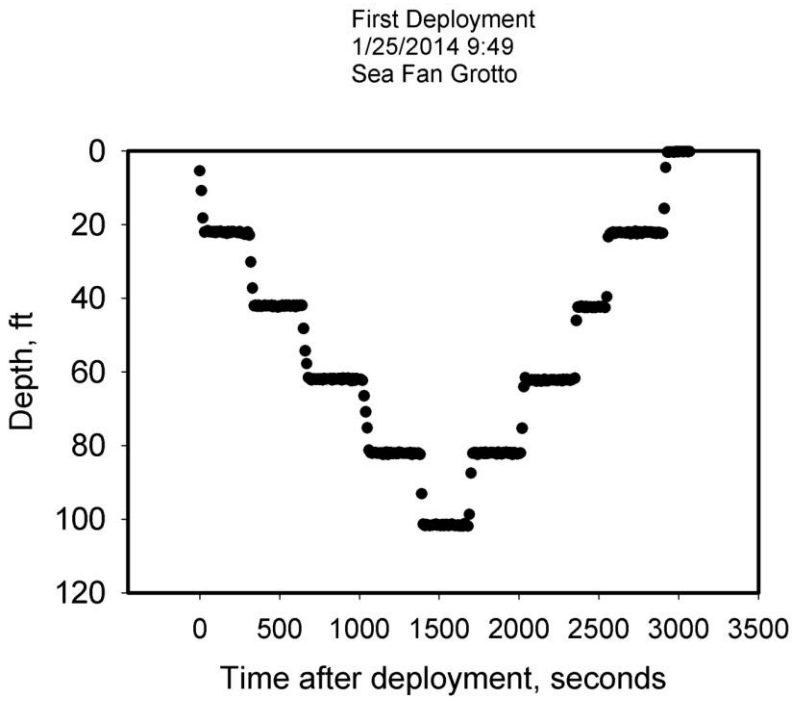

Figure 1. Sensus Ultra pressure measurements converted to depth of seawater.

Data from the pressure gauge of the Sensus Ultra were converted to fsw and are shown in Figure 1 as a function of time after the start of deployment. The recorded data indicated that this objective depth profile was reached, producing the staircase graph in Figure 1. A similar approach was used in the second deployment at the same location but starting at 12:54 pm PST.

The second deployment depths are shown in Figure 2. An impromptu decision to sample at 10 ft depth on the ascent is seen.

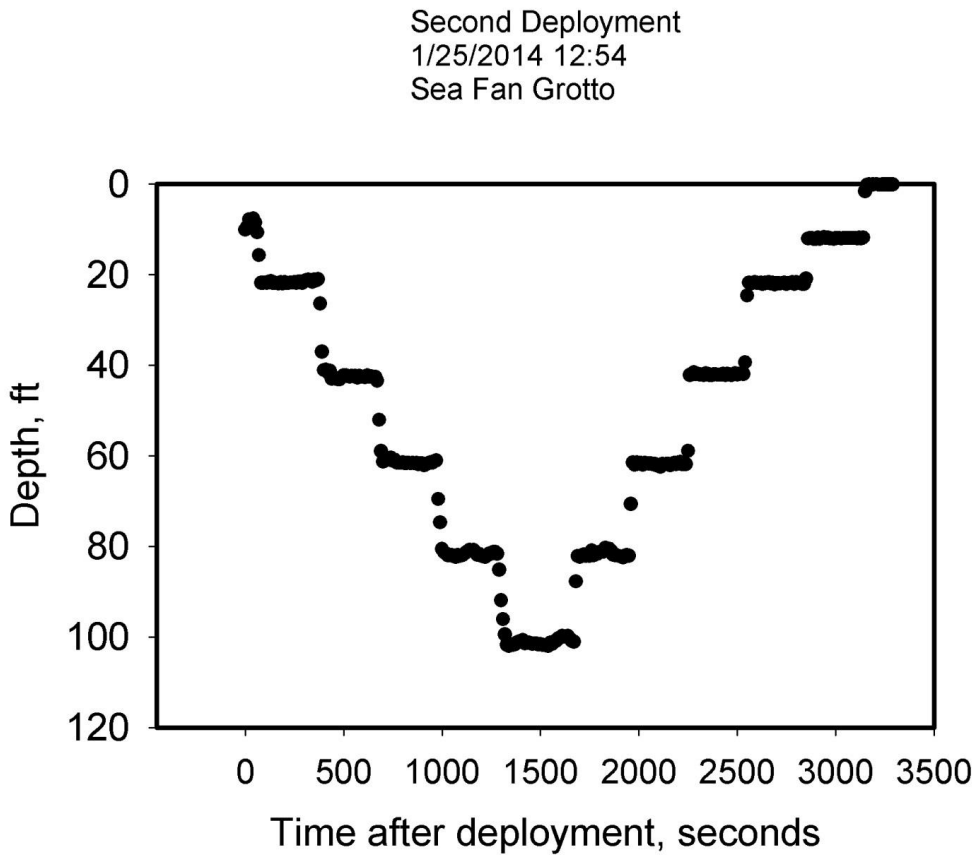

Figure 2. Sensus Ultra pressure measurements converted to depth of seawater.

The YSI was programmed to sample every 30 seconds. Its program was checked on the boat where unattended recording was initiated and scheduled to continue for 24 hours. After returning to dock, the YSI data were downloaded and cursory examined. At that time, the dissolved oxygen data were found to be bad – not unexpected as the O_2 sensor did not pass calibration the previous week.

The downloaded data were associated with depth by assigning the nearest in time SU recorded data to each YSI datum. This process created two files, one corresponding to each deployment.

Data from the two deployments are plotted on the same graph. Figure 3 is the depth profile of temperature for the two deployments. The temperature decreases slowly with depth

between 20 and 60 ft, being approximately 15.5 ^{o}C (~59.9 ^{o}F). Between 80 ft and 100 ft, the

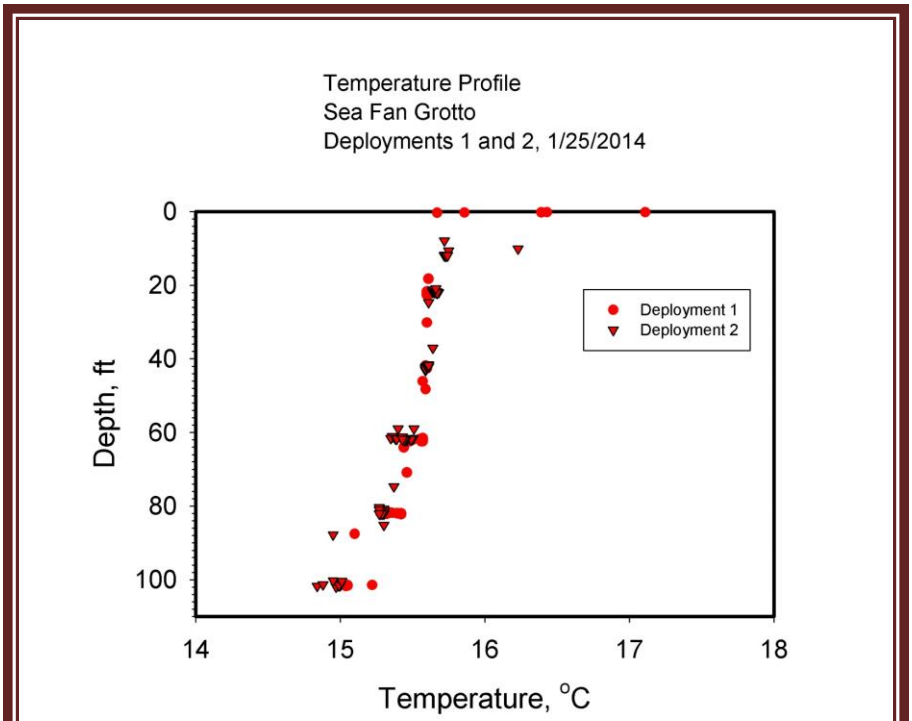

Figure 3. Temperature profiles for the 2 deployments.

temperature gradient increases, that is, the location of the thermocline is between 80 and 100 ft.

Figure 4 shows the salinity data. Salinity was computed internal to the sonde using the

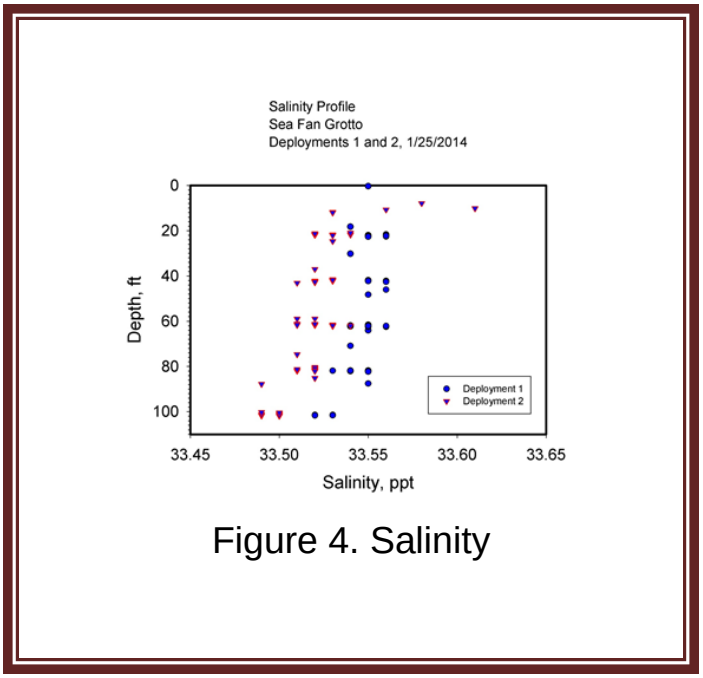

Figure 4. Salinity

temperature and conductivity measurements. The horizontal scale is much expanded to show the fine structure in the measurements. The average value for salinity in the ocean is 33.5 ppt, which is what is expected for the ocean off California. The spread in values for a specific deployment at a particular depth indicates the uncertainty in the measurement, about 0.02 ppt. For both deployments, the water was saltier the deeper we measured. The other feature of the plot is that the second deployment measured fresher water (not by much) than the first deployment did.

Figure 5 shows chlorophyll for both deployments. Chlorophyll is the chemical required for photosynthesis and is contained in diatoms and other phytoplankton. The values of

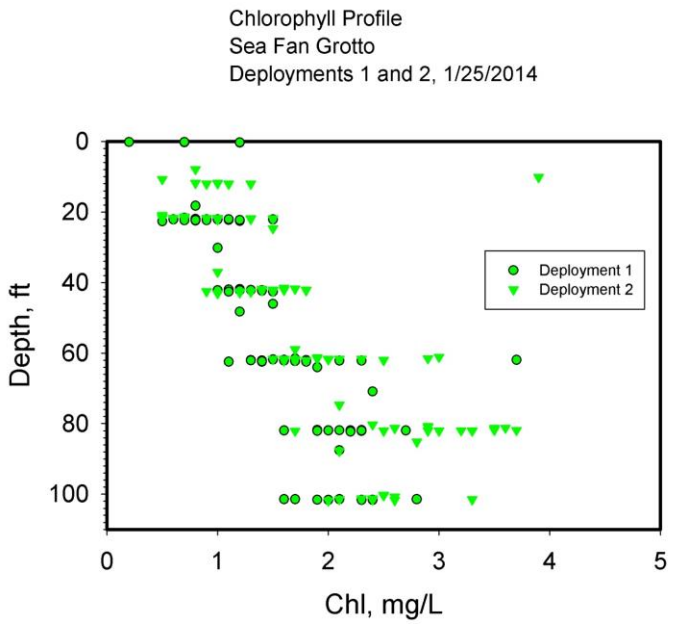

Figure 5. Chlorophyll for 2 deployments

chlorophyll are extremely low, which is one reason the visibility was great. Low values are expected during the winter. One interesting feature of Figure 5 is that the chlorophyll was a maximum at 80 ft for both deployments. Phytoplankton need both nutrients and sunlight. Sunlight is maximum near the surface but nutrients usually increase with depth. And, nutrients have difficulty being transported upward through the thermocline. Hence, phytoplankton may aggregate near the thermocline where they can get the most sunshine while being bathed in nutrients.

Figure 6 shows the measured pH, or acidity. The graph has some interesting features. For the first deployment, the pH was nearly constant, though decreasing slightly with depth. I believe this is typical behavior. However, for the second deployment, the pH dropped, that is, the ocean water was more acidic. This happened between 40 and 60 ft, and the water stayed at lower pH for the remainder of the deployment, including the measurement made at 10 ft , the last of the deployment.

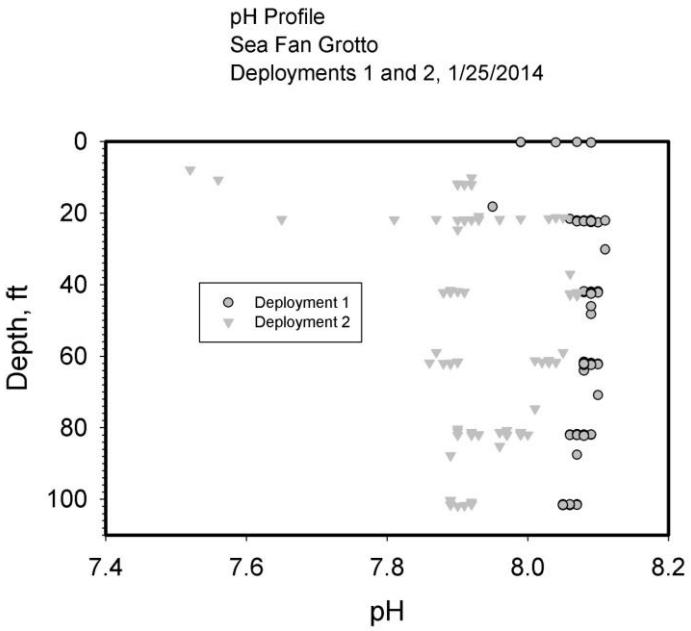

Figure 6. pH for 2 deployments

Current Observation

During the second deployment, a large current at the surface was observed when the sonde was deployed to 100 ft. When the current initiated is unknown and it ceased before the deployment terminated. Although current could not be measured directly, we did note an oscillation in the deployment depth for the second deployment. It can be seen in the expanded view of Figure 2, now shown in Figure 7. At the 80 ft and 100 ft stations, the SU went into oscillations with a period of 2 to 3 minutes. This could be an effect of the large current. The current could be expected to bring water with different properties to the sonde and may explain the difference in values measured between the first and second deployments, especially in the pH measurements.

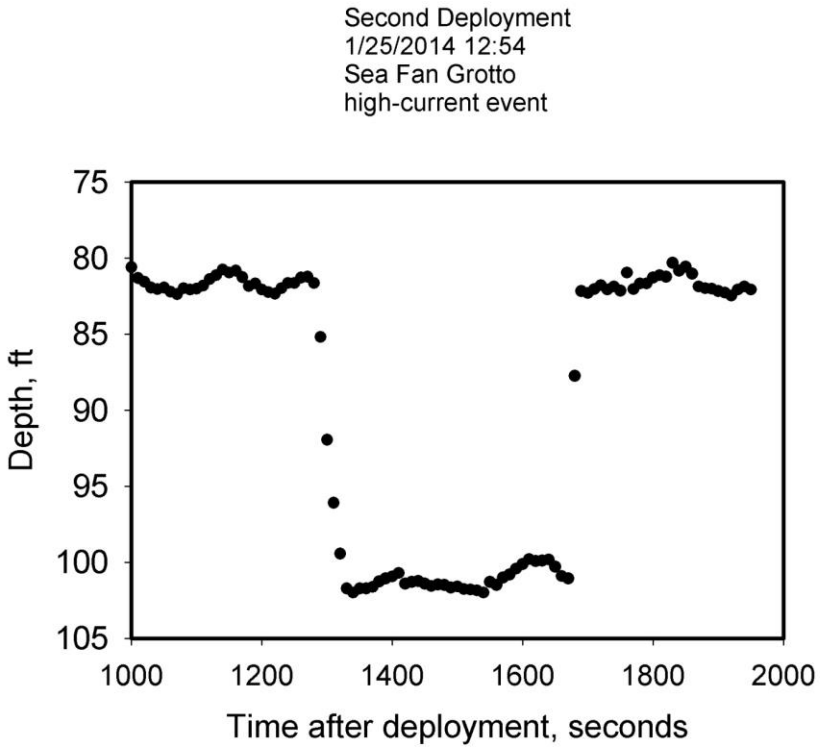

Figure 7. Expanded view of depth times.

Instrumentation used in Depth Profiling Experiment

We used the typical YSI sonde:

Model: 6600EDS-O
I.N. 6600E-00
SN 03G0061 AA

With the following instrumentation:
6560 temperature-conductivity sensor
6025 chlorophyll sensor
6562 Dissolved Oxygen sensor
6561 pH sensor