In which we realize getting close is still not finished

May 29[2nd] – June 6, 2022

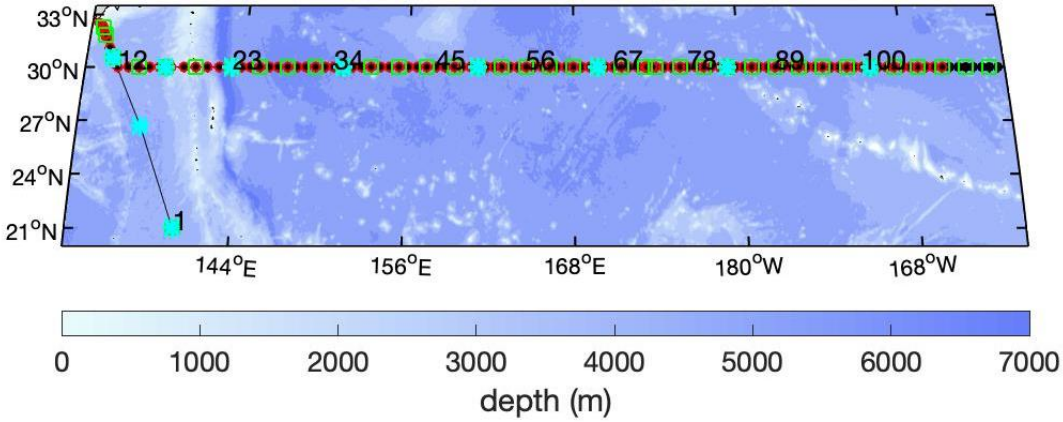

Figure 1: Map of station locations (black dots), completed stations as of the first morning of June 6, 2022 (red circles), bio casts or combined core/bio casts (green squares) and float deployments (cyan asterisks), as we were sitting on station 111.

It's hard to believe that it has been 8 weeks since we started this journey with quarantine in Guam and 7 since we boarded the Revelle. Now out of lettuce, but not croissant, we are tantalizingly close, but not quite there. We keep rolling along. Knock on wood and no whistling please, the weather and seas have been ridiculously good. The rosette goes in. The rosette comes out. We sample, turn it around, and back in it goes. We are working like a well-oiled machine, but we are also human and find ourselves having to be careful not to be sloppy – diligent in rechecking of the rosette before deployment, assiduously attentive to the console on the way down and up, and persistently careful in sampling, So far, so good. Issues continue to be minimal.

We had to burn our float boxes after insects were found in the wood and that has meant finding a new home for the 4, now unboxed, Leg 2 GO-BGC floats in the analytical lab. We appear to have finally managed to remove the worst of the noise in our SBE oxygen sensor (the Rinko is working beautifully) through changes in orientation and pumps. We still have the odd bottle that doesn't trip correctly and the occasional delay (usually due to miscommunication or winch maintenance), but these challenges come, go, and once dealt with and recorded are left behind us as we continue along our path eastward.

With not much to say about our modus operandi, we thought we would present a little of our preliminary shipboard science. Last week, we came across a seamount located northwest of the Hawaiian Ridge (Fig. 1a). In addition to repeating the previously occupied WOCE/CLIVAR stations, we added one station on top of the seamount. Our closely spaced (8 to 20 nm) stations 071 - 074 were designed to measure water properties at the foot of the seamount (071 and 074), on the slope (072), and at the peak (073). From LADCP data alone (preliminary results provided by Kurtis Anstey), we are excited to report bottom-intensified turbulent dissipation rates (>10^{-9} W/kg) on the slope of the seamount (Fig. 1b), and features that resemble internal waves over the peak

(073) and the foot of the seamount (stations 071, 073, and 074). The former result is seen in the comparison of the deep values at station 072 to those at 071 & 074, while the latter can be visualized from the periodic horizontal velocities at depths between 500 m and 1000 m at these same stations (Fig. 1c).

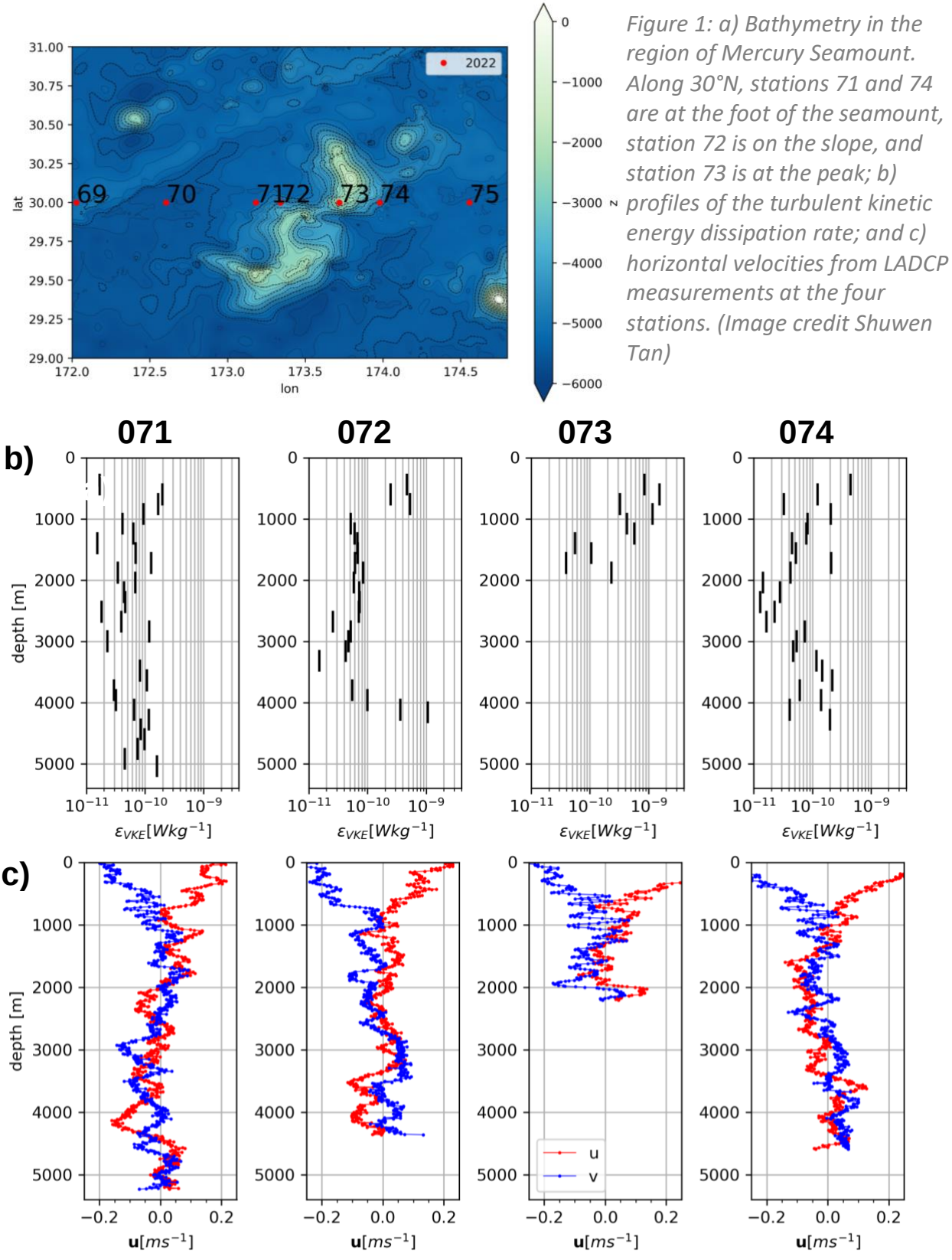

Figure 1: a) Bathymetry in the region of Mercury Seamount. Along 30°N, stations 71 and 74 are at the foot of the seamount, station 72 is on the slope, and station 73 is at the peak; b) profiles of the turbulent kinetic energy dissipation rate; and c) horizontal velocities from LADCP measurements at the four stations. (Image credit Shuwen Tan)

As we go along, we are all learning a little about each other's disciplines. We physical oceanographers have been interested to note that throughout the cruise we have been seeing a deep maximum (65-110 m) in the fluorometer, often, but not always below the subsurface minimum in transmissometer voltage and oxygen maximum (Fig. 2) and a spike in the UVP voltage (no pictures yet due to the previously noted downloading issue).

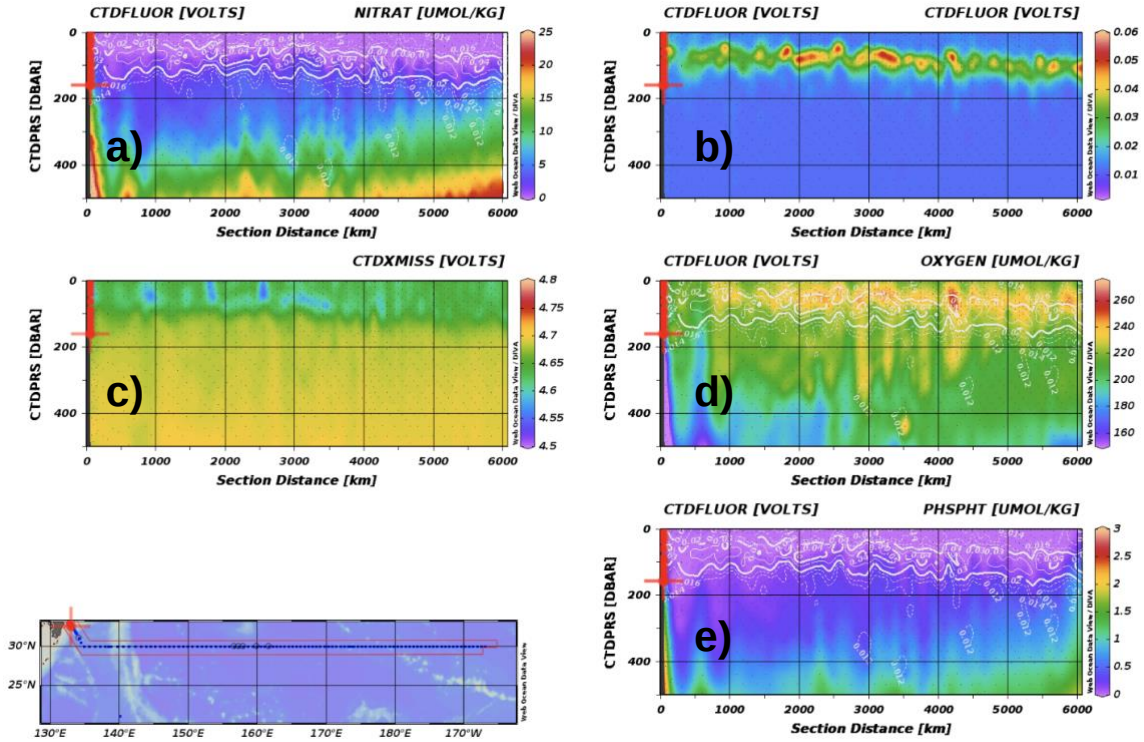

Figure 2: Section plots in the upper 500 m along the P02 stations depicted in the map: a) nitrates; b) fluorometer voltage; c) transmissometer voltage; d) bottle oxygen; and d) phosphate. All, except the transmissometer record have contours of fluorometer voltage overlaid. (Image created using Web Ocean Data View 5.4.5, web server 28).

Keeping in mind that a fluorometer voltage is indicative of, but not the same thing as, a Chl_A measurement and seeing similar features in the GO-BGC floats we have been deploying (the final one for this leg deployed on station 101), we asked and were provided with the following explanation by Ken Johnson (MBARI).

There are two ways to achieve the deep maximum we see. First, phytoplankton can sit on the deep nitrate gradient to get nutrients (Fig. 2a) in which the case, the chlorophyll maximum (Fig. 3) will align with biomass maximum, and one should see more optical backscatter (or reduced transmittance from the transmissometer). Ken points to some of this illustrated in the float backscatter data, but he suggests it probably doesn't account for all the chlorophyll.

The second cause for a deep chlorophyll maximum is light stress which causes the plankton to put on more chlorophyll (e.g., increase the number of chloroplasts or the amount of chlorophyll per chloroplast to absorb more light, and/or evolve to less require less light). However, if that

were the whole explanation, there wouldn't be more biomass and more backscatter. Therefore, Ken suggests that we are probably seeing a mix: more (but not a lot more) phytoplankton down deep seeking the upward flux of nitrate and because these phytoplankton are light stressed, more chlorophyll per unit biomass and that, he says, is "pretty normal".

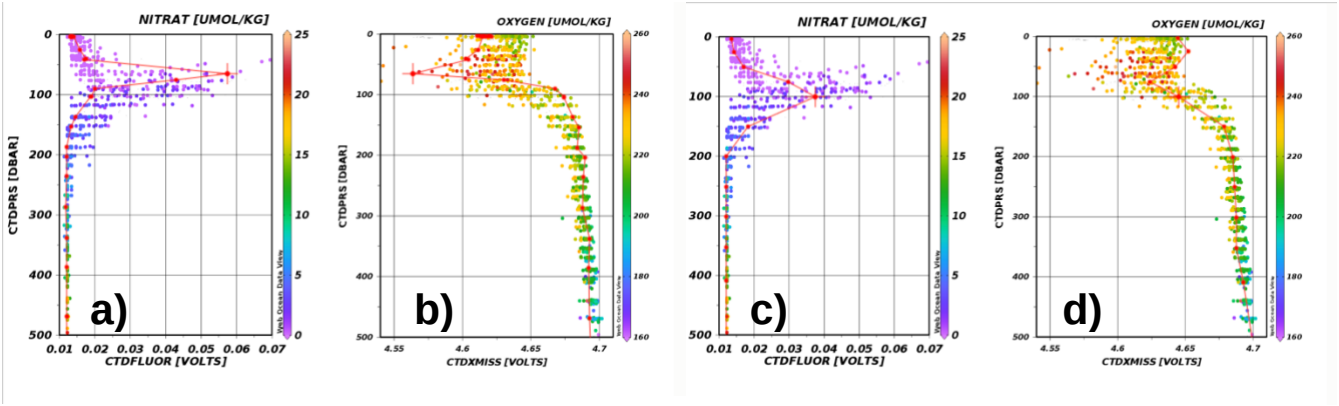

Figure 3: Upper water column profiles of fluorometer (a, c) and transmissometer voltage (b, d) from stations along our P02 30°N track. Color shading represents nitrates (a, c) and bottle oxygen (b, d). The red curve in (a) and (b) highlights an example where the max/min in fluorometer and transmissometer voltage align. The red curve in (c) and (d) highlights an example where the max/min in fluorometer and transmissometer voltage do not align quite so well. (WebODV 5.4.5)

We end once again with a birthday. This one for Vic, one of our CTD-watchstanders and the youngest member of the science party. It was celebrated with ship wide treasure hunt (Fig. 5). What was lost has been found. Happy Birthday Vic! We have another 5 or 6 stations before our planned departure from 30°N in the early hours of June 8th. After nearly two months together aboard the R/V Revelle, by this time next week, we will all be scattered to the winds.

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2022 P02/Leg 1 (33RR20220430)

Figure 4: Left – treasure-hunt clues (Image credit: Vic Dina). Right – a break from sampling to watch the sunrise (Image credit: A. Macdonald).