***ATLANTIS/ALVIN* Cruise 7, Leg 11** (April 26-May 11, 2002; HOLA-I)

***ATLANTIS/ALVIN* Cruise 7, Leg 19 (**August 4-25, 2002; HOLA-II)

NSF Project: The fate and implications of removal of hydrothermally injected NH_4^+ from plume waters: Endeavour Segment and Guaymas Basin

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Background

The project involved two research expeditions aboard the *R/V ATLANTIS*. The first cruise, designated HOLA-I (HydrOThermaL Ammonia) was to Guaymas Basin, Gulf of Mexico; the inclusive dates of the cruise were April 26 to May 11, 2002. HOLA-I consisted of 9 station days at Guaymas Basin. The second cruise (HOLA-II) was to the Endeavour Segment, Juan de Fuca Ridge (August 4-25, 2002). We shared this cruise with another project led by Stephen Giovannoni and Mary Fisk (both of OSU). The HOLA II component consisted of 10 days at Endeavour Segment. The OSU component had 8 days with dives distributed among 4 seamounts.

The objective of this project is to directly address the biogeochemistry of hydrothermally injected NH_4^+. We attempted to measure the rate of NH_4^+ removal and its partitioning between oxidation and assimilation processes, using complementary sensitive fluorometric and stable isotopic tracer techniques. The population dynamics of the relevant nitrifying bacteria in evolving hydrothermal plumes will also be studied using molecular genetic probe techniques. The differences in NH_4^+ concentrations (50x, 5x, 1x, respectively) between the sedimented Guaymas Basin, sediment-starved Endeavour ridge, and background (NH_4^+-deprived) deep water environments should influence strongly the composition, diversity and efficiency of the NH_4^+-oxidizing communities.

Operations

Both cruises involved a combination of *ALVIN* dives and CTD operations Thanks to the tremendous efforts, cooperation and competence of the *ALVIN* and *ATLANTIS* crews, we were able to meet our objectives and enjoyed two highly successful cruises.

The ***ALVIN* operations** were highly productive. Due to the efficiency and generousness of the *ALVIN* crew we were able to make more dives than originally anticipated on both cruises, despite loosing dive days to bad weather during the Endeavour cruise (HOLA-II). During the bad weather all hands were genuinely concerned with potential damage to our science objectives and worked with the scientists to successfully counter the loss of 'potential' dives with an excellent, and greatly expanded scope of, CTD operations (vertical profiles and tow-yos). The bridge provided excellent ship handling and precision navigation.

CTD operations: The *ATLANTIS* crew was exemplary as well. Our CTD operations were generally excellent during both cruises. We successfully completed 15 and 20 CTD casts during the HOLA-I and HOLA-II cruises, respectively. This is essentially 2 casts per night. We were limited only by our own processing and experimental setup/incubation time.

Problems: We experienced only one equipment problem with the CTD. This was a failure of the CTD pylon on the next to last day of operations at Guaymas Basin

(HOLA-I). Since no backup pylon was available, water collection ceased and only barebones CTD profiles were possible for the remaining cruise time. Fortunately, this did not happen at the beginning of the cruise. It has been explained to me that backup CTD and pylon and other expensive parts associated with CTD operations are not carried on the *ATLANTIS* because the amount of *ATLANTIS* CTD work does not justify the cost. Although I do understand the reality of fiscal constraints, I nevertheless strongly recommend that funds be secured to purchase a backup CTD system for the *ATLANTIS*. An alternative may be for WHOI to secure another CTD-rosette system that acts a floater that is assigned to the *ATLANTIS* during all cruises in which CTD ops are an important part of the cruise objectives.

Comment on *ALVIN*:

I am a huge supporter of both manned and unmanned submersible operations. I will not try to list all of the pros and cons of each; folks like Dan Fornari and Patty Fryer can do this far more completely than I. However, as a user of both I have some strong feelings. I think that much of the seafloor work can be done quite effectively by ROVs like the fabulous new *JASON*. However, manned submersibles like *ALVIN* offer some unique advantages. The most dramatic of these is that of the first hand (in situ) perspective. The view is great from ROV monitors, but there is no replacement for being there and taking in the panoramic 3-D view from the *ALVIN's* windows. My first *ALVIN* dive to a hydrothermal vent field was a mind-expanding, career changing event for me; I can visualize its physical dynamics like only those who have been there can. This experience/realization is renewed with every *ALVIN* dive that I make; and I see it in the 8 hour intellectual transition that each of my students have undergone with their first *ALVIN* dive. It is the most amazing educational experience that most of us will every have; it fairly breeds creative and energetic scientific thinking. Likewise, I would predict that the best ROV pilots started out as manned submersible pilots or at least have been down in one.

It is perhaps too easy to make judgmental comparisons between the new *JASON* with its new capabilities and excellent data processing and user interface upgrades with the current *ALVIN*. I think that they still compare favorably. However, I also imagine a new or completely refurbished/upgraded *ALVIN*, with upgraded data collection, instrument interfacing, payload, and working time capabilities, along with increased passenger comforts. We need both ROVs and a new *ALVIN*. I strongly endorse the development and construction of a new manned submersible to ultimately replace *ALVIN*. The capabilities of the new ROVs supplement the strengths of a manned submersible, but they do not replace them.

Sincerely,
James P. Cowen
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