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Scientist at Work
Notes From the Field

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0.144 Leagues Under the Sea

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Woods Hole Oceanographic Institution A mound covered in white microbial mat encountered near the Pinnacle of Hydrate Ridge South.

Sunday, Aug. 8

Saturday night, long after the sun had gone down but long before the day's final sample had been processed, I wandered out to Atlantis's bow with a steaming mug of peppermint tea. Hearing the waves lap against the boat, feeling the salty breeze and looking into the expansive blackness, I tried to savor the moment, anticipating the fact that on Sunday, I'd make my first dive on Alvin.

A few hours earlier, at the nightly dive briefing, six of us huddled around a well-lit table in Atlantis's computer lab, spreading maps, checklists and notes over its surface. The dive briefing brings the crews of one day's dive together with the crew of the next day's dive to discuss what worked well, what didn't and what can be improved.

It's a time when scientific protocols come up against physical and logistical realities, since the Alvin pilots know the sub and its abilities like the back of their hands. They know that polypropylene rope handles work better than string, that experiments for deployment should be positioned on the port side of the sub, and that you need about five pounds to keep your sample marker from drifting away. It's a remarkably effective partnership.

The plan for Alvin Dive 4636 was ambitious: deploy four experiments and collect eight authigenic carbonates, four Niskin bottles of water, 24 tube cores of seep sediment, one scoop of clams and two "slurps" of microbial mat. If we finished all of this in time, we would get an Alvin crew's equivalent of recess: an exploratory venture to look for signs of more active seepage and possible temperature anomalies.

(Hydrate Ridge is a cold seep, maintaining a typical seafloor temperature of about 37 degrees Fahrenheit.)

Hydrothermal vents, like the flashier black smokers of Juan de Fuca found a little over 300 miles west of us, exhibit temperatures well over 500 degrees and occur most frequently at midocean ridges, where plates form and spread outward. Hydrate Ridge (44°35'N / 125°10'W, 800 meters deep)

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is at a convergent plate boundary, or subduction zone, where the Juan de Fuca plate runs into and sinks below the North American plate, so finding hot fluids would be pretty unusual, i.e. very interesting. This being the final dive of the expedition, it would also be our group's last time seeing Alvin in its current configuration before he goes in for an upgrade in several months.

This morning, as groggy lab mates staggered out of bed for the launch, Mike Navarro, a graduate student at the Scripps Institution of Oceanography; a pilot, David Walter; and I climbed the blue metal staircase and wormed our way into the six-foot titanium sphere. Sinking beneath the water's surface, I watched as bright turquoise faded to black. Jellyfish, flutelike siphonophores, glass thimble ctenophores and galaxies of other organic goo – alive or otherwise – streamed by the window, sparking with phosphorescence as Alvin disturbed their pelagic slumber. On the seafloor, 2,600 feet down, an alien world resolved before our eyes. Enormous orange crabs, catatonic red-speckled rockfish, slithering blue eel-like fish and a number of smaller, more frenetic critters stared up at us, blinded by the headlights in their oversize eyes.

Mike Navarro Soft corals illuminated by Alvin's lights.

But there was no time to play tourist: we had a checklist to get to.

Most of our tasks required both active sites, where seeping methane was most pronounced, and inactive sites that were indistinguishable from the typical deep-ocean bottom. By placing experiments in both sites, we're able to tell how much of a given effect is a result of the unusual phenomenon of methane seepage and how much would have happened anyway. Cruising above the seafloor to the mellow tunes of Jack Johnson and Melody Gardot (no touching the pilot's radio), we searched for the telltale signs of activity: clam beds, shag carpets of gooey white or orange bacterial mat, or, if you're really lucky, strings of bubbles.

At one stop, we deployed a couple of Tony Rathburn's experiments designed to test the breakdown rate of foraminifera, microscopic organisms known more affectionately as forams. The fossil record of forams is among the best known of any organism, with well-preserved samples dating back hundreds of millions of years. Thus, a certain type of fossil in a rock layer would point to a given time period, a handy geological yardstick by which to measure key environmental events like earthquakes, volcanic eruptions or floods.

Mike Navarro Sampling tubes outside Alvin's port-side window.

Earlier this morning, as we loaded Alvin's cargo on deck, Tony showed me the elegant experimental design: mesh-wrapped steel-beam cages containing jars of forams, with fine plastic netting to keep the forams in and other bugs out. We placed one such cage in a thick bacterial mat and another on top of an inactive brown rock, next to a thoroughly unimpressed rockfish. Ashley Burkett, an Indiana State graduate student, and Elena Perez, a researcher at the Natural History Museum in London, will be back out here next year to pick up the samples and see the damage. By finding out just how quickly forams break down under methane seep conditions, they will be able to calibrate the foram yardstick and allow geologists to date past events with more precision.

A few mud cores, a slurp and a scoop later, David guided us up the Pinnacle, a cliff of craggy white carbonate rock leading to the southern summit of Hydrate Ridge. Huge slabs of fractured rock – 10 to 20 meters across – created a lattice of crevasses several meters deep.

Inside the fissures, white and orange sulfide-oxidizing microbial mats grew several inches deep, fueled largely by the methane-consuming archaea and sulfate-reducing bacteria our lab studies. With an impressive show of dexterity, Alvin gathered some samples, which we will examine back in the lab to learn more about the carbonate formation process and the role microbes play in global nutrient cycles. With each iteration of study, we find that these microbes and other hardy organisms living deep within the earth are more important on the global scale than we previously believed.

By 3 p.m., our power was running low and we dropped weights, sent home without recess. Thirty minutes later, we were bobbing like a cork on the surface of the north Pacific Ocean.

David Walter The blogger inside the Alvin submersible.

Since today was my first Alvin dive, I was subject to initiation upon my return to the Atlantis. All week, I've been on the photo-documentation side of the fence, watching with amusement as people were dressed up in ridiculous costumes and doused with frigid seawater. Now, I knew it was my turn and Mike's, and I prepared for the worst. Sitting on thrones of mud, wearing sampling nets over our heads, we were drenched with two bucketfuls of freezing water, followed, mercifully, by a warm third shower.

It will be months before the epilogue of this expedition can truly be written, since our experiments take time to set up and process. But we couldn't have asked for calmer weather (zero missed dives out of eight is an exception for the Pacific Northwest), a more supportive crew or better samples. This evening was a fitting end to the sampling phase of the expedition: wispy orange and pink clouds framed a beautiful sunset as a pod of dolphins played in the ship's wake, escorting us southward.