

Guaymas Basin cruise AT37-06

Manzanillo – Guaymas Basin - Manzanillo
Dec. 6 - Dec. 29, 2016



Cruise Report
Andreas Teske



WOODS HOLE OCEANOGRAPHIC INSTITUTION

DRAFT STANDARD FORM C

PRELIMINARY CRUISE REPORT

Cruise name/number:	AT37-06
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Authorizations:

Coastal State	Authorization Document Number	National Participant(s)
Mexico	CTC/10909/16	Dr. Javier Caraveo-Patino
		Lt. Jorge L. Arellano

Scientist in charge of reporting:

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Brief description of scientific objective:

We are investigating the biogeochemical links, genomic repertoire and physiological potential among sulfur-, carbon- and nitrogen-cycling microbial benthos in Guaymas Basin, esp. mat-forming Beggiatoaceae, sulfate-reducing hydrocarbon-oxidizers, and uncultured archaea

Update on anticipated dates for delivery of final results:

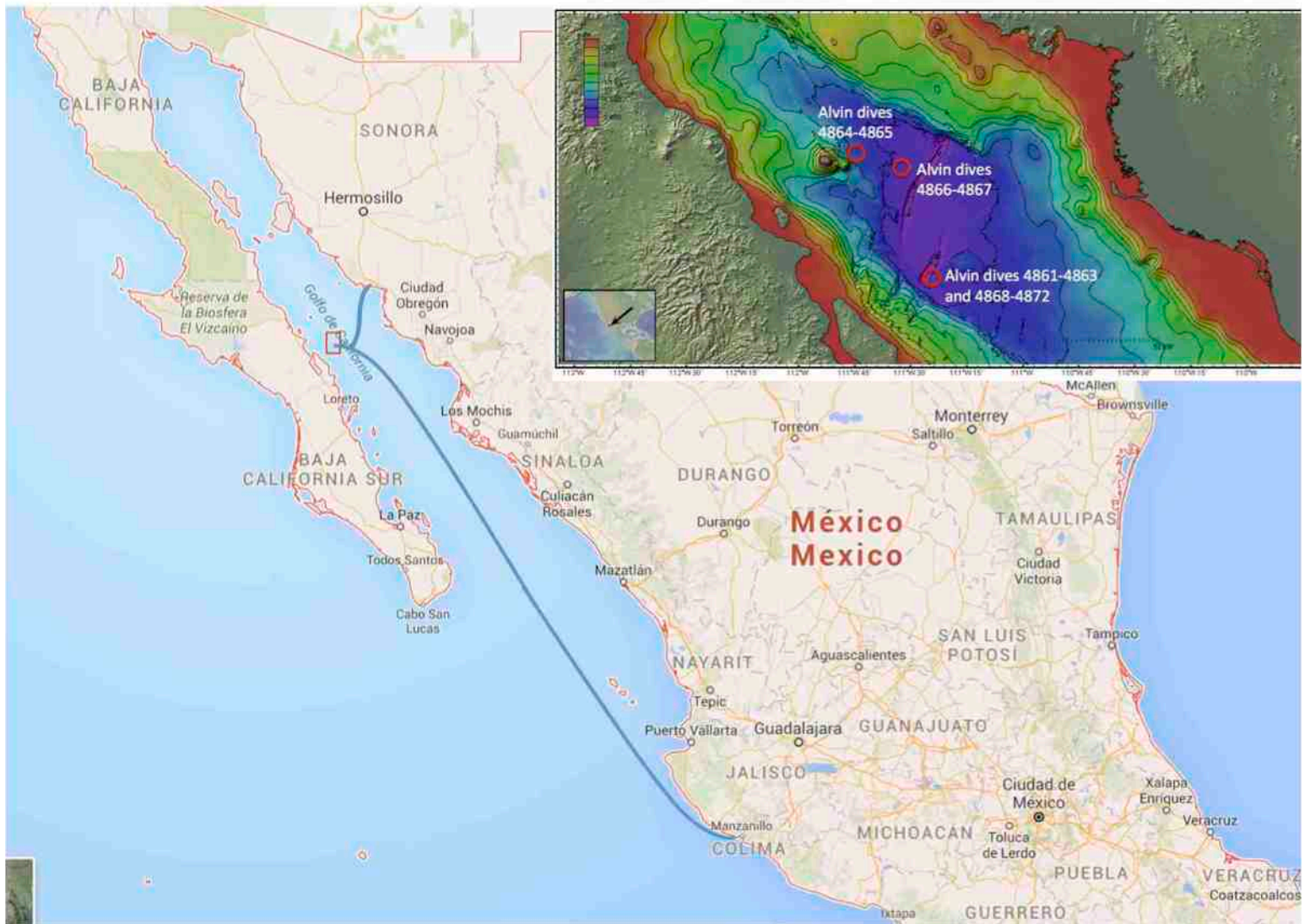
Metadata:	(locations of stations, variables measured, types of samples) see attached
Raw Data:	
Processed Data:	Gene sequences [NCBI], biogeochemistry [BCO-DMO]
Data Analysis:	
WODC Data Registration (if applicable):	Accession number

Append image or URL illustrating the route of the platform, locations where measurements were taken, and actual cruise track:

-----Cruise participants-----

Name	Position	Institution	Place	Project
Jorge Luis Arellano-Oliveras	Lieutenant, Navy of Mexico	Instituto Oceanografico del Pacifico	Manzanillo, Colima, Mexico	Mexican cruise observer
John Paul Piso Balmonte	Graduate student	University of North Carolina, Dept. of Marine Sciences	Chapel Hill, NC, USA	Geochemical and molecular sample processing
Hannah Choi	Graduate student	University of Georgia, Dept. of Marine Sciences	Athens, GA, USA	Aerobic methane and alkane oxidation measurements
Dirk deBeer	Professor	Max-Planck-Institute for Marine Microbiology	Bremen, Germany	Microsensor profiling and N metabolism of <i>Beggiatoa</i> mats
Alexander Epp	Journalist & Video expert	<i>Der Spiegel</i> Magazine	Hamburg, Germany	cruise video documentation
Daniel Hoer	Postdoctoral scientist	Harvard University	Cambridge, MA, USA	In-situ alkane detection
Barbara MacGregor	Assistant Research Professor	University of North Carolina, Dept. of Marine Sciences	Chapel Hill, NC, USA	Genomics of sulfur-oxidizing bacteria
Tito David Peña Montenegro	Graduate student	University of Georgia, Dept. of Marine Sciences	Athens, GA, USA	Aerobic methane and alkane oxidation measurements
Javier Caraveo-Patiño	Research Scientist	Centro de Investigaciones Biológicas del Noroeste	Baja California Sur, La Paz, Mexico	Hydrothermal food web structure
Richard N. Peterson	Professor	Coastal Carolina University	Conway, SC, USA	Hydrothermal flow rate measurements
Leigha E. Peterson	Graduate student	Coastal Carolina University	Conway, SC, USA	Hydrothermal flow rate measurements
Emil Ruff	Postdoctoral scientist	University of Calgary, Dept. of Geoscience	Calgary, Alberta, Canada	Isolation of new anaerobic microbes
Matthew Saxton	Staff Scientist	University of Georgia, Dept. of Marine Sciences	Athens, GA, USA	Osmosampler measurements of hydrothermal fluids
Ryan Sibert	Graduate Student	University of Georgia, Dept. of Marine Sciences	Athens, GA, USA	Alkane oxidation by symbiotic and free-living bacteria
Charles Schutte	Postdoctoral scientist	Max-Planck-Institute for Marine Microbiology	Bremen, Germany	Microsensor profiling and N metabolism of <i>Beggiatoa</i> mats
Min Song	Graduate Student	Center f. Marine Environ. Sciences, Bremen University	Bremen, Germany	Hydrothermal organic matter degradation
Andreas P. Teske	Professor	University of North Carolina	Chapel Hill, NC, USA	Chief Scientist
Samantha Waters	Postdoctoral Scientist	University of Georgia, Dept. of Marine Sciences	Athens, GA, USA	Nitrogen cycling in hydrothermal sediments
Gunter Wegener	Research Scientist	Max-Planck-Institute for Marine Microbiology	Bremen, Germany	Isolating alkane-degrading archaea; alkane quantification
Guangchao Zhang	Postdoctoral Scientist	University of Georgia, Dept. of Marine Sciences	Athens, GA, USA	Substrate-specific Methanogenesis rates

Cruise track
Manzanillo [Dec. 6-9]
Guaymas Basin [Dec. 9-18]
Guaymas [Dec. 19]
Guaymas Basin [Dec. 19-24]
Manzanillo [Dec. 27-29]



Cruise narrative

A detailed illustrated cruise blog in English and Spanish containing at least one entry for every day is available online at teskelab2016.wordpress.com.

December 6, 7, and 8: The science crew arrives on R/V *Atlantis* in Manzanillo. Expedition containers with cruise equipment turned are held up in Mexican customs, and remain so for the duration of the cruise.

December 9: After taking stock of the limited supplies and equipment that had been placed on the ship during Newport port call in October, R/V *Atlantis* departs for Guaymas Basin. The plan is to replenish the expedition supplies in Guaymas Port after one week; also, new emergency supply shipments to Guaymas Port are organized after it turns out that the containers cannot be redirected and mobilized in time [sending them to Guaymas constitutes importation into Mexico proper, instead of ship-to-ship transfer]. HOV *Alvin* and AUV *Sentry* are not affected by these customs problems and remain in good working order, ready for dives.

December 10 and 11: Transit from Manzanillo to Guaymas Basin. The labs are set up to the extent possible, and the available glass ware, plastic ware and other supplies are inventoried to make sure we can last one week with basic geochemical and molecular biology sampling. R/V *Atlantis* reaches Guaymas Basin on the evening of Dec. 11, and AUV *Sentry* is deployed during the night for its first mapping survey of the southern Guaymas Basin, centered on the Mat Mound region [AUV *Sentry* dive 407]. The goal is to map the entire hydrothermal area in the southern Guaymas Basin spreading center, which will be accomplished at the end of the cruise.

December 12, *Alvin* dive 4861

Pilot Bob Waters, portside observer Andreas Teske, starboard observer John Paul Balmonte.

Alvin dive narratives are based on the dive summaries from WHOI's *Alvin* framegrabber site, written immediately after each dive and lightly edited as needed. Since we did not have the *Sentry* map available in the sub, orientation was a little haphazard, and we relied initially on locating old markers and landmarks from the 2008/2009 cruise. Subsequent dives did not have this problem, as the *Sentry* seafloor bathymetric maps became available in time.

"While looking for hot and oily Megamat site 2008/2009, we find a large mound with *Riftia* and *Beggiatoa*. *Sentry* records indicate a second mound structure nearby. Based on the presence of old markers [rectangular markers 6 and 7], this is the area of Mat Mound 2008/2009. After exploring the apparently non-hydrothermal sediment area to the North of these two large structures, we return and find a large mat or better sediment area, ca. 2 m wide [North-South] and > 10 meters long [east-west], covered with granular white material, and measure moderate in-situ temperatures of 25 to 55°C at 50 cm depth using the 60 cm Heatflow probe. The sediments under the white powdery surface are dark grey and

black, obviously highly reduced, and after recovery in the lab have a distinct hydrocarbon smell. We take all 36 pushcores of this dive in a gradient of three clusters [55°C/25-28°C/21°C] along this mat. Water samples were collected using the Niskin bottle at the 55°C location. Three clams are collected at Marker 7 next to the mat, and a microbial mat [orange *Beggiatoa* mat from a nearby sedimented mound [containing what looks like small *Alvinella* worms] was siphoned up with the slurp gun. Finally, two inactive, fragile, light-grey chimney tips, ca. 5-10 cm in diameter and 20-30 cm long, were collected.”

At night, AUV *Sentry* is launched on its mapping survey of the previously unsampled hydrothermal region ca. 2.5 nm northeast of the frequently sampled southern Guaymas Trench area [Dive 408], in preparation for dive 4863.

December 13, *Alvin* dive 4862

Pilot Pat Hickey, starboard observer Dirk deBeer, starboard observer Emil Ruff

As the framegrabber system was not switched on during this dive, there is no framegrabber log and this short summary relies on the written dive notes. Hydrothermal sediments with *Beggiatoa* mats are sampled at multiple locations within the Mat Mound Massif; sediment temperatures are high in places [up to 150°C]. The *Sentry* map of this area [dive 407] is meanwhile available and shows a complex seafloor topography of multiple hydrothermal mounds clustered together, therefore the name Mat Mound Massif. Hydrothermal rocks with attached pale, off-white potato-shaped sponges are collected.

At night, AUV *Sentry* is launched on a mapping survey of the hydrothermal region north and northwest of the frequently sampled southern Guaymas Trench area [Dive 409], in particular north and northwest of the “Big Pagoda” and “Rebecca’s Roost” hydrothermal edifices that mark up to this point the approximate northern boundary of the well-explored terrain.

December 14, *Alvin* dive 4863

Pilot Jefferson Grau, portside observer Javier Caraveo-Patino, starboard observer Alexander Epp

Since the science crew is by now well supplied with sediment core samples and *Beggiatoa* mat samples, this exploratory dive focuses on collecting benthic invertebrates for Javier, and on taking pictures and video of the unfamiliar terrain and its animals. “We explore a new hydrothermal location ca. 2.5 nm north of the previous sampling area with steep spires and hydrothermal mounds. Yellow and white mats are growing on rocks or hard substrate, not on sediments. We attempt to collect corers at different areas but only collect two due to the recalcitrant seafloor substrates. We surveyed the area and collected *Riftia* tubeworms, large and small crabs, and one anemone. We collect five niskin bottles and we slurp yellow mat.”

After this *Alvin* dive is completed, R/V *Atlantis* transits 30 miles to the northern off-axis site “Ringvent”, aka site Guaymas-3B. Immediately after arrival, *Sentry* is launched to map the Ringvent site, which turns out to be doughnut-shaped, ca. 700 m in diameter, and pockmarked by small gullies and craters. The bathymetry

from this dive [No. 410] is available in the morning for the upcoming *Alvin* dive, the first *Alvin* exploration of an off-axis hot spot in Guaymas Basin.

December 15, *Alvin* dive 4864

Pilot Bob waters, portside observer Andreas Teske, starboard observer Tito Pena.

Sentry dive 410 has identified redox and thermal anomalies at localities on the southwestern segment of the Ringvent donut, named Mound 1, Mound 2 [in fact not mounds but small depressions] and ORP, short for oxygen redox potential. These sites are now being visited; the freshly printed bathymetry and the target coordinates are available in the morning for the *Alvin* dive.

"We explored Mount 1, ORP and Mount 2 regions, approaching from the south and moving along the donut ridge towards the northwest. The order of the day was first an approximation to Mount 2 from the south where we found seepage, tubeworms and shells. Around Mount 2 we found more shells, potential *Lamellibrachia* tubeworms, seafloor mineral accretions and signatures of seepage. Temperature profiles taken at Mount 2 were cold near 3°C, confirming cold seepage. Cores were taken as well. Then we visited the ORP site, where we found cold seeps with a bit higher temperatures [5-7°C]. More cores and seafloor rock samples were taken on that site. Finally we transited towards Mount 1, crossing a crater and a mound wall, all in clockwise direction. Temperature profiles confirmed small chimneys and warm, shimmering water flows [ca. 20°C]. Niskin bottles and slopegun samples were taken there. A final exploration to the south of Mount 1 found sponge-colonized seafloor minerals; the sedimented foot of Mount 1 was the last place to take the remaining cores.

Sentry dive 411 was launched in the evening, to record and map thermal and redox anomalies in the near-bottom water column along the western segment of the Ringvent donut, and to catch potential hydrothermal plumes emerging from the gullies and craters that are plentiful here.

December 16, *Alvin* dive 4865

Pilot Pat Hickey, portside observer Ryan Sibert, starboard observer Min Song

This dive was cut short around noon due to deteriorating weather. "Dove on Ringvent for heat flow measurements and basic exploration. Collected 5 separate heat flow measurements along the northwestern edge of ringvent; very muted gradients on the outer margin of Ringvent contrast with warmer temperatures when entering a small canyon. Attempted one set of cores (no luck) and collected one tuft of tubeworms. Found evidence of hydrothermal flow throughout one feature, with sediment temperatures underneath sulfur-oxidizing mats reaching 70-75°C (27 30.550 -111 40.909; "Vasile's Bane"). We should return for future exploration further to the North."

Unfortunately, further exploration of this fascinating site does not happen, as we have another off-axis site to visit on the next day, and pick up emergency supplies in Guaymas Port at night. No *Sentry* dive this night. We arrive outside of Guaymas port late at night, ca. 10 pm, and wait until the foggy weather clears and the pilot boat has ferried desperately needed lab supplies over at ca. 3 am. While most emergency supplies arrive and thus allow the basic science program to

continue, at least one box with sensitive electronics for the science crew and one for the Atlantis crew turn out to be missing, and cannot not be located.

December 17, Alvin dive 4866

PIT DIVE! Pilot Jefferson Grau, Pilot-in-training Danik Forsman, starboard observer Matt Saxton.

After the resupply operation in Guaymas Port, R/V *Atlantis* arrives at Guaymas Basin off-axis site 9A, aka Octopus Mound, for sediment, rock and tubeworm sampling. The dive is cut short due to weather, but manages to establish the overall layout of this small cold seep mound, and to identify the best sampling locations for the next day.

“This dive visited Guaymas Basin site 9A, an off-axis site with predicted methane seepage. Evidence of seepage was observed including abundant bivalve shells, carbonate outcroppings, and cold seep fauna. Modest bacterial mats were also observed. Tubeworm clusters [*Lamellibrachia*-like cold-seep worms] were observed associated with carbonates. Overall observations were in line with cold seep environment.”

In the evening, Sentry dive 412 is launched for mapping this location.

December 18, Alvin dive 4867

Pilot Bob waters, portside observer Daniel Hoer, starboard observer Hannah Choi.

This dive samples the biologically active northern end of Octopus Mound, and recovers ample sediment cores with diverse types of mats, including amphitrid mats where the seafloor is covered by a blanket of amphitrid polychaetes, textured like a 70ies shag carpet, and contrasting against the seafloor sediment by its lighter grey color. White fluffy microbial mats that look like crop circles are overlying shallow gas hydrates that are cored by *Alvin* [pure white in color, no petroleum admixtures].

“Second dive to site Guaymas-9A (first dive cut short due to weather). The objective of this dive was to collect cores and animals along a cold seep activity gradient. We sampled at four sites: A high activity site (many tube worms and mats of worm tubes), a peripheral site (carbonates, fewer tube worms, dead clams), a hydrate site (strange white mats, tube worms), and a background site. “

After this dive, R/V *Atlantis* heads back to the southern Guaymas spreading center and the hydrothermal sampling area that we have already sampled during dives 4861-63. After arrival, *Sentry* dive 413 is launched. From now on, all *Sentry* dives work towards completing the high-resolution bathymetric mapping survey of the southern Guaymas hydrothermal area, ca. 2.5 x 5 nm.

December 19, Alvin dive 4868

Pilot Pat Hickey, portside observer Richard Peterson, starboard observer Leigha Peterson

This is a short dive due to weather. The remaining dives focus on collecting hydrothermal sediments for rate measurements, *Beggiatoa* mats and filaments, and hydrothermal flow measurements.

“Our goal during this dive was to collect vent fluid, sediment cores, and *Riftia* from the area around Mat Mound. We found a good vent fluid discharge near the base of Mat Mound as well as a large *Riftia* sample. We then proceeded to Ultra Mound and collected 18 sediment cores from orange, white, and yellow *Beggiatoa* mats as well as surrounding sediments. Four niskin bottle were fired at different sampling stations (*Riftia* collection and mat coring).”

Sentry dive 414 is launched, but the recovery on the next morning is delayed due to weather.

December 20. No Alvin dive

Due to inclement weather, no Alvin or Sentry dives takes place today. The day is spend on catching up with sample and core processing, doing laundry etc. The break is not entirely unwelcome.

December 21, Alvin dive 4869

Pilot Jefferson Grau, portside observer Barbara MacGregor, starboard observer Charles Schutte

The dive starts one hour delayed since video system issues in the Alvin sphere have to be fixed, but does not have to be cut short; the weather issues that have plagued the last few dives will not reappear again for the remainder of the cruise. As previously, this dive samples the general area of the Mat Mound Massif.

“Reached the bottom near a white tower. Circled around Ultra Mound once. Identified an orange *Beggiatoa* mat within 10 m of Tube Worm target. Collected 9 sediment cores. Did a second loop north of Tube Worm target, back south of Ultra Mound, and landed again at another large *Beggiatoa* mat within 10 m of Tube Worm target. Collected many sediment cores and temperature profiles. Finished with 30 minutes of bottom time remaining. Explored around the tall pinnacles Northwest of Ultra Mound.”

Sentry dive 415 is launched in the evening and recovered next morning.

December 22, Alvin dive 4870

Pilot Bob waters, portside observer Gunter Wegener, starboard observer Jorge Luis Arellano

In search for larger and more consistent microbial mats, this dive ventures into the Cathedral Hill/Rebecca's Roost area northeast of the Mat Mound Massif; the move is definitely worth it. This dive also rediscovers the “Aceto Balsamico” mat, a moderately heated, acetate-rich, sulfur-covered area already sampled in 2009. The dive ends with stunning views of Rebecca's Roost and its top venting spires.

“We found and sampled the Aceto Balsamico mat (22 cores), we headed north and sampled a white mat in the Notre Dame area (SW, 6 core). After that we explored Cathedral Hill, Busted Mushroom and Rebecca's Roost. We ended with sampling a white mat next to Rebecca's Roost. Furthermore minerals, worms and vent water were retrieved “

Sentry dive 416 is launched in the evening and recovered next morning.

December 23, Alvin dive 4871

PIT DIVE! Pilot Pat Hickey, Pilot-in-training Logan Driscoll, starboard observer Guangchao Zhuang

This dive returns to the “Northern Towers” area that was sampled during dive 4863; the goal is to obtain hydrothermal sediments and microbial mat samples from this region. Dan Hoer has carefully analyzed the seafloor photomosaic footage collected by *Sentry* during dive 408 to localize promising mat areas. Armed with this information, *Alvin* locates and samples the hydrothermal mats, although they are general less plentiful than in other sampling regions. Without *Sentry*, this would have been a problematic search and possibly an unsuccessful dive.

“In total 29 push cores were collected from four different orange or white mat sites (8+10+8+3). “ [the dive report is a little curt]

The final *Sentry* dive 417 is launched in the evening and recovered in the morning; the resulting seafloor bathymetric map is the most highly resolved map of the southern Guaymas spreading center and its hydrothermal features. The contrast to previous maps is astounding; many features of the seafloor landscape that have puzzled us before finally make sense.

December 24, Alvin dive 4872

Pilot: Jefferson Grau, Portside observer Andreas Teske, starboard observer. Samantha Waters

Everyone realizes that this will be the last call for mats and sediments; encouraged by the outcome of dive 4870, we head to the Cathedral Hill area [which turns out to harbor two peaks, each with a hydrothermal edifice or “cathedral” on top] to collect abundant mat-covered hydrothermal sediments for those in the shipboard party who put in orders. We also collect hydrocarbon-rich sediment accretions [not “rocks”] at Cathedral Hill and near Rebecca’s Roost, and finish the dive with a sightseeing tour of Rebecca’s Roost, a massive hydrothermal structure that has been a Guaymas Basin highlight for many years.

“We started towards Cathedral Hill [western peak] and sampled a *Beggiatoa* mat gradient, including orange filaments in the hot center, white filaments in the less hot margin, and bare sediment ca. 30 cm outside the mat. Before coring heatflow profiles were measured to determine the thermal regime of the sediments underneath. After completing the gradient, we moved a few meters to profile and sample a large orange mat and an adjacent white mat for other members of the cruise party. Work completed, we toured the eastern peak of Cathedral Hill and its steep hydrothermal edifice. We also sampled very crumbly carbonates in this region. Turning west towards Rebecca’s Roost, we came across more crumbly rocks, sampled these to the extent possible, and ran into a moat-like structure and small but very ornate hydrothermal mineral formations, looking like a miniversion of Angkor Wat ca. 40 m east of Rebecca’s Roost. The dive concludes with sightseeing the bolder slopes and flanges of Rebecca’s Roost, and a slurpgun sampling at a large flange [after heatflow measurement to ensure the fluid was not too hot, ca. 25°C].”

The *Sentry* team is packing up and analyzing data; *Sentry* rests after having outperformed itself. *Alvin* is scrubbed clean and retired to its garage as well.

December 25: Transit back to Manzanillo. We process samples, clean up the labs and the coldrooms, and pack up equipment.

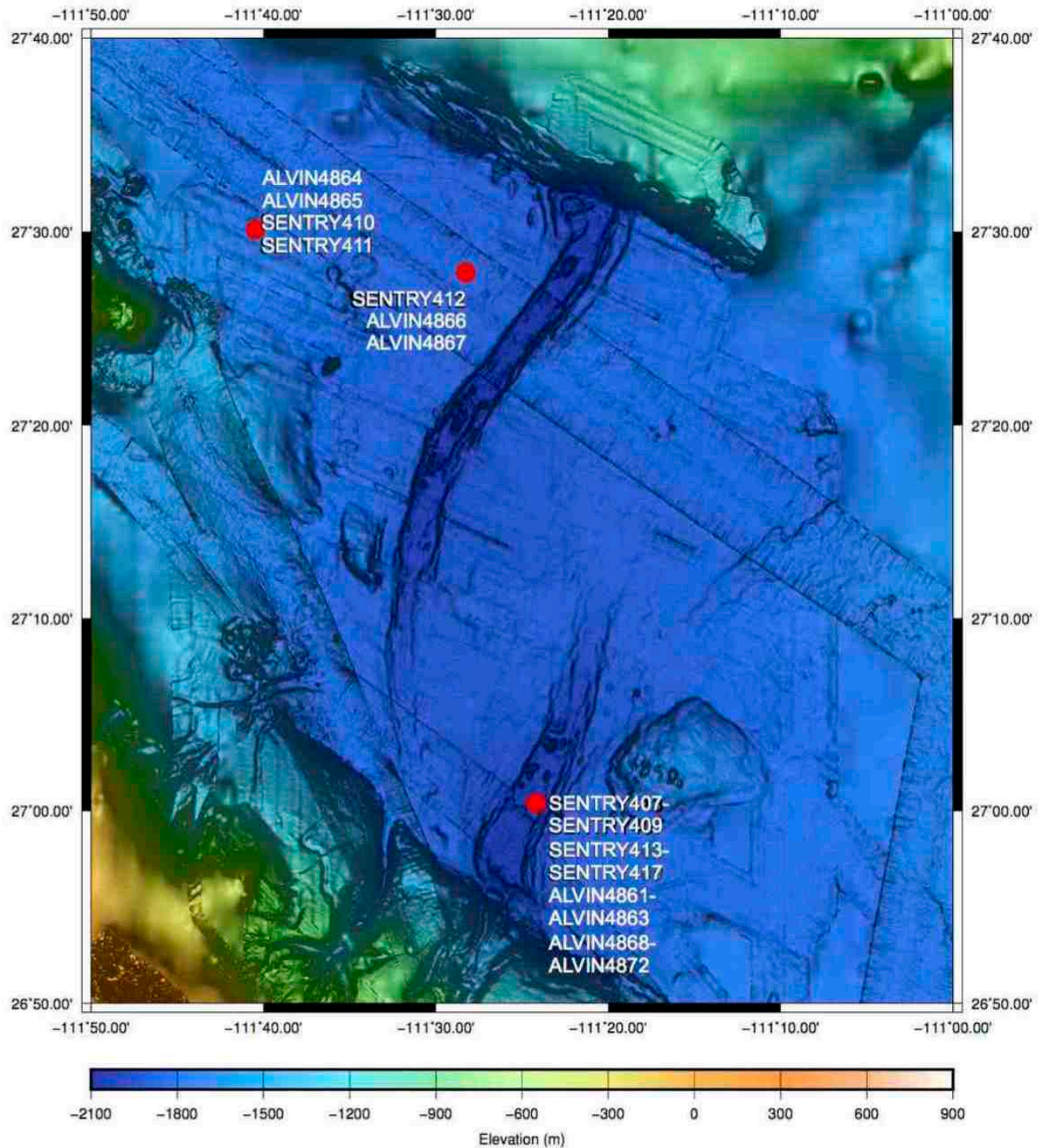
December 26: Transit back to Manzanillo. We process samples, clean up the labs and the coldrooms, and pack up equipment.

December 27: Arrival in Manzanillo in the morning, demobilization begins. World Courier makes belated and incoherent offers about sample transport; but we don't trust them and organize emergency shopping for small coolers, to divide up samples for hand-carrying them home in airplane-compatible portions. Samples for Mexican collaborators at UNAM are shipped by Fedex, which works well. Survival celebrations erupt at various places in town in the evening.

December 28: Demobilization continues. We get an extra night onboard since the next science party is not going to arrive immediately. The customs disaster continues for the next science party as well, and essential equipment is held back. The captain worries whether he will be able to refuel in Manzanillo since the fuel barge is nowhere to be seen [it will work last minute]. Some of our coolers and boxes find asylum in Dan Fornari's container, and are shipped to Woods Hole, where they arrive fine. Javier Caraveo and Tito Pena find a tour bus operator, and we charter his bus and pickup truck for everyone's ride to the airport next morning at 6 am. Taxis don't run at this time; we dodged a bullet.

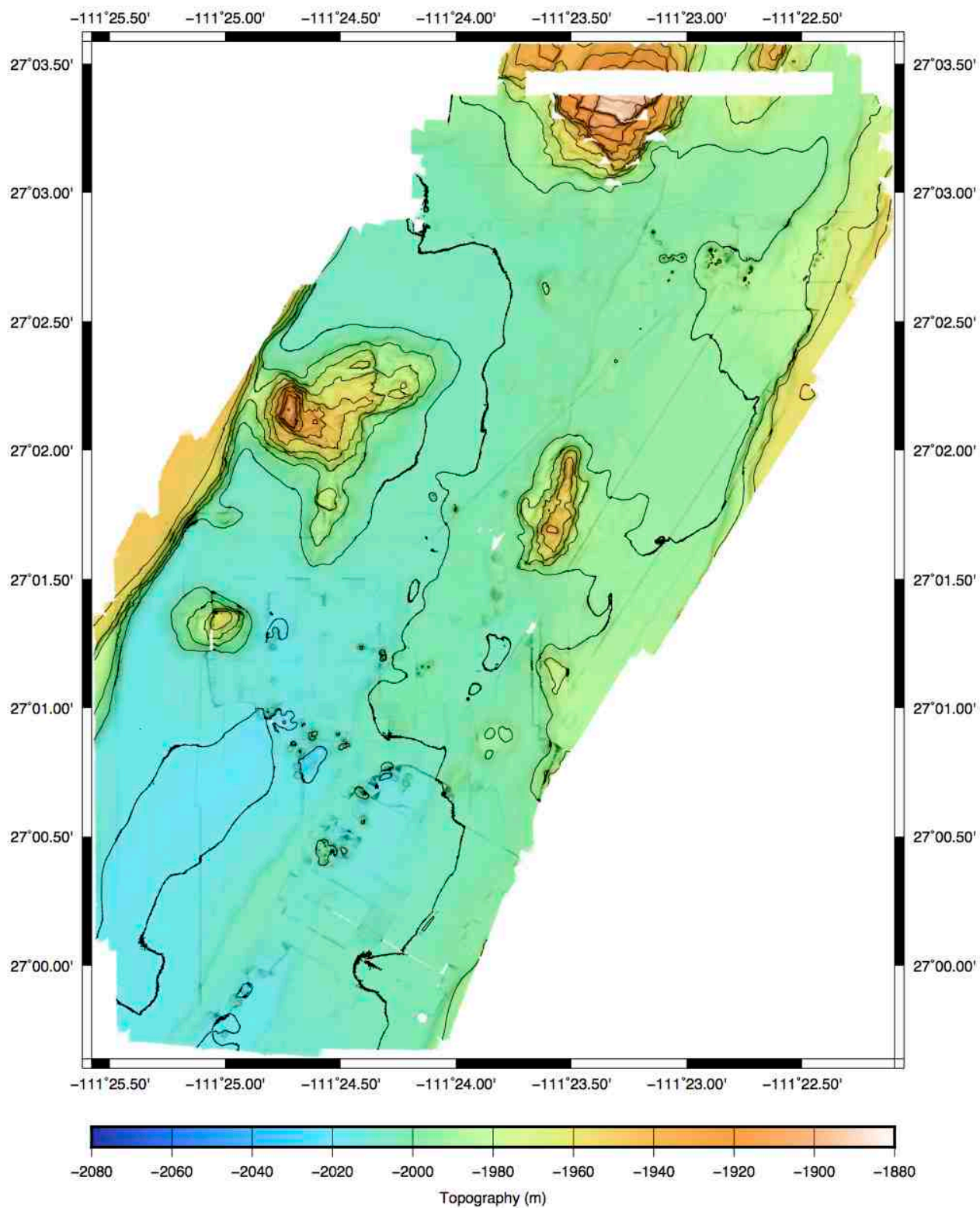
December 29: Departure. The tour bus and pickup combination, though a little overloaded, works very well and the price is reasonable. At the airport, check-in of luggage and expedition boxes proceeds without hiccups; the extra fees are a tiny fraction of what World Courier would have charged. The travelling parties report mostly smooth travel and make it home with their samples in reasonably good shape. The aftermath of the cruise, and research in the home lab, begins.

ALVIN AND SENTRY DIVE LOCATIONS



SENTRY BATHYMETRIC MAP OF SOUTHERN GUAYMAS BASIN SPREADING CENTER

2016_teske_full_rnv_tide_equal_1.00x1.00_BV01



Dive 4861 - December 12, 2016

1. **Primary Target Location :** Megamat (111°24. 512 W, 27°00.464 N)
2. **Additional Target Location:** Aceto Balsamico mat (111°24.427W, 27°00.470 N)
3. **Additional Target Location :** Mat Mound (111°24.560 W, 27°00.388 N)

Pilot: Bob Waters --- Port Observer: Andreas Teske ---Starboard Observer: JP Balmonte

Objectives: The primary objective of this dive is to collect sediment cores from hydrothermal hot spots that are previously checked for high temperature with the heatflow probe. Our primary target is oil-rich Megamat, but we don't find it for any reason, other large hot spots with mats are OK.

Alvin Basket: 60 cm Heatflow probe and High-T Alvin probe
3 push core crates, 12 cores each; two with 16" cores, 1 with 24" cores
1 collection box and 1 biobox
Niskin bottle rack for overlying water on top of Megamat
Slurpgun for harvesting *Beggiatoa* mat

1) Megamat. Once on the seafloor, the submersible should proceed to Megamat (see above); it is characterized by white sulfur patches and a crustal, craggy surface texture dusted white and yellow with sulfur, but not by fluffy *Beggiatoa* pillows.

1) Reconnaissance of the mat area- observers need to identify approaches optimal for sediment sampling and deployment of heatflow temperature probe, as well as the general structure of the system. Park Alvin on the edge of Megamat so that the sampling arms can reach into the interior mat area, but also the edge of the mat.

2) Place three or four heatflow measurements in a large rectangle or triangle, ca. 1 m each side, to define the temperature field; it should be hot everywhere.

3) collect Niskin bottles of overlying water on top of Megamat.

4) Place as many cores as possible into and around the rectangle, tightly spaced for maximal sediment recovery. Use one third of the cores, incl. large cores if practical.

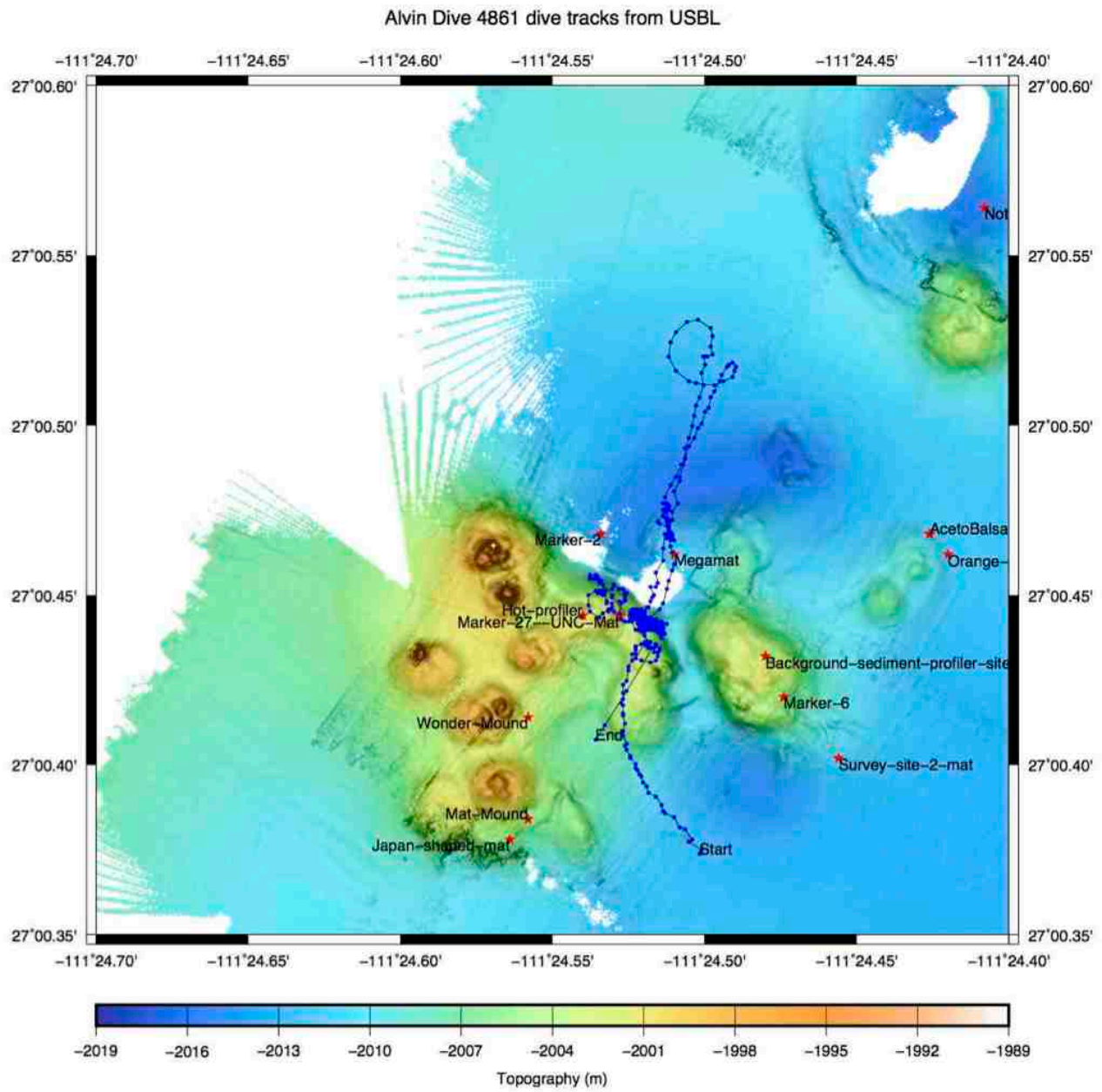
5) repeat T profiling and coring [not the niskins] on the margin of the mat, where the sulfur dusting fades away; temperatures are not quite as hot.

6) move Alvin approx. two meters and perform T profiling and coring in the brown sediment outside of the mat; the sediment may still be warm.

2) Aceto Balsamico Mat or Alternate. If Megamat cannot be found, try the sulfur-yellow Aceto Balsamico mat as an alternate; if Megamat was successful, skip to 3). If you find yourself at another, smaller mat for any reason, do a simpler inside vs outside core sampling scheme. Trigger Niskins inside the mat area.

3) Mat Mound. After mat sampling, try to collect rocks from hydrothermal mounds (Mat Mound is nice) or pick up carbonates from the seafloor. Also, collect benthic animals that come your way. Mat Mound has lots of *Beggiatoa* mats that can be siphoned off with the slurp gun; try to harvest either white or orange mats [they grow in separate patches], but don't mix the colors. Large tube worms (*Riftia*) only grow attached on rocky surfaces, for example Mat Mound, and should be picked carefully, not slurped. Last but not least, if some cores are not yet filled, they can be filled with *Beggiatoa* mats sediment that grows around the base of Mat Mound.

Alvin Dive track 4861



SAMPLING INFORMATION				
Site	Dive #	Lat/Long	Date	Time
Twin Peaks/Megamat II	4861		12 December 2016	

Site Description(s)

WHOI (W), Long (L), Rhizon (R)

Core type	Core number	Length (cm)	Description	Supernatant	Processed by:	Used or intended for:
W	4861-1	24	From hot area. 0-5 cm sulfur precipitation, black; 5-24 cm gray-brown, fine-grained.	Clear	UGA - Ryan Sibert	
W	4861-2	24	From hot area. 0-1.3 cm sulfur crust; 1.3-3.8 cm, black; 3.8-8.9 cm, black/brown; 3.8-24 brown, fine grained, some fractures	Cloudy	UGA - Ryan Sibert	
W	4861-3	26.7	From hot area. 0-2.5 cm sulfide crust; 2.5-3.8 cm black sediment/sulfide crust; 3.8-6.4 cm, black/brown, fine grained; 6.4-26.7 cm brown/gray, some fractures.	Cloudy	Barbara MacGregor	PAH analysis (Beizhan Yan)
W	4861-4	24; sloped	From hot area. 0-5.1 cm, sulfur precipitate, sulfidic black sediments; 5.1-19 cm, gray-brown, fine grained; 19-24 cm gray-brown, coarse-grained, fractured.	Cloudy	Andreas Teske	(whole core at 4°C)
W	4861-5	19	From hot area. 0-5.1 cm black mud; 5.1-19 cm brown, fine-grained sediments.	Clear	Andreas Teske	(whole core at 4°C)
W	4861-6	21.6	From hot area. 0-5.1 cm, loose brown/white sediments (probably sulfur); 5.1-17.8 cm gray-black, fine grained; 17.8-21.6 cm gray-brown, fine-grained, with oil.	Cloudy	JP Balmonte	
W	4861-7	23	From cool area. 0-1.3 cm black, loose sediments; 1.3-23 cm brown, fine-grained, fractured.	Clear	UGA	Geochemistry
W	4861-8	19	From cool area. 0-1.3 cm, loose brown/black sediments; 1.3-19 cm, loose brown/black mud with fracturing.	Clear	Emil Ruff	

W	9	21.6	From cool area. 0-1.3 cm black, coarse mud; 1.3-21.6 cm, gray-green mud, fractured at bottom, fine grained.	Clear	Min Song	
W	4861-10	21.6	From cool area. 0-1.3 cm loose, black sediments; 1.3-21.6 cm brown/black/green fine-grained sediments.	Clear	?	
W	4861-11	21.6	From cool area. 0-1.3 cm loose, black sediment; 1.3-21.6 cm fine grained brown/black/green sediments.	Clear	Andreas Teske	(live in Mason jar at 4°C)
W	4861-12	25.4	From cool area. With clam on top. 0-6.4 cm black sediment; 6.4-17.8 cm greenish brown with black streak - friable iron mineral?; (bottom section not described)	Clear	Rick Peterson, Javier Caraveo	porewater residence time, fauna
W	4861-13		From warm area DRAINED AND LOST			
W	4861-14	20.3	From warm area. 0-2.5 cm, black and sulfur crust; 2.5-10.2 cm, black mud; 10.2-20.3 cm, black mud and fractures.	Cloudy	Andreas Teske	(live in Mason jar at 4°C)
W	4861-15	19	From warm area. 0-2.5 cm, black sediments and sulfide crust; 2.5-8.9 cm, brown/black and fractured; 8.9-19 cm brown, fine-grained sediments.	Clear	UGA	Geochemistry
W	4861-16	10.2	From warm area. 0-2.5 cm black sediments, well consolidated; 2.5-10.2 cm black, poorly consolidated, fine-grained fractured sediments.	DRAINED	Andreas Teske	(live in Mason jar at 4°C)
W	4861-17	23	From warm area. 0-7.6 cm black mud, coarse-grained, fractured; 7.6-16.5 cm brown mud, coarse-grained, fractured; 16.5-23 cm brown-gray mud, coarse-grained, fractured;	Fractured throughout and DRAINED	Andreas Teske	(live in Mason jar at 4°C)
W	4861-18	12.7	From warm area. 0-2.5 cm black sediments and sulfur crust; 2-5-12.7 cm black sediments.	Cloudy, degassed	Dan Hoer	(whole core at 4°C)
W	4861-19	21.6, sloped	From warm area. Sulfidic. 0-1.3 cm sulfur flakes and black pieces; 1.3-7.6 cm black sediments; 7.6-21.6 cm brown-black, fractured.	Clear	Emil Ruff, Gunter Wegener	
W	4861-20	15.2 (lost some)	From warm area. 0-3.8 cm, black sediments, sulfide crust; 3.8-6.4 cm, black sediments and fractures, voids; 6.4-10.2 cm, brown/black; 10.2-15.2, brown/black with voids and fractures.	Partly drained, cloudy	Died in cold room	

W	4861-21	19	From warm area. 0-2.5 cm, loose, black flocs; 2.5-10.2 cm, black, coarse sediments; 10.2-19 cm brown/black, chunky, coarse.	Clear	Rick Peterson	Fluid fluxes
W	4861-22	16.5	From warm area. 0-3.8 cm black, fractured; 3.8-6.4 cm, brown with black, fractured; 6.4-16.5 cm brown, heavily fractured, drained.	Drained	Dan Hoer	DNA, RNA, FISH
W	4861-23	19	From warm area. 0-2.5 cm, black sediments and sulfur crust, 2.5-6.4 cm black; 6.4-8.9 black/gray; then mostly void space.	Cloudy	Emil Ruff, Guangchao Zhuang	
W	4861-24	23 (lost some of bottom)	From warm area. 0-1.3 cm, sulfur flocs and brown spots; 1.3-6.4 cm black, coarse-grained; 6.4-15 cm brown, coarse-grained, fractured; gap at bottom.	Clear	Emil Ruff	
W	4861-25	47, sloped	From hot area. Sulfidic. Some worms. Sulfidic. 0-1.3 cm sulfur precipitate; 1.3-5.1 cm black material; 5.1-23 cm brownish, coarse, fractured; 25-47 cm brown-gray.	Clear	Emil Ruff, Gunter Wegener	
W	4861-26	44.5, sloped	From hot area. Sulfidic. 0-1.3 cm sulfur precipitate; 1.3-7.6 cm black; 7.6-23 cm fine grained, brown gray; 23-44.5 cm, coarse-grained, brown gray.	Clear	Emil Ruff	
W	4861-27	47	From hot area. 0-1.3 cm, black sediment, sulfidic crusts; 1.3-7.6 cm, black with fractures; 7.6-28 cm, gray-brown with oily spots and fractures; 28-47 cm, coarse gray-brown with oil and fractures.	Clear	UGA - Ryan Sibert	
W	4861-28	36.8	From hot area. 0-2.5 cm white/yellow crust; 2.5-15 cm black sediment, top sloped; 15-36.8 cm gray.	Clear	Rick Peterson	Tracer partition experiments
L	4861-29	38.1	From hot area. 0-5.1 cm black with white crusts; 5.1-38 cm mottled gray.	Clear	Rick Peterson	Porewater fluxes
L	4861-30	45.7	From hot area. 0-5.1 cm sulfur crust and black sediments; 5.1-10.2 cm black and some brown; 10.2-15 cm brown-gray, fine-grained sediments; 15-45.7 cm, brown-gray, fine-grained sediments, fractured.	Clear	Dan Hoer	DNA, RNA, FISH
L	4861-31	35.6	From hot area. 0-6.4 cm black sediments with sulfur crusts (large mottled pieces); 6.4-30 cm gray-brown sediments with fractures and voids; 30-36 cm fine-grained gray-brown sediments, no fractures.	Clear	Dan Hoer	Whole core kept live

L	4861-32	41.9	From hot area. 0-1.3 cm, sulfide crust and black sediments; 1.3-6.4 cm, black; 6.4-22 cm, brown-gray; 22-32 cm, brown-gray and oil; 32-41.9 cm, brown-gray coarse-grained sediment, oil, fractures.	Clear	UGA	Geochemistry
L	4861-33	45.7. Sloped	From hot area. 0-2.5 cm, black sediments and sulfide; 2.5-10.2 cm, brown/black/green sediments; 10.2-28 cm, brown/gray fine-grained sediment; 28-46 cm, brown-gray coarse-grained sediment and fractures.	Clear	?	
L	4861-34	41.9	From hot area. 0-2.5 cm, black sediment and sulfur crust; 2.5-8.9 cm, brown-gray and black; 8.9-22 cm, brown-gray fine-grained sediment; 22-28 cm, brown-gray fine-grained sediment and oil.	Clear	UGA - Ryan Sibert	
L	4861-35	43.2	From hot area. 0-7.6 cm, black sediment, sulfur crust; 7.6-20 cm, gray-brown fine-grained sediment; 20-30 cm, gray brown fractured sediment; 30-43 cm, gray brown fractured with oil.	Clear	UGA - Ryan Sibert	
L	4861-36	44.5	From hot area. 0-2.5 cm, sulfur crust, loosely consolidated; 2.5-7.6 cm, black sediment, sulfur crust, and fractures; 7.6-10.2 cm, brown-gray coarse-grained sediment; 10.2-20 cm, fine grained gray/brown sediment; 20-44.5 cm, fine grained gray/brown sediment and fractures.	Clear	Min Song	

Dive 4862 - December 13, 2016

4. **Primary Target Location : Mat Mound (111°24.560 W, 27°00.388 N)**

As updated by Sentry for the large two mound structures mapped on Monday

5. **Additional Target Location: Marker 14 mat (111°24.431W, 27°00.470 N)**

Pilot: Pat Hickey --- Port Observer: Dirk de Beer --- Starboard Observer: Emil Ruff

Objectives: The primary dive objective is to collect *Beggiatoa* mat-covered, methane-rich sediment cores from mat- and methane-rich Mat Mound, complemented by some background cores, mat slurping, animal collection, rock collection [all at Mat Mound or nearby] and coring some additional orange *Beggiatoa* mats if they are handy.

Alvin Basket: (same as Dec. 12) 60 cm Heatflow probe and High-T Alvin probe

3 push core crates, 12 cores each; two with 16" cores, 1 with 24" cores

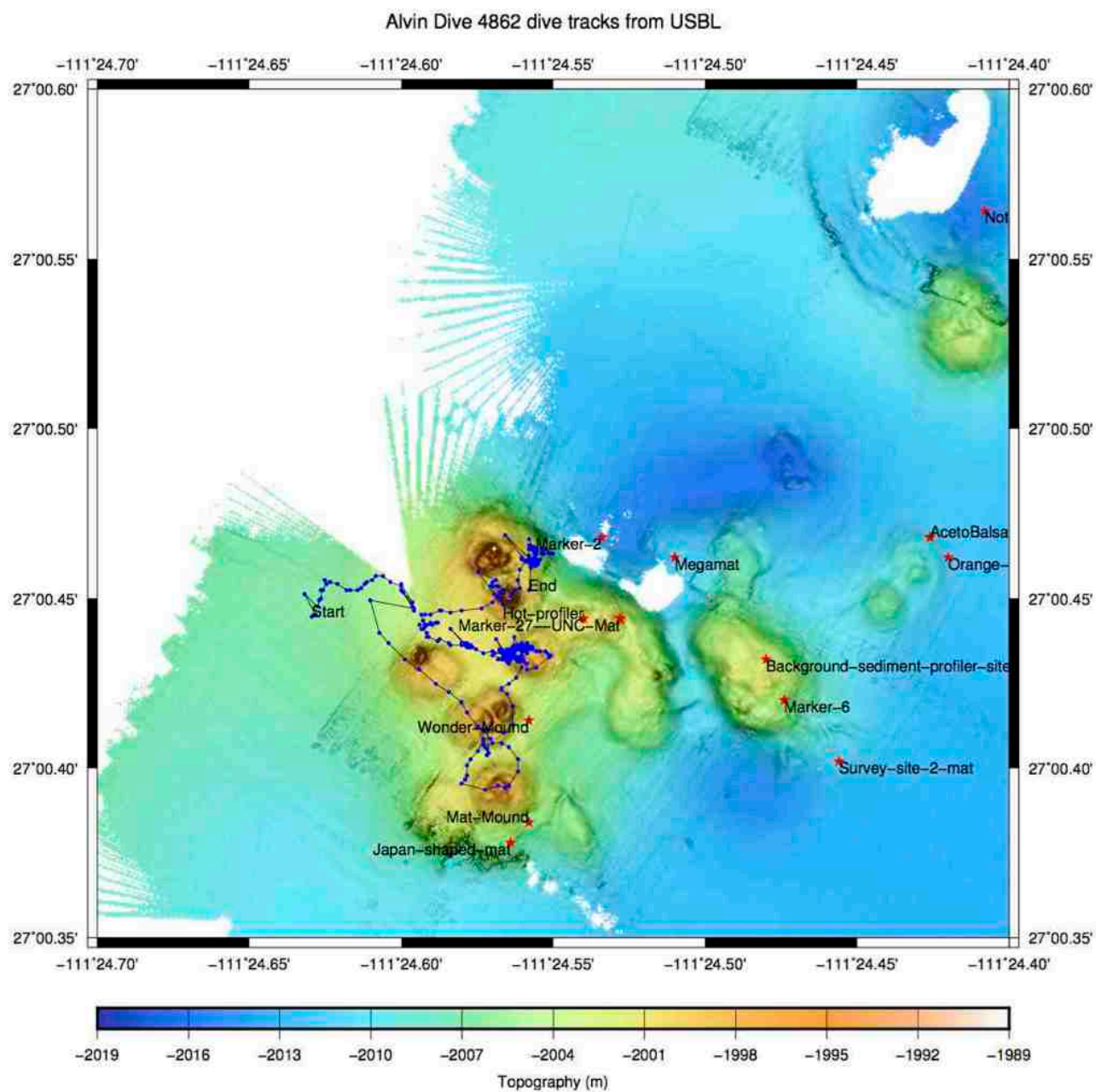
1 collection box [holds 24" cores on way down; rocks on the way up] and 1 biobox

Niskin bottle rack for overlying water on top of Megamat.

Slurpgun for harvesting *Beggiatoa* mat and animals if possible.

- 1) **Mat Mound: sediment & *Beggiatoa* mats.** Mat Mound is surrounded with a "skirt" of mostly white *Beggiatoa* mats that sit on hot, methane- and sulfide-rich sediment right at the foot of the mound. Measure the sediment temperature gradient with the Heat flow probe along the "skirt", it should be pretty hot. Trigger Niskins at the mat area. Core an extensive series of the mat-covered sediments along the base of the mound, or a cluster if you see a suitable patch. This is the most important coring effort. The model geochemistry cores [designate at least two] should be centrally located. Finally, collect some [four or five] background cores a meter off the mound.
 - 2) **Mat Mound: slurp gun & animals.** The flanks also have *Beggiatoa* mats with little critters inside that can be siphoned off with the slurp gun; try to harvest either white or orange mats [they grow in separate patches], but don't mix the colors if possible. Tube worms (*Riftia*) only grow attached on rocky surfaces, for example Mat Mound, and should be picked carefully, not slurped. Other animals at Mat Mound can also be collected if the occasion arises.
 - 3) **Mat Mound rocks.** Measure the surface temperature on selected spots of Mat Mound, and try to break off rock pieces. The temperature should be recorded, poking the rock surface with Alvin's High-T probe, and probing the fresh surface after breaking off a rock. Also collect diverse rocks from the base of the mound; it has quite a talus slope if I remember this correctly. The rocks are for the UNAM mineralogist, Carles Canet, who truly loves Guaymas; pick GOOD rocks and make sure to have good pictures of them *in-situ*. The temperature regime and *in-situ* context are important for mineralogy.
 - 4) **Orange *Beggiatoa* cores.** If the Mat mound *Beggiatoa* core harvest leaves room for improvement, collect cores with orange *Beggiatoa* where you find them. These can be individual and/or scattered cores, not for geochemistry [we are limited with vials and collect only geochem for large, representative clusters of cores] but for capturing good orange *Beggiatoa* mat. A good site for this is the general neighborhood of Marker 14, but you may find small-scale orange *Beggiatoa* mats elsewhere. Pre-coring, measure temperature with heatflow probe.
- 2) **Marker 14 Mat area as Alternate.** If Mat Mound cannot be found, try the Marker 14 Mat area as an alternate for finding large mat patches with *Beggiatoa*.

Alvin Dive track 4862



SAMPLING INFORMATION				
Site	Dive #	Lat/Long	Date	Time
Smoker "X", Marker 22 area, background site	4862		13 December 2016	

Site Description(s)

WHOI (W), Long (L), Rhizon (R)

Core type	Core number	Length (cm)	Description	Supernatant	Processed by:	Used or intended for:
W	4862-1	27, sloped	White mat nearby Marker 22. White filaments ~2.5 cm on top. 0-3.8 cm, white sulfur grains, black/green sediment; 3.8-8.9, fine-grained brown; 8.9-27, fine-grained brown with some gaps and pockets.	Clear	Barbara MacGregor, Dan Hoer	Large sulfur bacteria collection; whole core at 4°C
W	4862-2	25	White mat nearby Marker 22. White filaments ~2.5 cm on top. 0-5.1 cm, brown/gray mottled gassy sediments; 5.1-10.2 cm, brown, coarse-grained, gassy, fractured; 23-25 cm, brown-gray, coarse-grained, gassy, fractured.	Clear	UGA, Dan Hoer	Geochemistry; RNA, DNA, FISH
W	4862-3	25	White mat nearby Marker 22. White filaments on top. 0-5.1 cm, fine to mid-grained brown/gray sediments; 5.1-12.7, fine-grained brown; 12-7-25, fine-grained brown sediments and gas pockets.	Cloudy	Andreas Teske	(live in Mason jar at 4°C)
W	4862-4	28	White mat nearby Marker 22. White filaments on top. 0-2.5 cm, fine-grained sediments with shells; 2.5-7.6 cm, gray brown; 7.6-15 cm, fine grained with gas pockets; 15-28 cm, gray-brown sediments with fractures.	Clear	Dirk de Beer, Ryan Sibert	
W	4862-5	27	Smoker "X", white mat with T to 81°C. 0-2.5 cm, fine-grained black/brown with some white filaments; 2.5-7.6 cm, green/brown with gas pockets; 7.6-27 cm, gray-brown with gas pockets.	Cloudy	Barbara MacGregor, Dan Hoer	Large sulfur bacteria collection; whole core at 4°C
W	4862-6	20, sloped	Smoker "X", white mat with T to 81°C. White filaments on top. 0-7.6 cm, black sediments with some brown; 7.6-20 cm, brown/gray with large gas pockets.	Cloudy	Rick Peterson	Porewater residence times
W	4862-7	32, sloped	Smoker "X", white mat with T to 81°C. White filaments on top. 0-6.4 cm, fine-grained brown sediments and black splotches; 6.4-27 cm, gassy brown sediments, highly fractured.	Cloudy, gassy	UGA, Dan Hoer	Geochemistry; RNA, DNA, FISH

W	4862-8	27	Smoker "X", orange mat to 146°C. Some filaments on top - drained white mat. 0-3.8 cm, small grains and gas pockets; 3.8-27 cm, brown-black sediments with oil and gas.	Drained	Emil Ruff, Gunter Wegener, Min Song	
W	4862-9	22, sloped	Smoker "X", orange mat to 146°C. Hydrocarbon smell. 0-6.4 cm, pink <i>Beggiatoa</i> filaments, large grains, oil streaks; 6.4-22, brown/gray, gassy, oily.	Clear until degassed	UGA - Ryan Sibert	
W	4862-10	19	Smoker "X", probably hot. 0.7 cm white <i>Beggiatoa</i> mat. 0-2.5 cm, brown, coarse sediments; 2.5-12.7 cm, brown, fine-grained sediments; 12.7-19 cm, gray-brown, fine-grained.	Clear	Barbara MacGregor, Charles Schutte, Dan Hoer	Large sulfur bacteria collection (possible <i>Thiomargarita</i>); chemotaxis experiments; ???
W	4862-11	14	Smoker "X", probably hot. 0-1.3 cm, flocs, grainy; 1.3-14 cm, fractured, gassy, gray-brown sediments.	Cloudy	Min Song	
W	4862-12	24	Smoker "X", orange mat to 146°C. Uniformly gray/brown; oily, fractured hot mess of a core.	Blown	UGA - Ryan Sibert	
W	4862-13	17.8	Marker 22 area, hot orange mat. Some orange <i>Beggiatoa</i> . 0-2.5 cm, large-grained black/brown sediments; 2.5-6.4 cm, fine-grained black/brown with fractures; 6.4-17.8, fine-grained black/brown, no fractures.	Drained	Andreas Teske	(live in Mason jar at 4°C)
W	4862-14	16.5	Marker 22 area, hot orange mat. 2.5 cm orange <i>Beggiatoa</i> on top. 0-3.8 cm, brown/gray fine-grained sediment with fractures; 3.8-16.5 cm, same, but no fractures.	Clear	UGA	Geochemistry
W	4862-15	30	Marker 22 area, hot orange mat. 1.3 cm orange <i>Beggiatoa</i> filaments on top. 0-2.5 cm, medium-grained brown sediments; 2.5-5.1 cm, black/brown sediments; 5.1-30 cm, gray-brown.	Clear	UNC, Dan Hoer	Geochemistry; RNA, DNA, FISH
W	4862-16	29	Marker 22 area, hot orange mat. Some bubbling. 0-2.5 cm, some smeared orange <i>Beggiatoa</i> filaments, dark gray/brown sediments; 2.5-29 cm, fine-grained dark gray-brown sediments, some fractures.	None - lost	Andreas Teske	Orange filaments collected to jar; (whole core at 4°C)
W	4862-17	23	Marker 22 area, hot orange mat. 2.5 cm orange <i>Beggiatoa</i> mat on top. 0-2.5 cm, coarse black/brown sediments; 2.5-23 cm, fine-grained brown-black sediment, one large fracture at 10.2 cm.	Clear	Gunter Wegener	

W	4862-18	32	Marker 22 area, hot orange mat. 1.3 cm <i>Beggiatoa</i> mat and possible work burrow on top. 0-3.8 cm, coarse-grained black sediment with sulfur crusts; 3.8-6.4 cm, brown/gray; 6.4-32 cm, some small fractures, brown/gray sediments.	Clear	Dan Hoer	Whole core kept live
W	4862-19	24, sloped	Marker 22 area, warm orange mat. 2.5 cm orange <i>Beggiatoa</i> filaments on top. 0-2.5 cm, medium-grained brown sediments; 2.5-24 cm, brown-gray, fine-grained, some fractures.	Clear	Min Song	
W	4862-20	28	Marker 22 area, warm orange mat. Shock of <i>Beggiatoa</i> . 0-3.8 cm, brown/black sediment; 3.8-12.7 cm, brown/black sediment with voids; 12.7-28 cm, fine-grained sediment and voids.	Disturbed, overfilled	Andreas Teske	Frozen for ICBM
W	4862-21	27	Marker 22 area, hot orange mat. 2.5 cm orange <i>Beggiatoa</i> filaments on top. 0-5.1 cm, fine medium gray sediment; 5.1-27 cm, fine-grained brown/gray with some fractures.	Clear	UGA - Ryan Sibert	
W	4862-22	23	Marker 22 area, warm orange mat. 0-3.8 cm, some sparse filaments, white black and brown sediments; 3.8-7.6 cm, fine-grained brown-black, fractured; 7.6-23 cm, brown/black.	Clear	Guangchao Zhuang	
W	4862-23	20	Marker 22 area, warm orange mat. Thin layer of orange <i>Beggiatoa</i> on top. 0-2.5 cm, fine, poorly consolidated brown/black sediments; 2.5-20 cm, fine-grained, black/brown/gray.	Cloudy	Guangchao Zhuang	
W	4862-24	19	Marker 22 area, warm orange mat. 1.3 cm <i>Beggiatoa</i> mat on top. 0-3.8 cm, brown/black sediment with worm; 3.8-19 cm, brown/black sediment with some fractures.	Cloudy	Dan Hoer	Whole core kept live
	4862-25					
L	4862-26	30	Smoker "X", orange mat. Some <i>Beggiatoa</i> filaments, orange/white. 0-3.8 cm, medium-grained green/brown sediments; 3.8-30 cm, fine-grained gray/brown sediments.	Clear	Barbara MacGregor, Dan Hoer	Large sulfur bacteria collection; whole core at 4°C
L	4862-27	34	Smoker "X", orange mat. Some orange <i>Beggiatoa</i> filaments. 0-5.1 cm, coarse gray-brown sediments with yellow grains and oil; 5.1-17.8 cm, fine-grained gray-brown sediment; 17.8-34 cm, fine-grained gray-brown sediment with fractures.	Clear	Rick Peterson	Porewater fluxes
	4862-28					

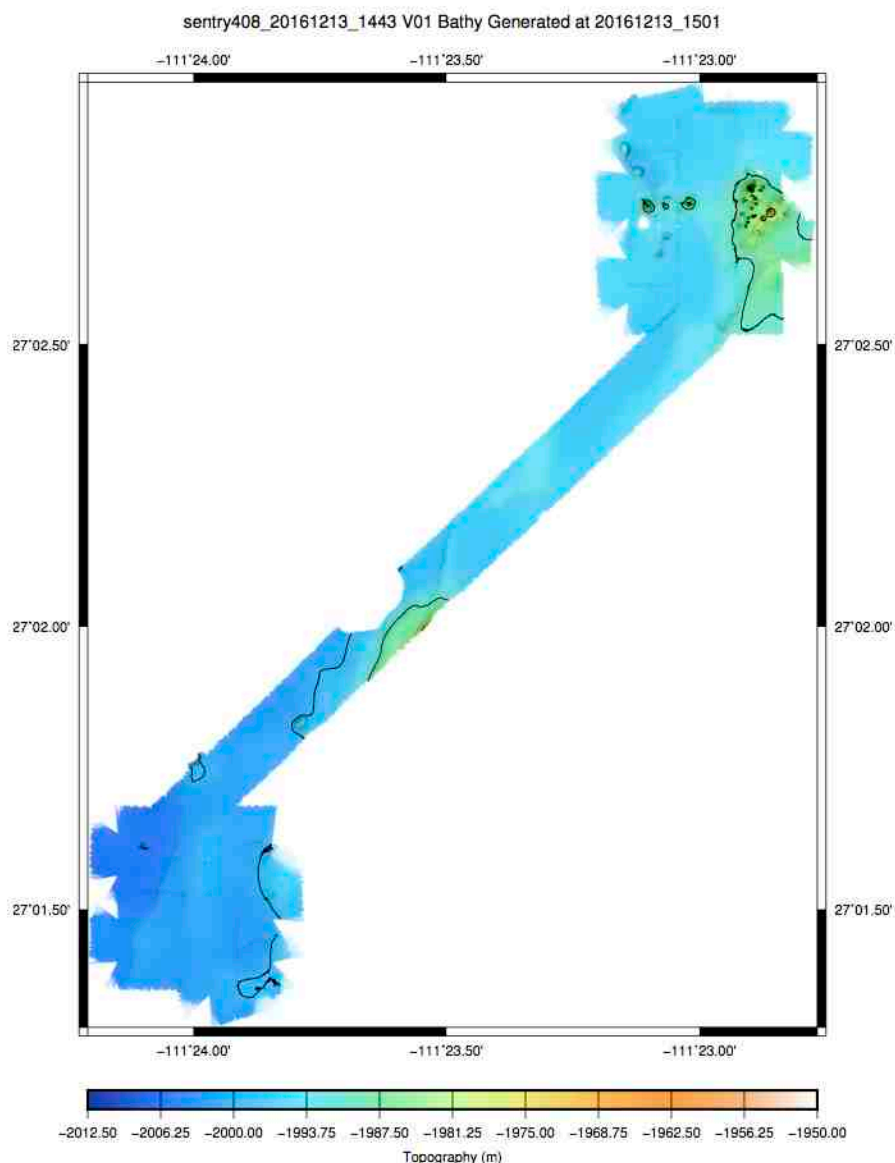
L	4862-29	39	Background site. 0-3.8 cm, brown, fine-grained sediment; 3.8-20 cm, green/brown; 20-39 cm, light gray/black/brown sediment.	Clear	Rick Peterson	Porewater fluxes
L	4862-30	32	Smoker "X", orange mat. Small orange <i>Beggiatoa</i> tuft on surface. 0-12.7 cm, gray brown, fractured, with orange <i>Beggiatoa</i> ; 12.7-25 cm, gray brown, fractured; 25-32 cm, gray brown, no fractures.	Clear	UGA, Dan Hoer	Geochemistry; RNA, DNA, FISH
	4862-31					
L	4862-32	34, sloped	Background site. 0-6.4 cm, brown/black fine-grained sediments 6.4-23 cm, gray brown, fractured; 23-32 cm, gray brown, no fractures.	Clear	Andreas Teske	Frozen for ICBM
L	4862-33	43	Background site. 0-5.1 cm, fine-grained brown/black sediments; 5.1-27 cm, fine-grained brown sediment; 10.5-17 cm, fine-grained gray sediments.	Clear	Emil Ruff, Gunter Wegener, Andreas Teske	???;???; (28-42 cm layer kept at 4°C in WhirlPak)

Dive 4863 – December 14, 2016

1. Primary dive target: newly discovered vent area at 27.044358 and 111.384589 [decimal coordinates]

Pilot: Jefferson Grau – Port Observer: Javier Caraveo – Starboard observer: Alexander Epp

Objectives: This is an exploratory dive at the newly mapped location with steep spires and hydrothermal mounds several miles north of the established vent areas that were sampled so far. This area, mapped on the next page [upper right corner] corresponds to the hydrothermal features in the hiking guide map at 27N05' and 111W23', in the upper right corner.

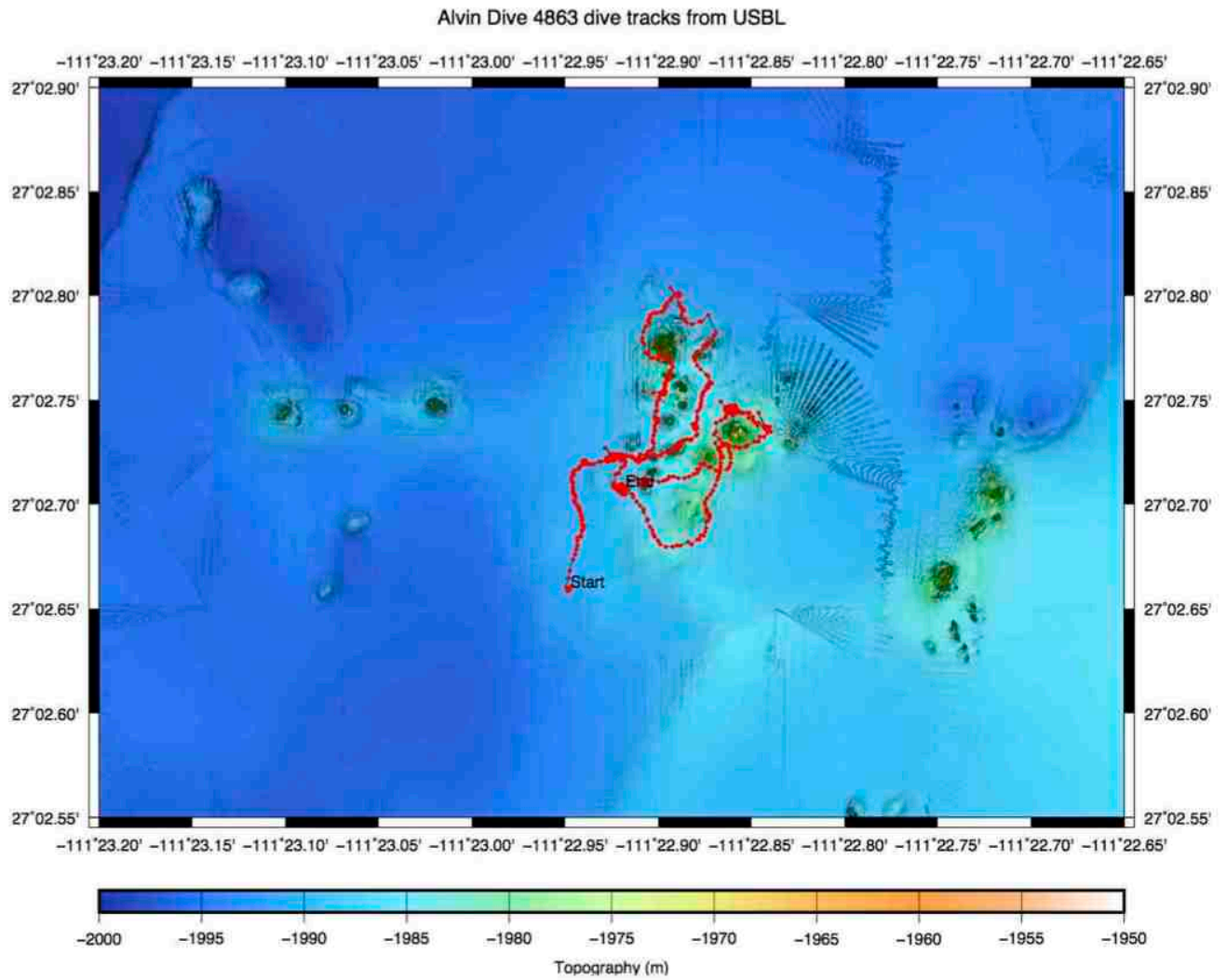


Alvin basket: as on previous dive, but exchange one basket of cores for a second biobox that is large enough for riftia, and take scoops for collecting benthic animals.

1) the primary emphasis of this dive is exploration, taking good pictures and video, collecting diverse animals [lots of animals] and some rocks.

2) Some mat cores should be collected, in particular if you find nice orange and white *Beggiatoa* mats. If you do, make sure to collect a gradient after measuring the temperature with the 60 cm heatflow probe: orange mats in center, white mats on periphery, bare sediment outside of mat; several cores in each spot.

Alvin Dive track 4863



SAMPLING INFORMATION

Site	Dive #	Lat/Long	Date	Time
"Northern Chimneys"	4863	x5094, y 499	14 December 2016	

Site Description(s)

WHOI (W), Long (L), Rhizon (R)

[illegible]

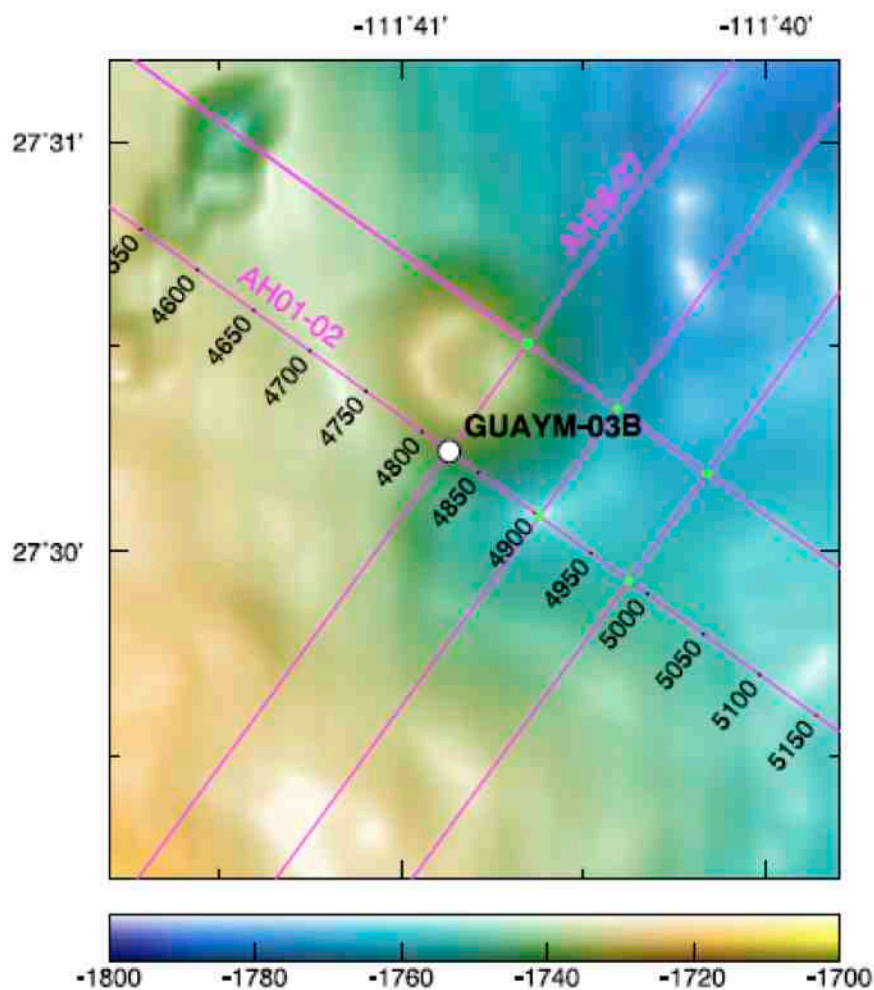
Dive 4864 – December 15, 2016

Primary dive target: The Ring vent area, an off-axis hydrothermally driven seep at 27.30°24486 and 111.40°86834 [decimal minutes] on the NW ridge flank

Pilot: Bob Waters – Port Observer: Andreas Teske – Starboard observer: Tito Montenegro

Objectives: This is an exploratory dive at the recently [2009] mapped off-axis location with thin microbial mats, methane-dependent tube worms, some clams and crabs, but no *Riftia* and no large hydrothermal Megafauna. Not visited by Sentry or Alvin before.

Alvin basket: Similar to previous dive, but some changes: with 12 large cores, 12 short cores; 1 m heatflow probe for low thermal gradients [can the 60 cm HF probe go on as a backup? The heatflow measurements will be very important here]; biobox large and small, large open box for rocks. Scoop for collecting animals.



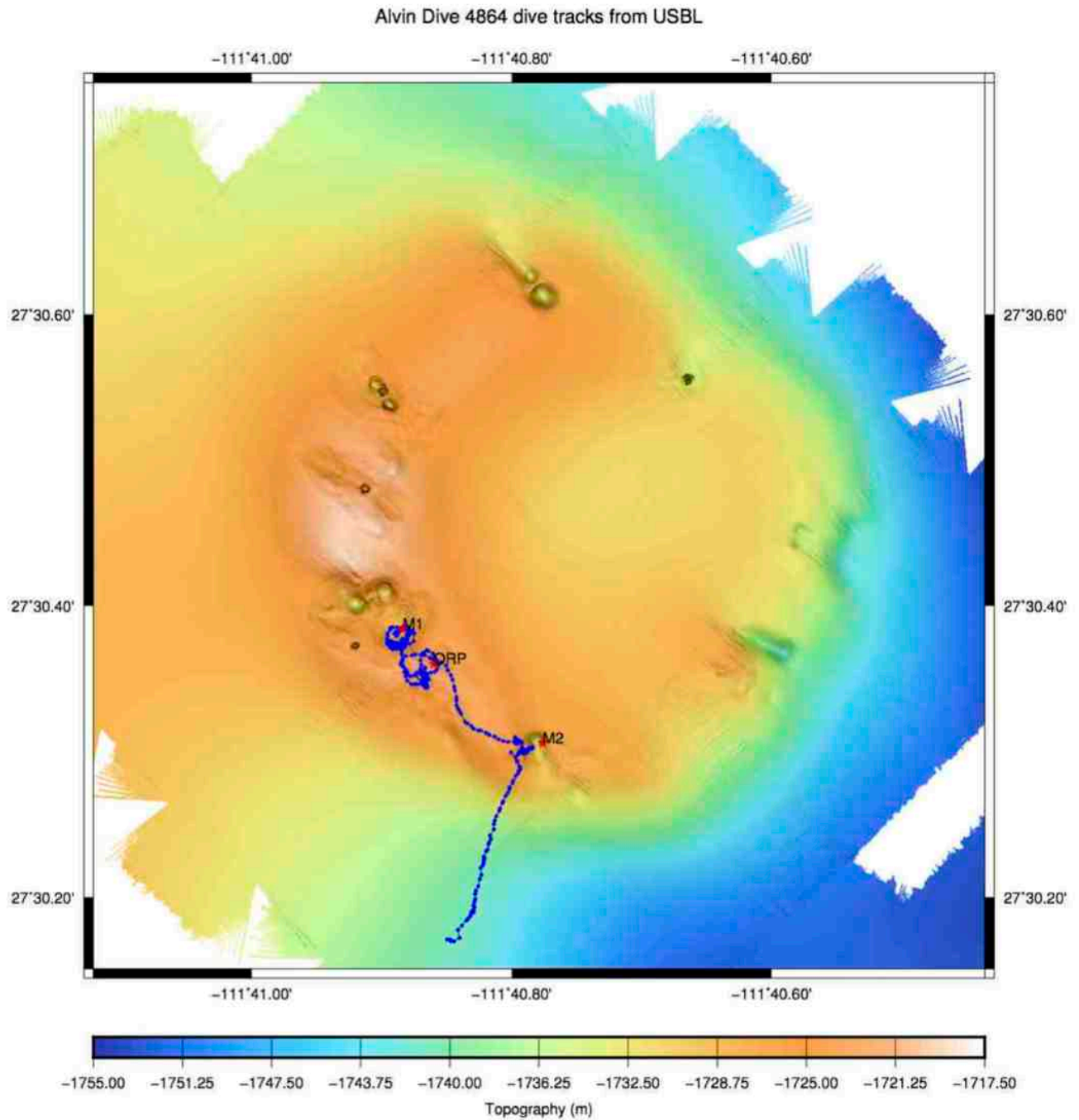
--- Look for an area with mats and seep fauna, check out a few promising locations on the ring structure; measure HF profile with 1 m probe. Southwest part of the ring has deep-tow images that look promising.

--- Carbonate outcrops marked by mats and worms at their base

--- Collect animals; they are a different assemblage from the Guaymas vents

--- Collect cores, preferentially long ones since the geochemical and thermal gradients will be very gradual. Active fluid flow may be most active around the outcrop edges [otherwise carbonate pavement at ca. 1.20 m depth, cored into during El Puma cruise]

***Alvin* Dive track 4864**



SAMPLING INFORMATION				
Site	Dive #	Lat/Long	Date	Time
Ring Vent	4864		15 December 2016	

Site Description(s) **Mound 1:** Hydrothermal in places; 3° at surface to 7°C at 1 m depth; tube worms, carbonate reefs. **Mound 2:** Seep-type tube worms found; cold (3° C) but should have methane. **ORP:** Oxidation/ reduction potential anomaly observed by *Sentry*; 3° at surface to 6.5°C at 1 m depth.

WHOI (W), Long (L), Rhizon (R)

Date	Core type	Core number	Length (cm)	Description	Supernatant	Processed by:	Used or intended for:
15 Dec 2016	W	4864-1					
15 Dec 2016	W	4864-2					
15 Dec 2016	W	4864-3		Mound 2. Empty.			
15 Dec 2016	W	4864-4	23	ORP. 0-3.8 cm, loose dark brown flocs. 3.8-23 cm, dark brown fine-grained sediment with carbonate specks.	clear	Rick Peterson, Guangchao Zhuang	Porewater fluxes, ???
15 Dec 2016	W	4864-5	19, sloped	ORP. 0-3.8 cm, loose dark brown flocs. 3.8-19 cm, brown fine-grained sediments and some carbonate.	clear	UGA	Geochemistry
15 Dec 2016	W	4864-6	20	ORP. 0-2.5 cm, fine-grained loose brown flocs; 2.5-20 cm, dark brown fine-grained sediments.	cloudy	Andreas Teske	(whole core at 4°C)
15 Dec 2016	W	4864-7	17.8, sloped	Mound 1. 0-2.5 cm, loose brown flocs. 2.5-17.8 cm, fine-grained brown sediments.	cloudy	Andreas Teske	(whole core at 4°C)

Date	Core type	Core number	Length (cm)	Description	Supernatant	Processed by:	Used or intended for:
15 Dec 2016	W	4864-8	10.5	Mound 1. 0-3.8 cm, loose brown flocs. 3.8-11.4 cm, brown fine-grained sediments. 11.4-16.5 cm, dark brown splotchy sediments. 16.5-27 cm, dark brown fine-grained sediments.	Clear	JP Balmonte	FISH
15 Dec 2016	W	4864-9	23	Mound 1. 0-2.5 cm, loose brown flocs. 2.5-11.4 cm, brown fine-grained sediments. 11.4-23 cm, fine-grained grey/brown sediments.	Clear	UGA	Geochemistry
15 Dec 2016	W	4864-10	23, sloped	Mound 1. 0-1.3 cm, loose chunky material. 1.3-12.7 cm, brown fine-grained sediments. 12.7-23 cm, brown/gray sediments.	Clear	UNC	Geochemistry
15 Dec 2016	W	4864-11	24, sloped	Mound 1. 0-2.5 cm, brown loose flocs. 2.5-12.7 cm, brown fine-grained sediments and fractures. 12.7-24 cm, gray-brown fine-grained sediments.	Clear	Javier Caraveo	Fauna
15 Dec 2016		4864-12	19	ORP. 0-1.3 cm, brown loose flocs. 1.3-12.7 cm, brown fine-grained sediments. 12.7-19 cm, brown/gray fine-grained sediments.	Clear	UNC	Geochemistry
15 Dec 2016	L	4864-13	23	ORP. 0-7.6 cm, dark brown, loose flocs, some white spots. 7.6-23 cm, brown fine-grained sediments.	Clear	JP Balmonte	FISH
15 Dec 2016	L	4864-14	19	ORP. Worms on top. 0-6.4 cm, dark brown sediments. 6.4-19 cm, dark brown, fine-grained, some shells.	Clear	Javier Caraveo, Andreas Teske	Fauna; (live in Mason jar at 4°C)
15 Dec 2016	L	4864-15	16.5	ORP. 0-3.8 cm, loose brown flocs. 3.8-16.5 cm, fine-grained brown sediments and gas pockets.	Clear	Guangchao Zhuang	
15 Dec 2016	L	4864-16	33	Mound 1. Worms and burrows. 0-2.5 cm, loose brown sediments. 2.5-12.7 cm, brown/green sediment. 12.7-33 cm, brown fine-grained sediments.	Clear	Rick Peterson	Porewater residence times

Date	Core type	Core number	Length (cm)	Description	Supernatant	Processed by:	Used or intended for:
15 Dec 2016	L	4864-17	3.8	Mound 2. 0-3.8 cm, brown sediments, mixed quality.	Mixed quality.	Andreas Teske	(collected in Falcon tubes at 4°C)
15 Dec 2016	L	4864-18	12.7	Mound 2. 0-12.7 cm, fine grained brown sediments and worm casings,	Cloudy.	Died in cold room	
15 Dec 2016	L	4864-19		Mound 2. Blown.			
15 Dec 2016	L	4864-20		Mound 2. Blown.			

Dive 4865 – December 16, 2016

Primary dive target: The Ring vent area, an off-axis hydrothermally driven seep.

Start the dive at 27N30.457 / 111W 41.026 [decimal minutes]; this is ca. 200 m west of the western section of Ringvent, to prevent dropping ballast on your favorite seep features.

Pilot: Pat Hickey – Port Observer: Ryan Sibert – Starboard observer: Min Song

Objectives: Survey the northwestern quadrant of Ringvent, starting north of Mound 1 where Dive 4864 left off. This is the second exploratory dive at this recently [2009] discovered off-axis location with microbial mats, methane-dependent tubeworms, clams and crabs, and even a single *Riftia* (near hydrothermal venting at Mound 1). Lots of fish and octopus.

Alvin basket: As previous dive to Ringvent: with 12 large cores, 12 short cores; 1 m heatflow probe for low thermal gradients [with 60 cm HF probe as backup]; biobox large and small, large open box for rocks. Scoop for collecting animals.

--- Use the new Sentry map to explore the mysterious hills and valleys on the northwestern margin of Ringvent. The Sentry team has provided interesting dive targets, numbered from West to North around Ring Vent:

No. 1: 27N 30.482 / 111W 40.912

No. 2: 27N 30.547 / 111W 40.899

No. 3: 27N 30.614 / 111W 40.777

No. 4: 27N 30.558 / 111W 40.664

--- At interesting sites (sulfides; mats; mounds) measure the heatflow with the 1 m heatflow probe. Insert the probe as far as possible and note how far it goes; also read the temperature profile at least twice, at the start and after 5 minutes since the T readings need a little time to equilibrate. Seawater temperature is ca. 2.9°C; previous HF measurements found ca. 7°C at 1 m depth in the southwestern portion of Ring Vent.

--- If you see shimmering water emerging from a rock, measure the temperature with the heatflow probe - carefully, without blowing up the rock. If it is cool enough and OK for plastic, slurp gun the fluid.

--- take informative pictures of new features

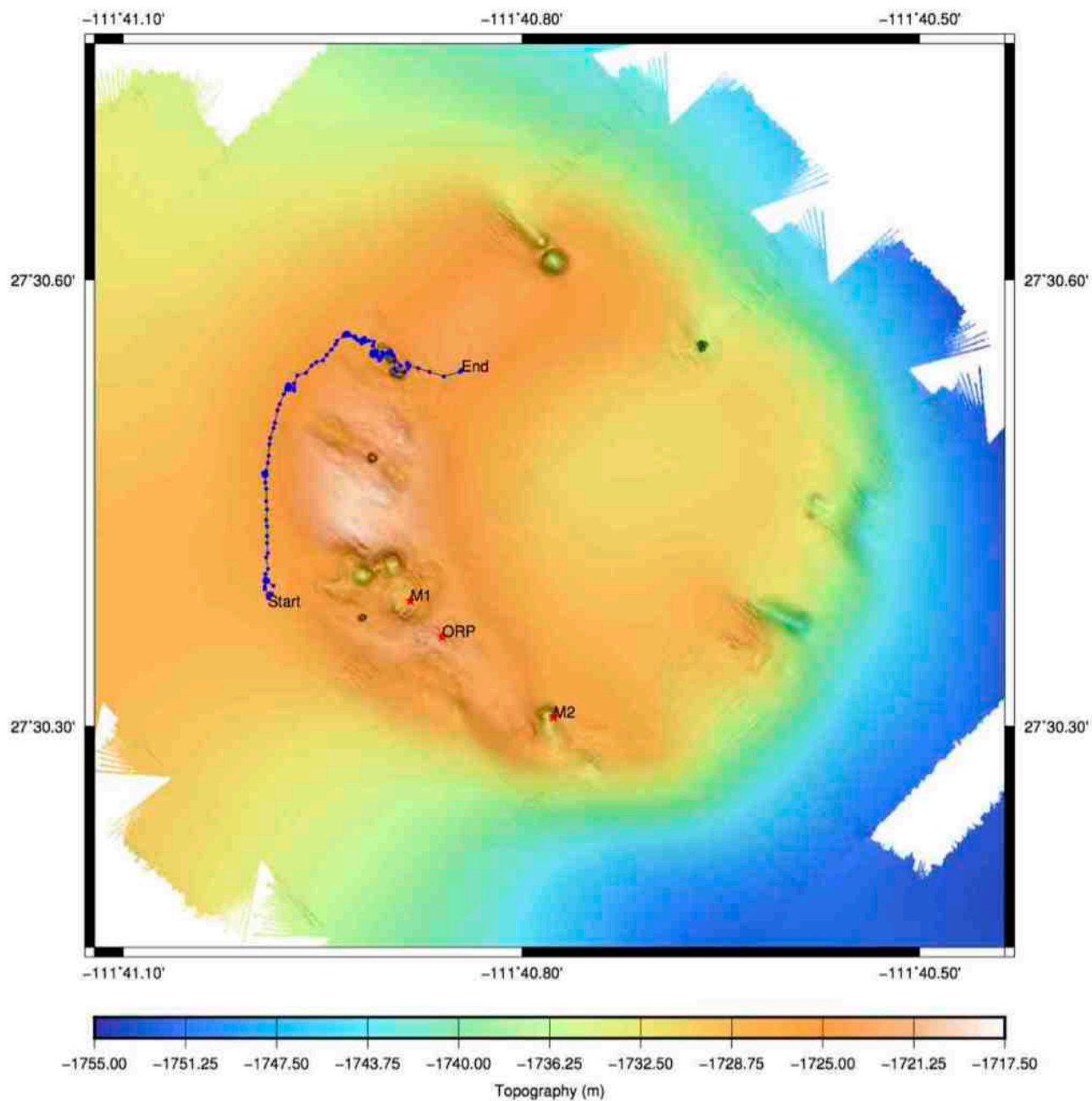
--- **Optional:** Collect cores, preferentially long ones since the geochemical and thermal gradients will be very gradual and the sediment is soft [except you hit a rock, as it happens on the mounds]. But, since time is short, don't spend much time on cores if you don't see a compelling reason. The heatflow profiles are more important.

Of course, if you see an oil well or something wild, core away – your call.

--- **Optional:** Collect some animals [or rocks with small animals on it]; they are a different assemblage from the Guaymas vents. Please don't pick any *Riftia*.

Alvin Dive track 4865

Alvin Dive 4865 dive tracks from USBL



SAMPLING INFORMATION

Site	Dive #	Lat/Long	Date	Time
Ring Vent	4685		16 December 2016	

Site Description(s)

WHOI (W), Long (L), Rhizon (R)

[illegible]

Dive 4866 – December 17, 2016

Primary dive target: The Guaymas-9A area, an off-axis seep where hydrothermal subsurface heat is suspected to melt a layer of hydrates embedded in the sediments. Probably gassy and methane-rich [BSR].

Dive origin 27.469613 / 111.473531 [decimal] or 27°N28.200 / 111°W28.400. Water depth = 1843 m.

Pilot: Jefferson Grau – Trainee: Danik Forsman– Starboard observer: Matthew Saxton

Objectives: Survey this area, take sediment cores, heatflow samples, animals and rocks. This is the first exploratory dive at this off-axis location.

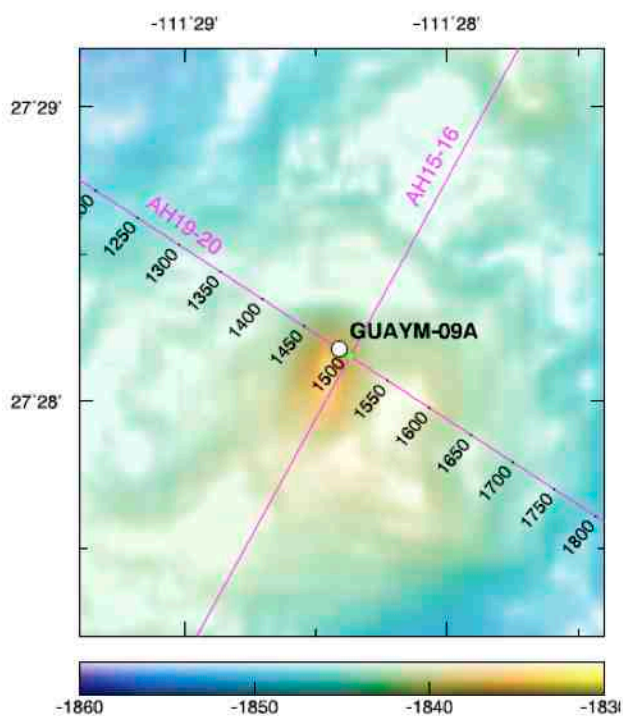
Alvin basket: 6 large cores, 18 short cores; 1 m heatflow probe for low thermal gradients [with 60 cm HF probe as backup]; biobox large and small, large open box for rocks. Scoop for collecting animals.

--- Sentry has a short dive here tonight, but will map the bathymetry and provide dive targets. Otherwise; circle around the area and check it out; it is basically a point on the map.

--- At interesting sites (sulfides; mats; mounds) measure the heatflow with the 1 m heatflow probe. Insert the probe as far as possible and note how far it goes; also read the temperature profile at least twice, at the start and after 5 minutes since the T readings need a little time to equilibrate. Seawater temperature is ca. 2.9°C; previous HF measurements found ca. 7°C at 1 m depth in the southwestern portion of Ring Vent.

--- If you see shimmering water and/or gas bubbles, measure the temperature with the heatflow probe. If cool enough and OK for plastic, slurp gun the fluid and/or bubbles [always good for methane isotopes].

--- Collect cores; remember that the most methane-rich sediments can launch the long cores like a rocket into the water once you are approaching the surface.

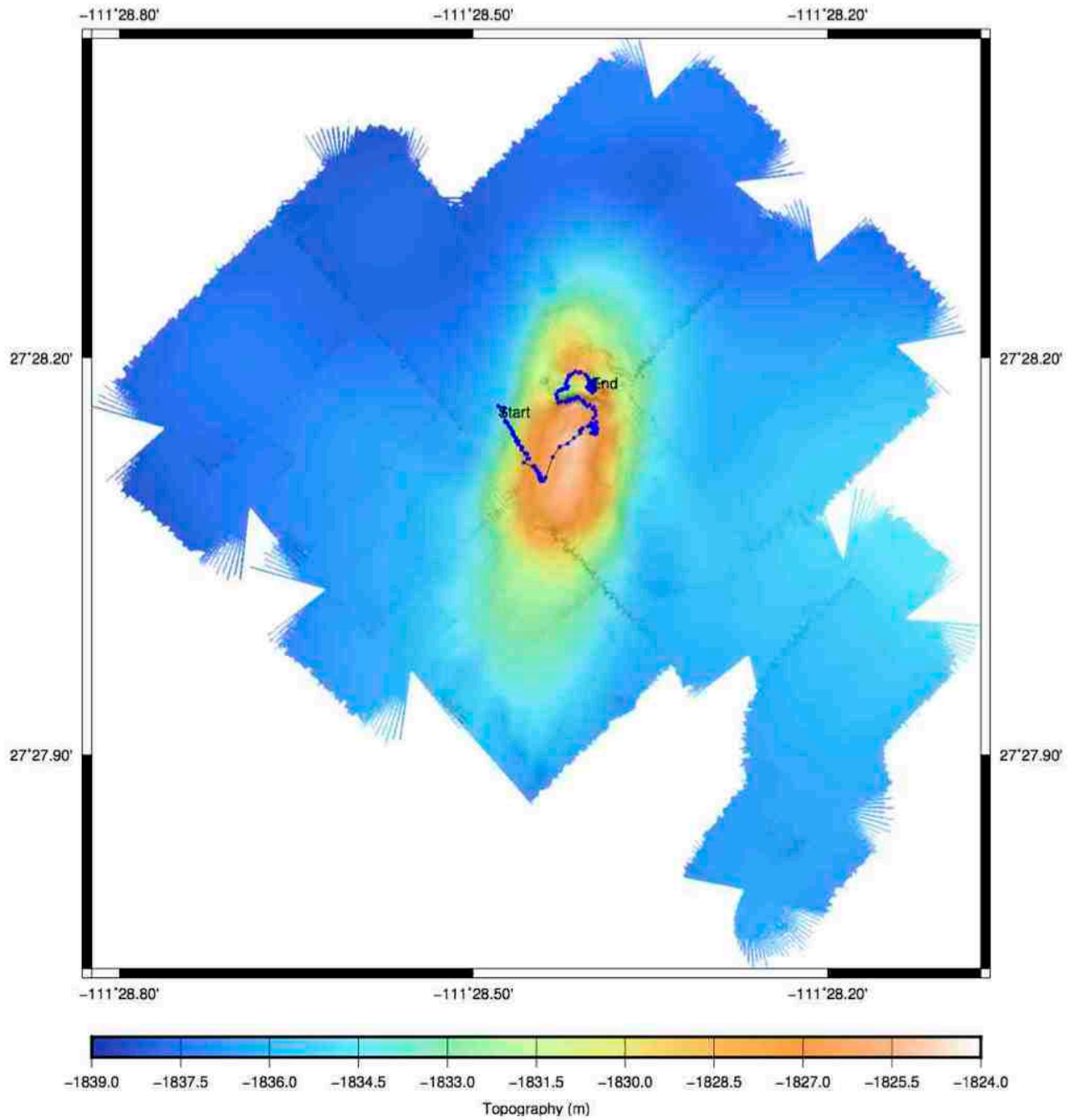


--- take informative pictures of new features

--- Optional: Collect some animals [or rocks with small animals on it]; methane-dominated sites have different assemblage than the hot Guaymas vents. Please don't pick any *Riftia* unless they are plentiful.

Alvin Dive track 4866

Alvin Dive 4866 dive tracks from USBL



SAMPLING INFORMATION				
Site	Dive #	Lat/Long	Date	Time
Guaymas 9A	4866		17 December 2016	

Site Description(s)

WHOI (W), Long (L), Rhizon (R)

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
L	1	24	Worm tubes on top; clam shell at ~2.5 cm. 0-2.5 cm, loose brown mud. 2.5-24 cm, brown/black sediment.	Clear	UNC
W	6	25	Sulfidic; worm tubes on top; visible worm at ~2.5 cm depth. 0-2.5 cm, loose brown/gray sediment. 2.5-25 cm, brown/black sediment.	Clear	Min
W	7	12.7	0-1.3 cm, loose brown/black sediment. 1.3-12.7 cm, brown/black sediment.	Clearish	Rick, if wanted
W	9	15	Worm tubes on top. 0-1.3 cm, loose gray sediment. 1.3-15 cm, brown/black sediment with fractures.	Clear	Javier
L	10	15	Worm burrow on top, worm burrow and tubes at 2.5 cm depth. 0-2.5 cm, loose brown/black sediment. 2.5-15 cm, brown/black sediment.	Cloudy	Andreas
L	11	24	Worm tubes on surface. 0-3.8 cm, loose dark brown/gray sediment. 3.8-24 cm, dark brown sediment.	Clear	UGA
W	12	20	Worm burrows on top. 0-1.3 cm, loose gray/brown sediment. 1.3-20 cm, brown/black sediment.	Clear	Rick

Dive 4867 – December 18, 2016

Primary dive target: The Guaymas-9A area, an off-axis seep where hydrothermal subsurface heat is suspected to melt a layer of hydrates embedded in the sediments. Gassy and methane/sulfide-rich [BSR].

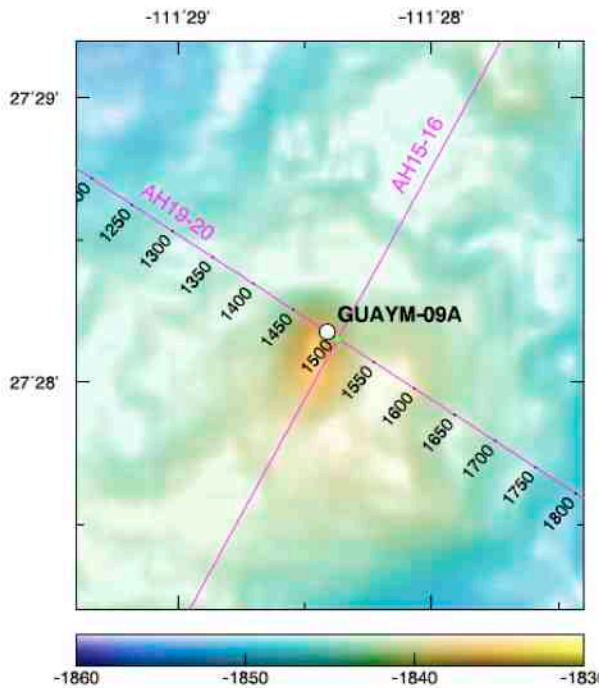
Dive origin as yesterday 27.469613 / 111.473531 [decimal] or 27°N28.200 / 111°W28.400 [close enough?]. Water depth = 1843 m.

Pilot: Bob Waters –**Portside observer:** Dan Hoer – **Starboard observer:** Hannah Choi

Objectives: Survey the gradient towards increasing seepage, take sediment cores, heatflow samples, animals and rocks at three sampling stations progressing into the center of the seep/mound area. The

coring stations should be correlated with different animal communities: clam shells on the periphery, tubeworms as they appear, and then the very center of the mound.

Modify as required by circumstance.



Alvin basket: three coring crates with at least 6 to 8 large cores, the rest short cores; 1 m heatflow probe for low thermal gradients [with 60 cm HF probe as backup]; 2 small bioboxes. Scoop for collecting animals. [Sorry for the late change, this came up during science meeting discussion]

--- Consult the Sentry bathymetry and possible dive targets. Otherwise circle around the area and into its center.

--- At interesting sites (sulfides; mats; mounds) measure the heatflow with the 1 m heatflow probe. Insert the probe as far as possible and note how far it goes; also read the temperature profile at least twice, at the start and after 5 minutes since the T readings need a little time to equilibrate. Seawater temperature is ca. 2.9°C; previous

HF measurements found ca. 7°C at 1 m depth in the southwestern portion of Ring Vent.

--- If you see shimmering water and/or gas bubbles, measure the temperature with the heatflow probe. If cool enough and OK for plastic, slurp gun the fluid and/or bubbles [always good for methane isotopes].

--- Collect cores; remember that the most methane-rich sediments can launch the long cores like a rocket into the water once you are approaching the surface.

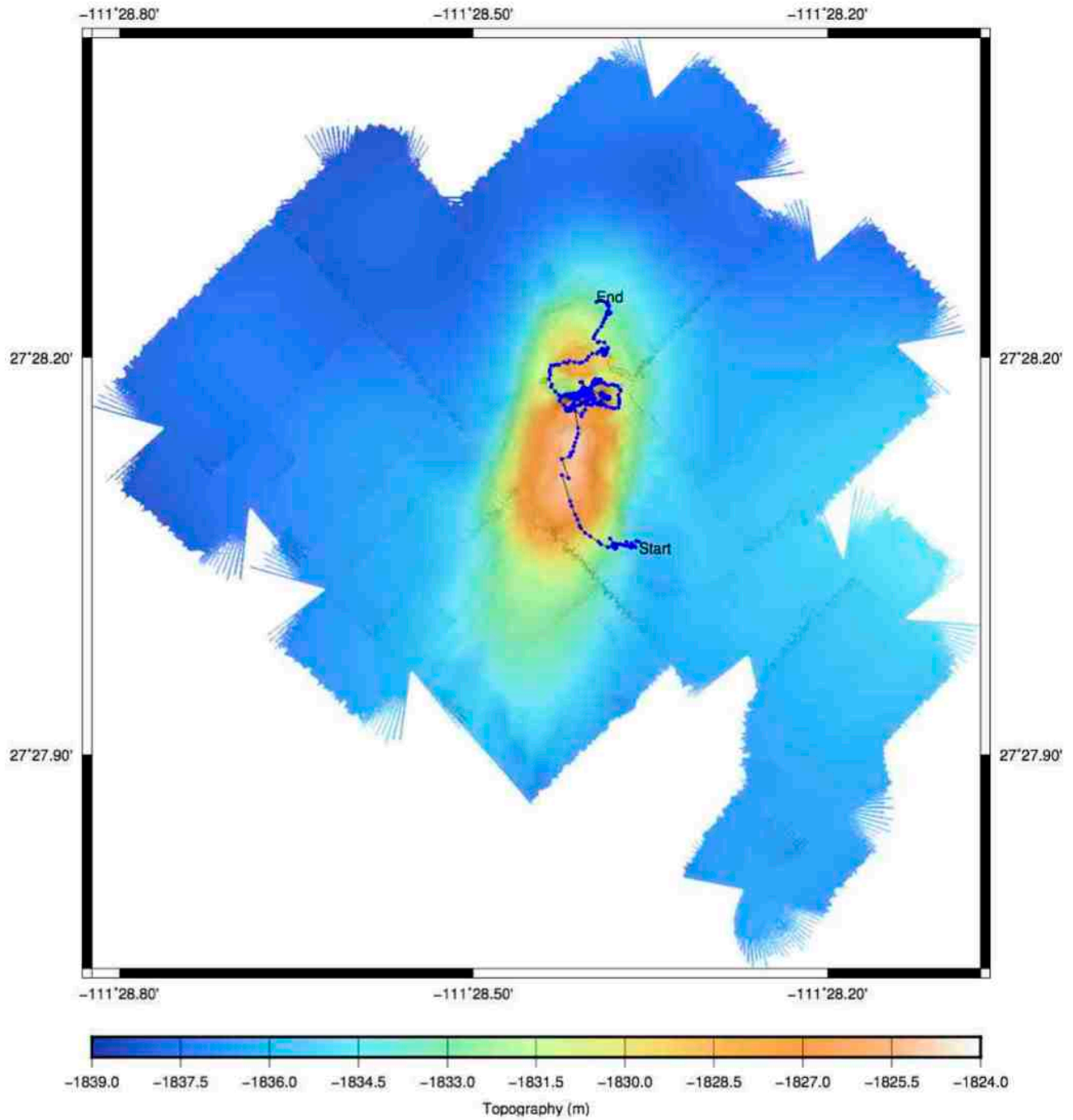
--- at each of the three major coring sites, collect typical animals and note which is which; use different bioboxes if they are easy to mix up.

--- take informative pictures of new features and of each animal community at the three coring sites.

--- take a rock if it hops into your basket

Alvin Dive track 4867

Alvin Dive 4867 dive tracks from USBL



SAMPLING INFORMATION				
Site	Dive #	Lat/Long	Date	Time
Octopus Mound	4867		18 December 2016	

Site Description(s)

WHOI (W), Long (L), Rhizon (R)

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
L	1	19	Periphery. 0-19 cm uniform brown/gray.	clear	Andreas
L	2	32	Periphery. 0-1.3 cm green/brown. 1.3-14 cm dark brown. 14-32 cm light brown.	clear	Gunter/Emil/Min
L	3	33	Active. 0-1.3 cm loose gray/white flocs. 1.3-12.7 cm dark brown. 12.7-33 cm brown/gray.	clear	Gunter/Emil/Min
W	4	30	Background. 0-2.5 cm dark brown. 2.5-30 cm dark tan.	clear?	UNC
	5		LOST		
W	6	25	Active. Worms and burrows on surface. 0-2.5 cm loose brown flocs. 2.5-25 cm brown/gray sediment with black streaks.	clear	UGA
W	7	20	Hydrate. 0-20 cm brown/black sulfidic sediment and rocks. Numerous gas bubbles.	cloudy	Charles
W	8	29	Background. 0-3.8 cm loose, dark brown flocs. 3.8-29 cm green/brown sediment with gas pockets.	cloudy	Gunter/Emil/Min

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
W	9	22	Active. Worm tubes on top. 0-2.5 cm, loose flocs and shells. 2.5-22 cm, brown/dark brown.	clear	UGA
W	10	12.7	Hydrate. Some bubbling; sulfidic. 0-12.7 cm black/brown with gas bubbles.	cloudy	UGA
W	11	12.7	Hydrate. Sulfidic. 0-12.7 cm black/brown with scattered white flecks, gas bubbles, and carbonates.	cloudy	UNC (floating mat chunk → Barbara)
W	12	24	Active. 0-1.3 cm worm burrows and flocs. 1.3-24 cm brown/gray with white worms.	clear	UGA
L	13	34	Active. 0-2.5 cm loose flocc and worm tubes. 2.5-7.6 cm gray/brown, flocculent, worm tubes. 7.6 -34 cm black/brown.	clear	Dan H.
L	14	33	Active. Worm burrows on top. 0-2.5 cm loose brown flocs. 2.5-33 cm brown/gray with dark blotches.	clear	Gunter/Emil/Min
	15	28	(T-handle fell off; rode to surface without lid.) 0-1.3 cm loose brown/gray flocs. 1.3-28 cm brown/gray with dark splotches.	clear	Rick
W	16	16.5	Active. Worms and tubes on top. 0-3.8 cm loose white/gray flocs. 3.8-16.5 cm gray/brown with worms.	clear	Dan H.

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
W	17	19	Active. Long worm tubes and worms. 0-2.5 cm loose flocs, white/gray. 2.5-19 cm, brown gray sediment and shell pieces.	clear	UGA
W	18 with yellow tape	22	Active. Worm tubes on top. 0-2.5 cm, loose brown flocs. 2.5-22 cm, brown/gray.	clear	UGA
	18 without yellow tape		(a/k/a 19)		
	19	12.7	Sulfidic, worm burrows. 0-3.8 cm, loose brown flocs. 3.8-12.7 cm, brown/gray.	cloudy	Andreas
W	20	17.8	Active. Worm tubes and polychaete on top. 0-2.5 cm loose flocs, white/gray. 2.5-17.8 cm, brown/gray.	clear	UGA
W	21				
L	22	36	Active. Worm tubes on top. 0-2.5 cm, loose brown flocs. 2.5-36 cm, brown/grey.	clear	Dan H.
L	23	6.4	Active. 0-6.4 cm, dark brown with squashed animal.	cloudy	Andreas
W	24	29	Periphery. 0-15 cm, dark brown with cracks. 15-29 cm, dark brown/black with cracks.	clear	Sam

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
W	25	20	Periphery. 0-20 cm, uniform, brown and rocks.	cloudy	Sam
W	26	23	Periphery. 0-12.7 cm, brown sediment with fractures. 12.7-23 cm, dark brown with numerous fractures.	cloudy	UNC
W	27	23.5, sloped	Periphery. 0-2.5 cm, loose dark brown. 2.5-23.5 cm, medium brown.	clear	UGA
W	28	27	Background. 0-27 cm dark brown/tan.	clear	UGA
R	29	19	Active. 0-2.5 cm, gray/white with worm tubes. 2.5-10.2 cm, gray/white. 10.2-19 cm, black/brown with worms.	clear	Javier
R	30	24	Active. 0-2.5 cm, loose gray/brown flocs and worms. 2.5-24 cm, dark brown with wicked small pink worms.	clear	Gunter/Emil/Min
W	31	27	Background. 0-3.8 cm, dark brown loose floc. 3.8-27 cm, light brown.	clear	Rick
R	32	27	Background. 0-2.5 cm, loose dark brown. 2.5-27 cm, uniform brown, with hydrate cap at bottom (?).	cloudy	Gunter/Emil/Min
L	33	20	Periphery. 0-20 cm, uniform medium brown.	clear	Gunter/Emil/Min

Dive 4868 – December 19, 2016

Primary dive target: Mat Mount Massif in the southern Guaymas area

Dive origin: in lat./long 27°N00.45/-111°W 24.650 / Water depth 2000 m.

Pilot: Pat Hickey – **Portside observer:** Rick Peterson – **Starboard observer:** Leigha Peterson

Objectives: *Beggiatoa* sampling, heatflow, *Riftia* sampling.

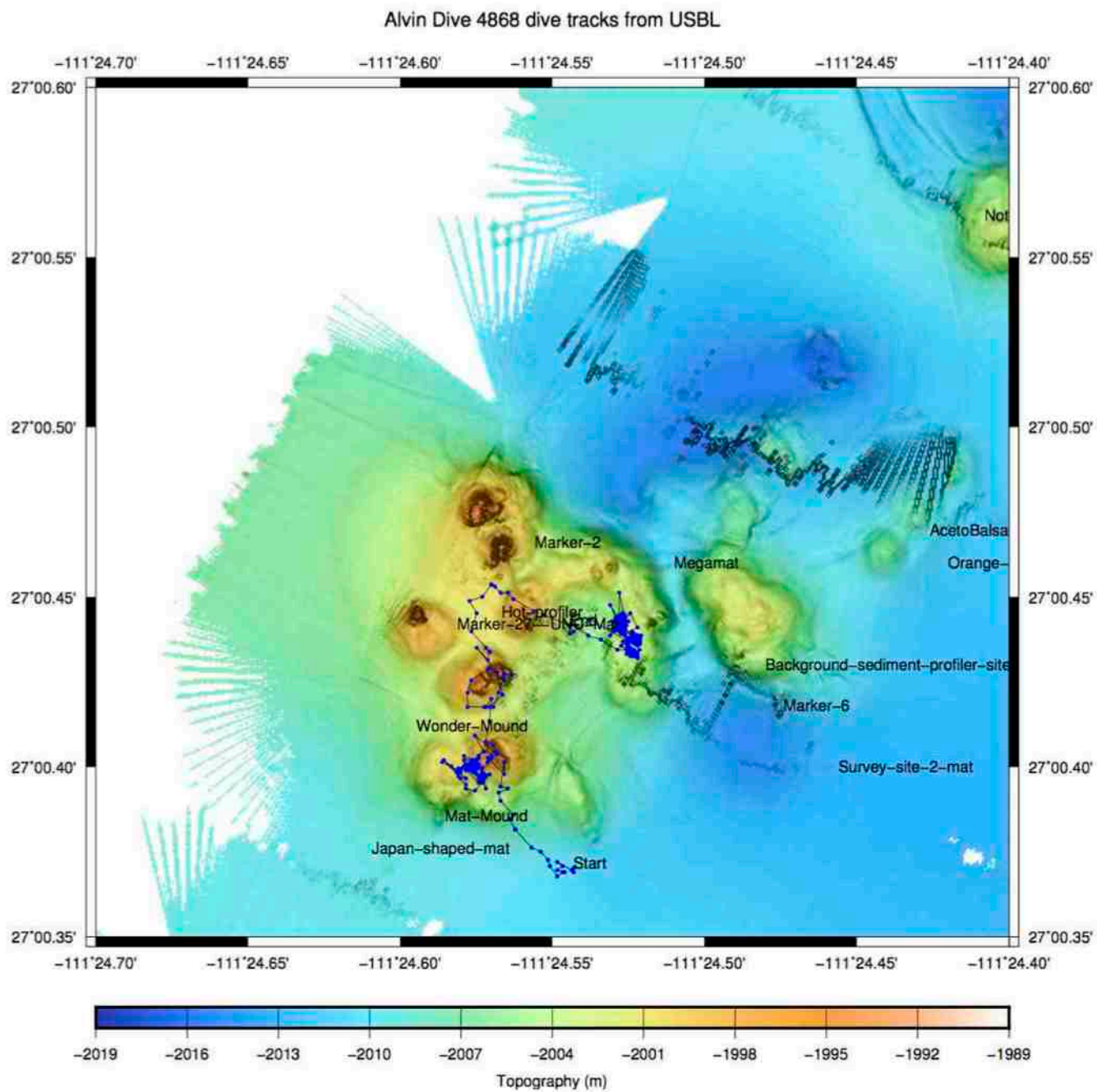
Alvin basket: two coring crates with 6 to 8 large cores, the rest short cores; 1 m heatflow probe [let's try it out], 1 small biobox and 1 large biobox, the latter for *Riftia*. Scoop for collecting animals.

To-do-list: --- Go to large *Beggiatoa* mat sampling site on Mat Mound Massif visited on dive 4862; at the same spot where the *Beggiatoa* cores were taken during dive 4862 check Heatflow, then use the slurpgun to collect some diffuse vent fluid emerging at the orange mat, or at least water as close as possible from the mat surface; it is OK if some *Beggiatoa* slip in. Then take some fresh orange and white *Beggiatoa* cores for Charles and Dirk. White *Beggiatoa* may require driving around.

--- Harvest *Riftia* of distinct sizes and age, two or three each, for Javier's project. Explore new mats; now we have Sentry photo targets [list is in the works] that need to be checked out.

--- Always be on the lookout for Barbara's mat gradient: two orange, two white, two brown cores in the same mat, with Heatflow profiles.

Alvin Dive track 4868



SAMPLING INFORMATION				
Site	Dive #	Lat/Long	Date	Time
Ultra Mound	4868		19 December 2016	

Site Description(s)

WHOI (W), Long (L), Rhizon (R)

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
L	1	41	Separate orange mat. 0-41 cm, gray/brown with gas gaps and active degassing.	cloudy	Dirk
L	2	44	Transect - orange. 0-7.6 cm, dark brown. 7.6-36 cm, gray/brown with gaps and cracks. 36-44 cm, gray/brown.	clear	UGA
L	3	47	Transect - white. 0-20 cm, brown/gray with gas gaps. 20-47 cm, brown/grey.	clear	UGA
S	4	27	Separate orange mat. 0-3.8 cm, loose brown flocs. 3.8-5.1 cm, loose, degassed. 5.1-27 cm, brown/gray with gas gaps.	cloudy	Guangchao
S	5	28	Yellow mat. 0-2.5 cm, loose brown floc and yellow filaments. 2.5-28 cm, gray/brown.	Full core, no supernatant	Dirk
S	6	20	Transect - white. 0-20 cm, medium coarse-grained brown sediment with chunks and gaps; drained.	No supernatant	Dan
S	7	25	Separate orange mat. Active degassing. 0-1.3 cm, loose brown floc. 1.3-5.1 cm, loose brown sediment with <i>Beggiatoa</i> . 5.1-25 cm, brown with gas gaps.	cloudy	Andreas
S	8	25	Yellow mat. 0-2.5 cm, loose brown sediment with filaments. 2.5-25 cm, brown/gray sediment.	cloudy	Barbara → Dirk

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
S	9	28	Transect - white. 0-7.6 cm, semi-loose flocs and large gaps. 7.6-28 cm, brown/gray with gas gaps.	clear	Barbara → Rick
R	10	11.4	Separate orange mat. 0-11.4 cm, brown/black sediment with rocks and gas gaps.	cloudy	Gunter/Emil/Min
R	11	10.2	Separate white mat. 0-10.2 cm, dark brown with large rocks and gas gaps.	drained	Gunter/Emil/Min
R	12	16.5	Separate white mat. 0-1.3 cm, loose light brown floc. 1.3-6.4 cm, dark brown with <i>Beggiatoa</i> . 6.4-10.2 cm, dark brown. 10.2-16.5 cm, rocky with sulfide minerals and oil at bottom.	cloudy	Gunter/Emil/Min
L	13	41	Transect - brown. Oil in core; white filaments on top. 0-8.9 cm, gray brown. 8.9-16.5 cm, medium-grained sediment with gas gaps and oil. 16.5-34 cm, coarse-grained brown/gray sediment with oil and gas gaps. 34-41 cm brown.	clear	Barbara → Rick
	14				
	15				
S	16	15	Separate white mat. White <i>Beggiatoa</i> on top. 0-1.3 cm, dark brown flocs. 1.3-15 cm, brown sediment.	clear	Barbara → Dirk

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
S	17	30	Transect - brown. Some filaments on surface. 0-10.2 cm, brown floc. 10.2-30 cm, brown sediment with many gas gaps.	cloudy	Guangchao
S	18	17.8	Transect - orange. Orange mat on top. 0-2.5 cm, loose brown floc. 2.5-17.8 cm, brown with gas gaps and rocks.	cloudy	Barbara → Rick
R	19	17.8	Separate white mat. 0-1.3 cm, gray/brown. 1.3 - 5.1 cm, gray/brown, possibly with some white mat mixed in. 5.1 - 17.8 cm, gray/brown with gas gaps.	drained	Gunter/Emil/Min
S	20	14	Transect - brown. 0-6.4 cm, loose brown floc. 6.4-14 cm, brown sediment, with possibly living crab.	lost ~4", cloudy	Javier
S	21	25 cm sediment, 5.1 cm rock at bottom	Transect - orange. 0-25 cm, brown/gray with gas gaps.	drained	Dan

Dive 4869 – December 20, 2016

Primary dive target: Mat Mount Massif in the southern Guaymas area

Dive origin: in lat./long 27°N00.45/-111°W 24.650 / Water depth 2000 m.

Pilot: Jefferson Grau – **Portside obs:** Barbara MacGregor – **Starboard obs:** Charles Schutte

Objectives: *Beggiatoa* gradient sampling and heatflow.

Alvin basket: three coring crates with 6 to 8 large cores, the rest short cores; 60 cm heatflow probe, slurp gun, 1 large biobox for *Riftia*. Scoop for collecting animals.

To-do-list: --- Go to large *Beggiatoa* mat sampling sites on Mat Mound Massif visited on dive 4862; same spot or similar where the *Beggiatoa* cores were taken during dive 4862. Check Heatflow, collect gradient of orange, white and bare sediment *Beggiatoa* in the following manner:

Four Orange cores in center where the temperature is hottest

[add at least six cores for Ryan in this part of the mat]

next, core at least four white cores where temperature is cooler

next, following the same line from the center of the mat to the outside of the mat, and

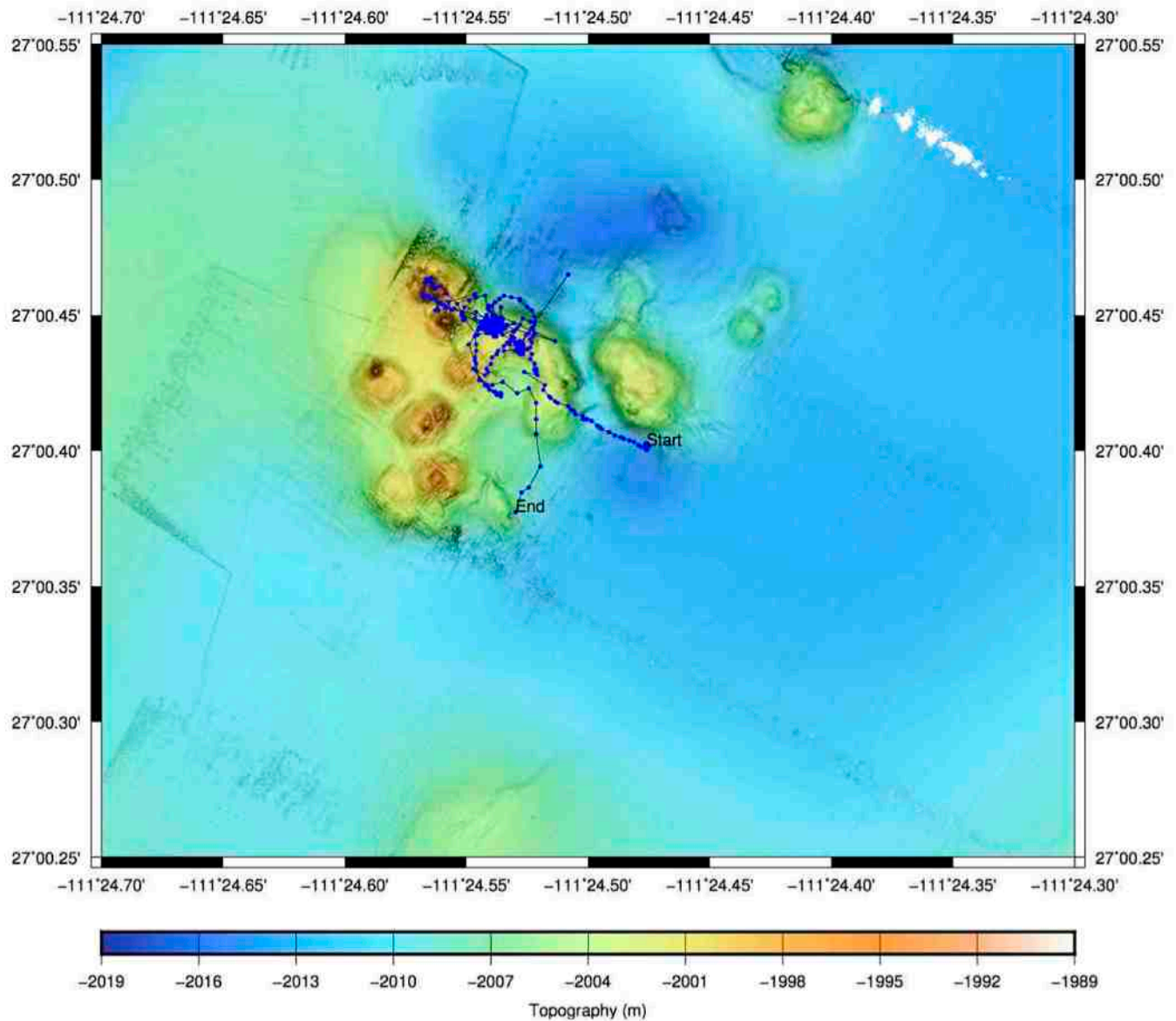
core at least four brown sediment on this transect where the temperature is coolest

Very Important: To avoid surprises, measure all heatflow profiles before coring begins.

If possible, collect shimmering water on top of the *Beggiatoa* mat

Alvin Dive track 4869

Alvin Dive 4869 dive tracks from USBL



SAMPLING INFORMATION				
Site	Dive #	Lat/Long	Date	Time
Ultra Mound	4869		21 December 2016	

Site Description(s)

WHOI (W), Long (L), Rhizon (R)

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
	1	47	Gradient - brown. Some white mat on top. 0-3.8 cm, loose brown floc and shells. 3.8-16.5 cm, brown with some gaps. 16.5-19, void. 19-47, gray/brown with gaps.	clear	CCU
	2	30	Gradient - brown. Lots of WLPW (wicked little pink worms). 0-5.1 cm, sparse white filaments, brown flocs. 5.1-30 cm, gray/brown.	clear	
	3	47	Bremen orange mat. Degassing. 0-6.4 cm, loose brown flocs. 6.4-16.5 cm, brown. 16.5-47 cm, gray/brown with gas gaps.	cloudy	Gunter/Emil/Min
	4	22	Ryan's cluster orange mat. 0-1.3 cm, loose brown floc and orange filaments. 1.3-22 cm, brown with gas gaps.	cloudy	UGA-Guangchao
	5	28	Ryan's cluster orange mat. 0-2.5 cm, loose brown flocs and orange mat. 2.5-28 cm, gray/brown with gas gaps.	cloudy	UGA-Guangchao
	6	37	Ryan's cluster orange mat. Sulfidic. Orange mat on top. 0-6.4 cm, dark brown. 6.4-19 cm, dark brown with gas gaps. 19-22 cm, void. 22-37 cm, dark brown with gas gaps.	none	Dan H.
	7	11.4	Ryan's cluster orange mat. 0-11.4 cm, gray/brown with orange mat.	cloudy, partly drained	UGA - Sam
	8	28	Ryan's cluster orange mat. Orange and white filaments on top. 0-1.3 cm, loose brown flocs. 1.3-7.6 cm, dark brown with gas gaps. 7.6-28 cm, gray/brown with large gas gaps.	cloudy	Dan H.

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
	9	28	Ryan's cluster orange mat. 0-1.3 cm, loose brown flocs and orange filaments. 1.3-28 cm, gray/brown with gas gaps.	cloudy	UGA
	10	29	Ryan's cluster orange mat. 0-1.3 cm, loose brown floc and orange mat. 1.3-29 cm, gray/brown with gas gaps.	full - no supe?	UGA
	11	28	Ryan's cluster orange mat. Orange filaments on top. 0-2.5 cm, loose brown flocs. 2.5-28 cm, brown with gas gaps.	cloudy	UGA
	12	29	Ryan's cluster orange mat. Orange mat on top. 0-2.5 cm, loose brown flocs and filaments. 2.5-29 cm, gray/brown with gas gaps.	cloudy	UGA
	13	56	Bremen white mat. 0-2.5 cm, loose brown flocs. 2.5-28 cm, brown/gray. 28-56 cm, "subnatant" (water).	cloudy?	Gunter/Emil/Min
	14	38	Bremen white mat. Core melted on bottom. 0-2.5 cm, loose brown floc. 2.5-38 cm, gray/brown with gas gaps, 5.1 cm melted on bottom.	cloudy	Gunter/Emil/Min
	15	5.1	Bremen white mat. 0-5.1 cm, loose brown flocs.	cloudy	Gunter/Emil/Min
	16	42	Gradient orange mat. 0-2.5 cm, loose brown flocs. 2.5-8.9 cm, gray/brown. 8.9-24 cm, gray/brown with gas gaps.	cloudy, bubbles	UNC

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
	17	20	Gradient orange mat. Big ol' mat on top. 0-1.3 cm, loose brown flocs. 1.3-20 cm, gray/brown with gas gaps.	clear	UGA - Hannah
	18	20	Gradient orange mat. "Big Fluff". 0-1.3 cm, loose brown flocs and orange mat. 1.3-5.1 cm, gray/brown, loose. 5.1-20 cm, gray/brown with gas gaps.	clear	Barbara
	19	36	Gradient orange mat. Orange mat on top. 0-12.7 cm, medium- to coarse-grained brown brown flocs. 12.7-36 cm, gray/brown with gas gaps.	clear	CCU
	20	27	Gradient orange mat. Orange and white filaments on top. 0-6.4 cm, loose brown floc, filaments, and little pink "worms". 6.4-16.5 cm, gray/brown. 16.5-27 cm, grey/brown with gas gaps.	clear	UGA
	21	28	Gradient white mat. 0-5.1 cm, loose flocs. 5.1-15 cm, gray/brown. 15-28 cm, grey/brown with gas gaps.	cloudy	UNC
	22	38	Gradient white mat. 0-10.2 cm, gray/brown with gas gaps and white filaments. 10.2-38 cm, gray/brown with gas gaps.	none	CCU
	23	36	Gradient white mat. White mat on top. 0-7.6 cm, loose brown with little pink "worms". 7.6-36 cm, gray/brown.	cloudy	CCU → UGA (Sam)
	24	30	Gradient white mat. 0-7.6 cm, brown flocs and filaments. 7.6-30 cm, gray/brown with gas gaps.	clear	UGA

Dive 4870 – December 22, 2016

Primary dive target: Large Yellow mat [Aceto balsamico] in southern Guaymas area

Dive origin: in lat./long (111°24.427W, 27°00.470 N) Water depth 2000 m.

Pilot: Bob Waters – **Portside obs:** Gunter Wegener – **Starboard obs:** Lt. Jorge Arellano

Objectives: Yellow mat, near former 2009 Acetobalsamico mat, for core sampling and heatflow measurement.

Alvin basket: three coring crates with 6 to 8 large cores, the rest short cores; 60 cm heatflow probe, slurp gun, 1 small biobox for *Riftia*. Scoop for collecting animals.

To-do-list: --- Go to yellow mat area near Marker 14/Aceto balsamico and check out Sentry dive targets; they will be programmed in the sub.

Large lime-yellow mat [target 407-8] is located at:

Lat. 27. 00775949/ Long. -111. 40720202 [decimal units]

The large lime-yellow mat – hopefully the true descendant of Aceto Balsamico mat - should be suited for taking large clusters of cores, but don't forget to check with heatflow measurements whether the sampling field is homogeneous. The original Aceto Balsamico mat was moderately warm, ca. 30-40C at 40 cm depth, and had 300-400 micromolar acetate, increasing at depth.

This is also a suitable mat for long cores, to obtain acetate-rich cores for ethanogenesis experiments (Dan/Emil).

There is one more dive target in the Marker 14 area; back in 2009 this was a very mat-rich area where we did most of our sampling.

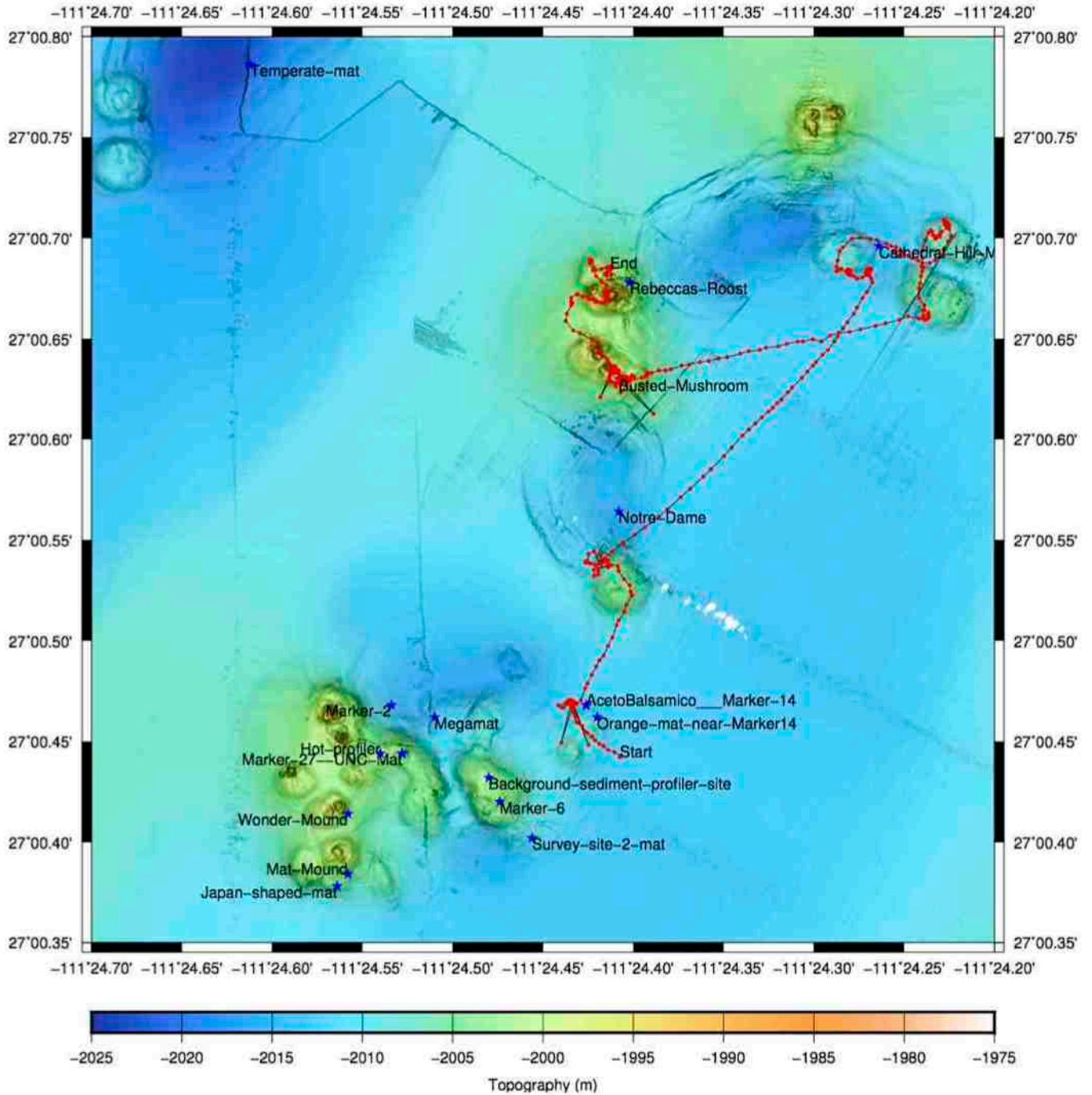
Mound with *Riftia* and orange and white mats [target 407-9]:

Lat. 27. 00766703 / Long. -111. 40718607 [decimal units]

If you have loaded your sampling basket with at least 20 Aceto balsamico mat cores, you can head northeast towards Cathedral Hill and explore the area; a map of Sentry targets in the Cathedral Hill area is provided in the sub.

Alvin Dive track 4870

Alvin Dive 4870 dive tracks from USBL



Core type	Core number	Length (cm)	Description	Supernatant	Used for:
	25	30	Bremen orange mat. 0-7.6 cm, loose brown flocs. 7.6-30 cm, gray/brown with gas gaps.	cloudy	Gunter/Emil/Min
	26	32	Bremen orange mat. 0-3.8 cm, loose brown flocs. 3.8-12.7 cm, grey/brown with small gas gaps. 12.7-32 cm, gray/brown with many gas gaps.	clear	Gunter/Emil/Min
	27	36	Gradient brown mat. 0-5.1 cm, loose brown floc and shells. 5.1-17.8 cm, gray/brown. 17.8-36 cm, gray/brown with gas gaps.	clear	UGA - Hannah
	28	24	Bremen white mat. Melted on bottom. 0-2.5 cm, loose brown floc and white filaments. 2.5-8.9 cm, gray/brown. 8.9-24 cm, gray/brown with gas gaps. 5.1 cm melted on bottom.	drained	Gunter/Emil/Min
	29	25	Bremen white mat. White mat on top. Drained. 0-25 cm, gray/brown with gas gaps.	cloudy	Gunter/Emil/Min
	30	17.8	Gradient brown mat. Some shell on top. 0-2.5 cm, loose flocs and filaments. 2.5-17.8 cm, gray/brown.	clear	Barbara
	31	7.6	Bremen orange mat. 0-7.6 cm, brown floc and orange mat. Upside-down stopper.	clear	Gunter/Emil/Min
	32	28	Gradient brown mat. Pink "worms" and shells on top. 0-5.1 cm, fine-grained loose flocs. 5.1-19 cm, gray/brown. 19-28 cm, gray/brown with gas gaps.	clear	UNC
	33	28	Gradient brown mat. Clam shells on top. 0-3.8 cm, loose brown floc. 3.8-17.8 cm, gray/brown. 17.8-28 cm, gray/brown with gas gaps.	clear	UGA

SAMPLING INFORMATION				
Site	Dive #	Lat/Long	Date	Time
Cathedral Hill, Rebecca's Roost, Aceto Balsamico mat, hot mat	4870		22 December 2016	

Site Description(s)					
WHOI (W), Long (L), Rhizon (R)					
Core type	Core number	Length (cm)	Description	Supernatant	Used for:
	1	39	Cathedral Hill. Oily! 0-39 cm brown/gray sediment with gas gaps and oil.	Drained	UGA
	2	56	Aceto Balsamico mat. 0-3.8 cm black sediment with filaments. 3.8-56 cm gray/brown sediment with gas gaps.	Drained?	Dirk
	3	56	Aceto Balsamico mat. 0-2.5 cm, black with filaments. 2.5-56 cm, brown/grey with gas gaps.	Drained	UGA
	4	53	Aceto Balsamico mat. Actively degassing. 0-5.1 cm, loose brown/black sediment with white filaments. 5.1-53 cm, gray/brown with gas gaps.	Cloudy	Ryan
	5	57	Aceto Balsamico mat. 0-3.8 cm, black with filaments. 3.8-57 cm, gray/brown with gas gaps.	Drained	UGA
	6	57	Aceto Balsamico mat. 0-11.4 cm, black with gas gaps. 11.4-57 cm, grey/brown with gas gaps.	Drained	Dan
	7	24	Cathedral Hill. Cracked tube. 0-24 cm, brown/grey with gas gaps; heavily oiled.	Drained	Barbara
	8	25	Cathedral Hill. 0-2.5 cm, loose dark brown flocs and pink worms. 2.5-10.2 cm, dark oil and grey/brown sediment with gas gaps. 10.2-25 cm, dark brown/grey sediment with oil and gas gaps. All of 2.5-25 cm heavily oiled.	Cloudy	Sam, Guangchao

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
	9	23	Rebecca's Roost. 0-5.1 cm, loose brown sediment with cracks and oil. 5.1 - 23 cm, brown/black sediment with gas gaps and oil.	Cloudy	CCU
	10	36 (uneven)	Rebecca's Roost. White filaments on top, oil on surface. 0-15 cm, brown with gas gaps. 15-36 cm, gray/brown with gas gaps and oil.	Cloudy	Guangchao
	11	16.5	Rebecca's Roost. 0-1.3 cm, grey/brown sediment with white filaments. 1.3-16.5 cm, gray/brown with gas gaps and oil.	Oil and cloudy	Barbara
	12	28	Rebecca's Roost. 0-3.8 cm, brown sediment and loose flocs. 3.8-28 cm, gray/brown with gas gaps and oil.	Very little; cloudy	Charles
	13	25	Rebecca's Roost. 0-5.1 cm, black and white crust with oil and orange mat. 5.1-25 cm, brown/gray sediment with gas gaps.	Cloudy	UNC
	14	36	Cathedral Hill. Core liner shattered. 0-36 cm, brown/gray, heavily oiled, gas gaps.	Drained	UGA
	15				
	16	28	Cathedral Hill. 0-2.5 cm, brown flocs and white crust. 2.5-15 cm, brown with gas gaps, heavily oiled. 15-28 cm, brown with gas gaps, lightly oiled.	Cloudy	Gunter/Emil/Min

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
	17	27	Separate hot site. 0-1.3 cm, loose brown floc with white sulfur (?) deposits. 1.3-27 cm, brown/black with gas gaps.	Cloudy	Barbara (filaments), Sam
	18	28	Aceto Balsamico mat. 0-5.1 cm, dark brown. 5.1-28 cm, grey/brown with gas gaps.	Drained	Barbara (filaments), UGA
	19	28	Aceto Balsamico mat. 0-5.1 cm, dark brown/black with filaments. 5.1-28 cm, gray/brown with gas gaps.	Drained	UGA
	20	34	Aceto Balsamico mat. 0-34 cm, dark brown with gas gaps.	Drained	UGA
	21	37	Aceto Balsamico mat. 0-5.1 cm, grey/brown with filaments. 5.1-37 cm, gray/brown with gas gaps.	Very little	Ryan
	22	37	Aceto Balsamico mat. 0-3.8 cm, brown/black with filaments. 3.8-37 cm, gray/brown with gas gaps.	Cloudy	CCU
	23	38	Aceto Balsamico mat. 0-5.1 cm, brown/black with filaments. 5.1-6.4 cm, gap. 6.4-38 cm, dark gray/brown with gas gaps.	None - full	UGA
	24	38	Aceto Balsamico mat. 0-5.1 cm, dark brown/black with white specks. 5.1-38 cm, gray/brown with gas gaps.	Drained	Dan

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
	25	37	Aceto Balsamico mat. 0-3.8 cm, black sediment with yellow filaments. 3.8-37 cm, gray/brown with gas gaps.	Cloudy	Dan
	26	38	Aceto Balsamico mat. 0-2.5 cm, black. 2.5-38 cm, grey/brown with gas gaps.	None visible - full	Dan
	27	38	Aceto Balsamico mat. 0-2.5 cm, black sediment with filaments. 2.5-38 cm, black/brown with gas gaps.	None visible - full	Dan
R	28	29	Aceto Balsamico mat. 0-3.8 cm, black. 3.8-29 cm, gray/brown with gas gaps.	None visible - full	Gunter/Emil/Min
R	29	27	Cathedral Hill. 0-3.8 cm, loose brown/black floc. 3.8-27 cm, brown/black with gas gaps and oil.	None visible - full	Gunter/Emil/Min
R	30	24	Cathedral Hill. Shattered tube. 0-24 cm, gray/brown with gas gaps, heavily oiled.	Drained	Gunter/Emil/Min
R	31	33	Aceto Balsamico mat. Blown core. 0-33 cm, brown/black with gas gaps and active bubbling.	Drained	Gunter/Emil/Min
R	32	38	Aceto Balsamico mat. 0-2.5 cm, black with filaments. 2.5-15 cm, brown/black with gas gaps. 15-38 cm, brown/black with large gas gaps.	Cloudy	Gunter/Emil/Min

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
	33	28	Aceto Balsamico mat. 0-5.1 cm, loose black with filaments. 5.1-28 cm large gap, then brown/gray with gas gaps.	None visible	Ryan
	34	29	Aceto Balsamico mat. 0-2.5 cm, brown/black with filaments. 2.5-3.8 cm, gap. 3.8-29 cm, gray/brown with gas gaps.	None visible	Ryan
	35	27	Aceto Balsamico mat. 0-27 cm, gray/brown with gas gaps. Obvious degassing.	None visible	Ryan
	36	38	Aceto Balsamico mat. 0-1.3 cm, black/brown with filaments. 1.3-38 cm, gray/brown with gas gaps.	None visible	UNC

Dive 4871 – December 23, 2016

Primary dive target: Primary dive target: newly discovered vent area at 27.044358 and 111.384589 [decimal coordinates]

Dive origin: Same as during dive 4863; Water depth 2000 m.

Pilot: Pat Hickey – **Pilot-in-Training:** Logan Driscoll – **Starboard obs:** Guangchao Zhuang

Objectives: sample some rock and hydrothermal sediments in this underexplored area. Heatflow measurements. Collect cores in clusters for geochemistry.

Alvin basket: three coring crates with 6 to 8 large cores, the rest short cores; 60 cm heatflow probe, slurp gun, 1 small biobox for *Riftia*. Scoop for collecting animals.

To-do-list: This is an exploratory dive at the newly mapped location with steep spires, hydrothermal mounds, and microbial mats, several miles north of the established vent areas that were sampled so far.

General strategy:

- 1) Look for interesting mats; park *Alvin* in a good coring position and measure heatflow profile; write down heatflow profile; in a large mat with different colors and surface textures, take several heatflow profiles.
- 2) For each sampling spot, collect at least some sediment cores if possible so that geochemistry can be combined with other measurements.
- 3) If heatflow temperature profiles are too high [$>130^{\circ}\text{C}$], pull cores out one by one just after they go in, before they melt.
- 4) When you find a large source of shimmering water, collect slurpgun; in a different area with strong hydrothermal flow, collect niskins.

This area has been mapped by *Sentry*, and some *Sentry* targets will be picked for the dive. Two very promising dive targets for coring have already been identified:

Sentry 408-7

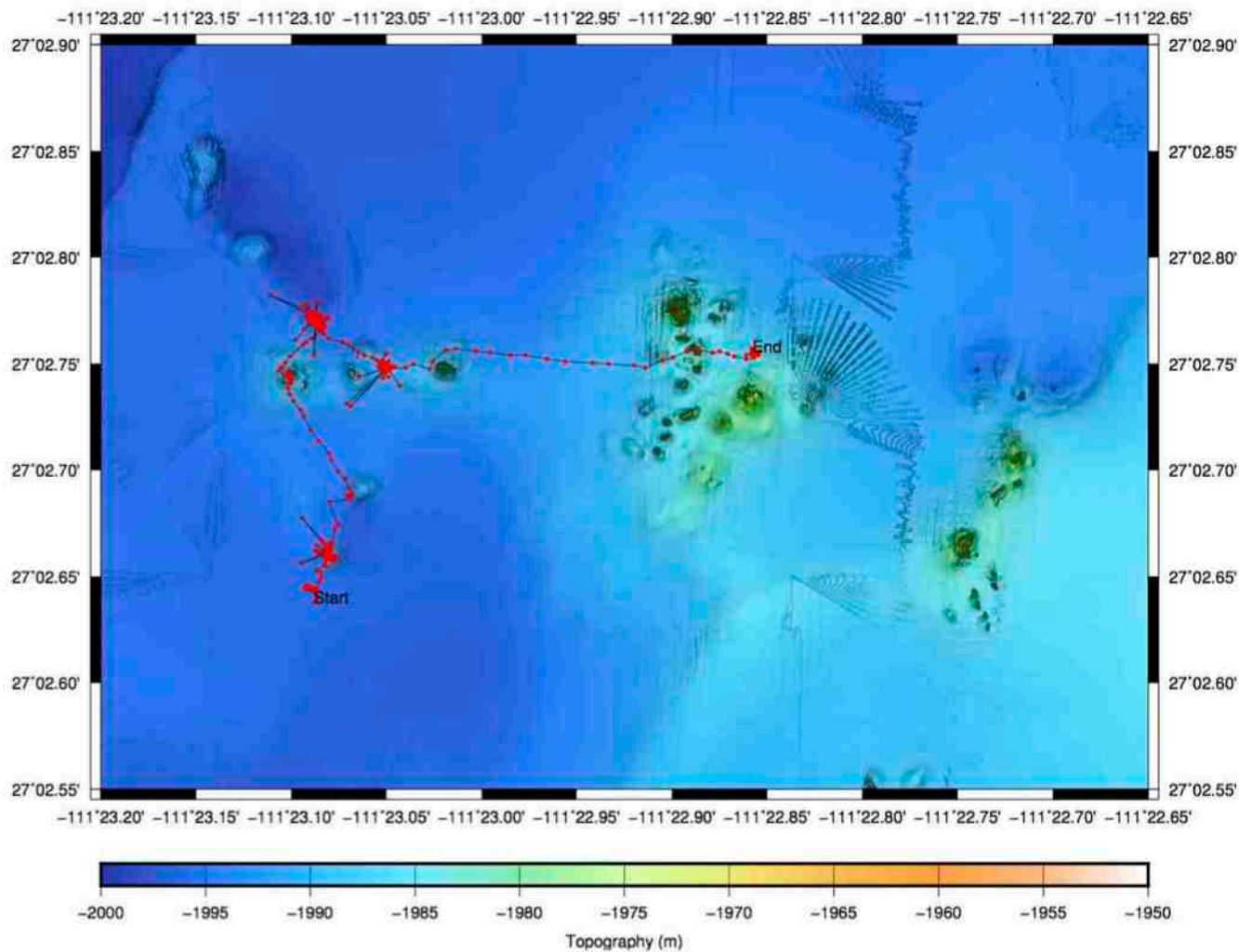
Large white mat with crusty surface, looks like the 2008/2009 Megamat
27.04584318 / -111.3841454

Sentry 408-17

Large white mat or crusts, looks again like Megamat 2008/2009
27.04608845 / -111.3848457

Alvin Dive track 4871

Alvin Dive 4871 dive tracks from USBL



SAMPLING INFORMATION				
Site	Dive #	Lat/Long	Date	Time
	4871			

Site Description(s)

WHOI (W), Long (L), Rhizon (R)

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
L	1	55	Site 3. xy 4878/5075. Hot white mat (50-92°C). 0-6.4 cm, brown/green sediment with white flecks. 6.4-55 cm, gray/brown with gas gaps.	Cloudy	UGA - Guangchao
L	2	32	Site 3. xy 4878/5075. Hot white mat (50-92°C). 0-15 cm, gray with gas gaps. 15-20 cm, void. 20-32 cm, brown/grey with gas gaps.	Cloudy	UGA
L	3	50	Site 3. xy 4878/5075. Hot white mat (50-92°C). 0-1.3 cm, loose sediment with white crust. 1.3-50 cm, gray/brown with gas gaps.	Cloudy	UGA
S	4	23, sloped	Site 1. xy 4828/4919. Orange mat (36-107°C). 0-10.2 cm, large flocs, white filaments, sulfur crust, carbonate crust. 10.2 - 23 cm, brown/gray sediment with gas gaps.	Clear	JP (carbonate for Dan)
S	5	2.5	Site 1. xy 4828/4919. Yellow mat (36-107°C). Just a rock.	"Humid" (none)	
S	6	8.9	Site 1. xy 4828/4919. Yellow mat (36-107°C). 0-2.5 cm, loose flocs and white filaments. 2.5-8.9 cm, black/brown with clastics and gas gaps.	Cloudy	Barbara
	7				
S	8	15	Site 1. xy 4828/4919. Yellow mat (36-107°C). 0-5.1 cm, brown flocs and yellow filaments. 5.1-15 cm, gray/brown sediments.	Cloudy	Barbara (filaments), Sam

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
S	9	17.8	Site 1. xy 4828/4919. Background. 0-7.6 cm, loose brown sediment. 7.6-17.8 cm, gray/black.	Clear	CCU
S	10	20	Site 1. xy 4828/4919. Yellow mat (36-107°C). 0-5.1 cm, loose brown sediment with white filaments. 5.1-20 cm, brown with gas gaps and shells.	Clear	Barbara (filaments)
S	11	28	Site 1. xy 4828/4919. Yellow mat (36-107°C). 0-5.1 cm, loose brown sediment with filaments. 5.1-16.5 cm, gray/brown sediment and 1.3 cm gap. 16.5-28 cm, gray/brown sediment with gas gaps.	Cloudy	CCU
S	12	25	Site 2. xy 4813/5137. Cool white mat (7-14 °C). 0-14 cm, black sediment with gas gaps. 14-25 cm, gray/brown sediment with gas gaps.	Cloudy, disturbed	UGA - Guangchao
L	13	50	Site 3. xy 4878/5075. Hot white mat (50-92°C). 0-3.8 cm, loose sediment with white bits. 3.8-50 cm, gray/brown sediment with gas gaps.	Cloudy	UGA
L	14	46	Site 2. xy 4813/5137. Cool white mat (7-14 °C). 0-10.2 cm, black sediment and gas gaps. 10.2 - 20 cm, brown/gray sediment with gas gaps. 20 - 46 cm, brown/gray sediment with many gas gaps.	Cloudy	UGA
L	15	53	Site 2. xy 4813/5137. Cool white mat (7-14 °C). 0-19 cm, black sediment with many gas gaps. 19-53 cm, brown/gray with gas gaps.	Cloudy	UGA
S	16	33	Site 2. xy 4813/5137. Cool white mat (7-14 °C). 0-8.9 cm, black with gas gaps. 8.9-33 cm, gray/brown with gas gaps.	Cloudy	UGA

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
S	17	34	Site 2. xy 4813/5137. Cool white mat (7-14 °C). 0-8.9 cm, black with gas gaps. 8.9-34 gray/brown with gas gaps.	None	UGA
S	18	28	Site 2. xy 4813/5137. Background. 0-2.5 cm, loose brown flocs. 2.5-28 cm, dark brown with no gas gaps.	Clear	CCU??
S	19	14	Site 2. xy 4813/5137. Cool white mat (7-14 °C). Lost some into Dan's clothes. 0-14 cm dark brown/black, well mixed. *possibly no stopper*	None	UGA
S	20	34	Site 2. xy 4813/5137. Cool white mat (7-14 °C). 0-11.4 cm, black with gas gaps. 11.4-34 cm, gray/brown with gas gaps.	Cloudy	Gunter/Emil/Min
S	21	36	Site 2. xy 4813/5137. Cool white mat (7-14 °C). 0-7.6 cm, black with gas gaps. 7.6-20 cm, brown/black with gas gaps. 20-36 cm, gray/brown with gas gaps.	Cloudy	UGA - Guangchao
R	22	25	Site 2. xy 4813/5137. Cool white mat (7-14 °C). 0-3.8 cm, black. 3.8-25 cm, gray/brown with gas gaps.	None	Gunter/Emil/Min
R	23	34	Site 3. xy 4878/5075. Hot white mat (50-92°C). 0-3.8 cm, loose brown sediment. 3.8-34 cm, gray/brown sediment gas gaps.	Cloudy	Gunter/Emil/Min
S	24	16.5	Site 4. xy 5211/5090. Hot orange mat (102-107°C). 0-1.3 cm, loose brown flocs. 1.3 - 16.5 cm, gray/brown with gas gaps.	Cloudy	Barbara (filaments), Sam

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
L	25	51	Site 1. xy 4828/4919. Orange mat (36-107°C). 0-5.1 cm, loose brown floc and little pink worms. 5.1-12.7 cm, medium grain carbonate crust. 12.7-25 cm, brown with gas gaps. 25-51 cm, gray/brown sediment gas gaps.	Clear	CCU
S	26	36	Site 3. xy 4878/5075. Hot white mat (50-92°C). 0-2.5 cm, black flocs and white crust. 2.5-36 cm, gray/brown sediment with gas gaps.	Cloudy	Gunter/Emil/Min
S	27	25	Site 4. xy 5211/5090. Hot orange mat (102-107°C). 0-2.5 cm, loose brown flocs and filaments. 2.5-12.7 cm, gray with gas gaps. 12.7-25 cm, gray/brown with gas gaps.	Cloudy	UNC
S	28	37	Site 3. xy 4878/5075. Hot white mat (50-92°C). 0-2.5 cm, loose brown floc and white crust. 2.5-17.8 cm, dark brown with gas gaps. 17.8-37 cm, dark brown/grey with gas gaps.	Cloudy	Gunter/Emil/Min
S	29	29	Site 3. xy 4878/5075. Hot white mat (50-92°C). 0-3.8 cm loose brown and white crust. 3.8-11.4 cm, gray/brown with gas gaps.	Cloudy	UGA
S	30		Site 4. xy 5211/5090. Hot orange mat (102-107°C). LOST.	Cloudy	

Dive 4872 – December 24, 2016

Primary dive target: Rebecca's Roost area, 27°N00.68"/-111°W24.40"

Dive origin: 27°N00.68"/-111°W24.40"; Water depth 2000 m.

Pilot: Jefferson Grau – **Portside Observer:** Andreas Teske – **Starboard observer:** Samantha Waters

Objectives: sample hydrothermal sediments with classic *Beggiatoa* mats in Cathedral Hill, Rebecca's Roost and Big Pagoda area.

Alvin basket: three coring crates with 6 to 8 large cores, the rest short cores; 60 cm heatflow probe, slurp gun, 1 small biobox for *Riftia*. Scoop for collecting animals.

To-do-list: This is the last opportunity to sample classic *Beggiatoa* mats.

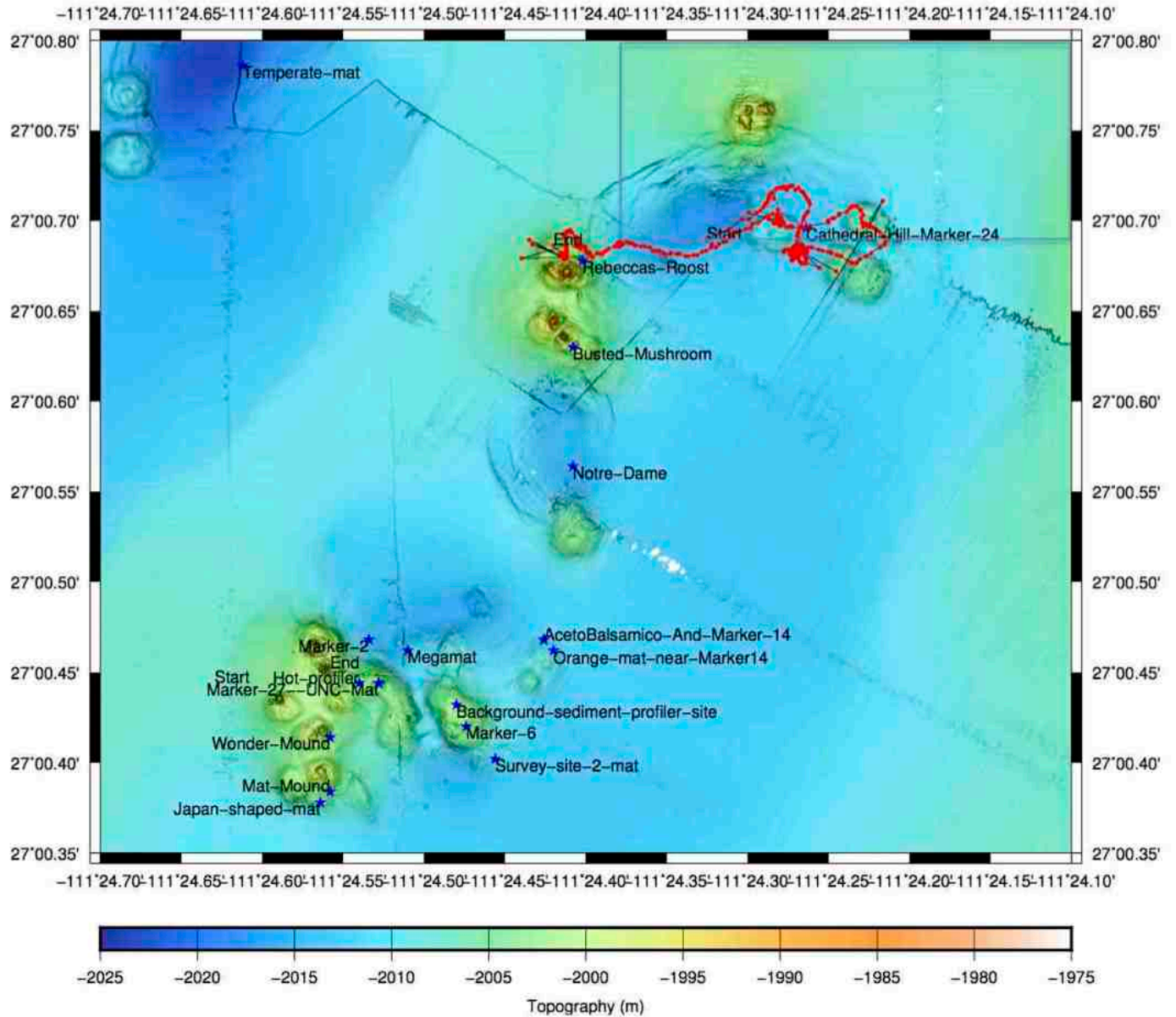
General strategy:

- 1) Look for classic *Beggiatoa* mats; park *Alvin* in a good coring position and measure heatflow profile; write down heatflow profile; in a large mat with different colors and surface textures, take several heatflow profiles.
- 2) For each sampling spot, collect at least some sediment cores if possible so that geochemistry can be combined with other measurements.
- 3) If heatflow temperature profiles are too high [$>130^{\circ}\text{C}$], pull cores out one by one just after they go in, before they melt.
- 4) When you find a large source of shimmering water, collect slurp gun; in a different area with strong hydrothermal flow, collect niskins.

This area has been mapped by *Sentry*, and some *Sentry* targets will be picked for the dive.

Alvin Dive track 4872

Alvin Dive 4872 dive tracks from USBL



SAMPLING INFORMATION				
Site	Dive #	Lat/Long	Date	Time
Cathedral Hill	4872			

Site Description(s)

WHOI (W), Long (L), Rhizon (R)

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
	1	52	Gradient - brown. 0-1.3 cm, loose brown flocs. 1.3 - 52 cm, gray/brown.	clear	UNC
	2	53	Gradient - brown. 0-1.3 cm, dark brown flocs. 1.3 - 53 cm, brown.	clear	CCU
R	3	55	Gradient - white. 0-2.5 cm, loose brown flocs and filaments. 2.5 - 55 cm, gray/brown.	clear	CCU
	4	33	Gradient - brown. 0-5.1 cm, loose brown flocs. 5.1-33 cm, gray/brown.	clear	Barbara
	5	38	Gradient - brown. 0-38 cm, brown.	none	Hannah
	6	37 (sloped)	Gradient - white. Pink worms. 0-2.5 cm, brown flocs. 2.5-37 cm, gray/brown.	clear	UNC
	7	34	Cluster - orange. 0-5.1 cm, loose dark brown flocs. 5.1-34 cm, gray/brown.	clear	UGA
	8	38	Cluster - orange. 0-2.5 cm, dark brown with filaments. 2.5 - 38 cm, gray/brown.	none	UGA

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
	9	27	Cluster - orange. 0-3.8 cm, loose brown sediment with filaments. 3.8 - 27 cm, gray/brown.	none	UGA - Guangchao
	10	28	Cluster - orange. 0-2.5 cm, dark brown flocs and filaments. 2.5 - 28 cm, gray/brown.	none	Dan
	11	29	Cluster - orange. 0-2.5 cm, loose brown flocs and filaments. 2.5 - 29 cm, gray/brown.	none	UGA
R	12	29	Dirk - white. 0-29 cm, gray/brown with fractures and oil	none	Dirk
	13	52	Gradient - white. White and pink filaments and worm on top. 0-3.8 cm, brown floc. 3.8 - 42 cm, gray/brown. 42-52 cm, brown with gas gaps.	clear	Barbara
	14	43, sloped	Gradient - orange. Bubbling on way up? 0-5.1 cm, dark brown flocs. 5.1 - 17.8 cm, gray/brown. 17.8 - 43 cm, tube frosted by heat.	cloudy	UNC
	15	41 ("burnt")	Gradient - orange. Bubbling on way up? Two pink worms. 0-6.4 cm, loose brown floc. 6.4-23 cm, gray/brown with cracks. 23 - 41 cm, welded shut.	clear	CCU
	16	38	Gradient - white. 0-2.5 cm, loose brown floc and filaments. 2.5 - 38 cm, gray/brown.	none	Hannah

Core type	Core number	Length (cm)	Description	Supernatant	Used for:
R	17	36	Gradient - orange. 0-5.1 cm, loose brown floc and orange filaments. 5.1 - 36 cm, gray/brown with oil. Tube split/shattered/melting.	clear	Bremen
	18	38	Gradient - orange. 0-3.8 cm, loose floc and filaments. 3.8 - 17.8 cm, gray/brown with cracks. 17.8 - 23 cm, gray/brown with oil. 23-38 cm, gray/brown.	none	Barbara (filaments for Dirk?)
	19	30	Cluster - orange. 0-2.5 cm, loose floc with filaments. 2.5 - 30 cm, gray/brown.	none	UGA
	20	27	Cluster - orange. 0-3.8 cm, loose brown floc and filaments. 3.8 - 27 cm, gray/brown.	cloudy	Dan
	21	53	Cluster - orange. 0-6.4 cm, dark brown flocs and mat. 6.4 - 53 cm, gray/brown with gas gaps.	cloudy	UGA - Guangchao
	22	29	Dirk - white. 0-2.5 cm, loose brown flocs and white filaments. 2.5 - 29 cm, gray/brown.	cloudy	Dirk
	23	23	Dirk - white. White filaments on top. 0-23 cm, gray/brown.	clear	Dirk
	24	29	Dirk - white. 0-2.5 cm, loose brown floc and filaments, worms. 2.5 - 29 cm, gray/brown.	none	Dirk