

NeMO 2012 Cruise Report

Axial Volcano, Juan de Fuca Ridge

Marcus Langseth Cruise MGL1216

August 16-26, 2012, Astoria, Oregon to Astoria, Oregon

Jason Dives J2-660 to J2-663

Chief Scientists: David Butterfield, Univ. of Washington and NOAA/PMEL

Maurice Tivey, Woods Hole Oceanographic Institution

R/V Langseth Captain: Jim O'Loughlin

Jason Expedition Leader: Akel Kevis-Stirling

Cruise Report Prepared by: David Butterfield

Maps prepared by: Andra Bobbitt, PMEL-Newport

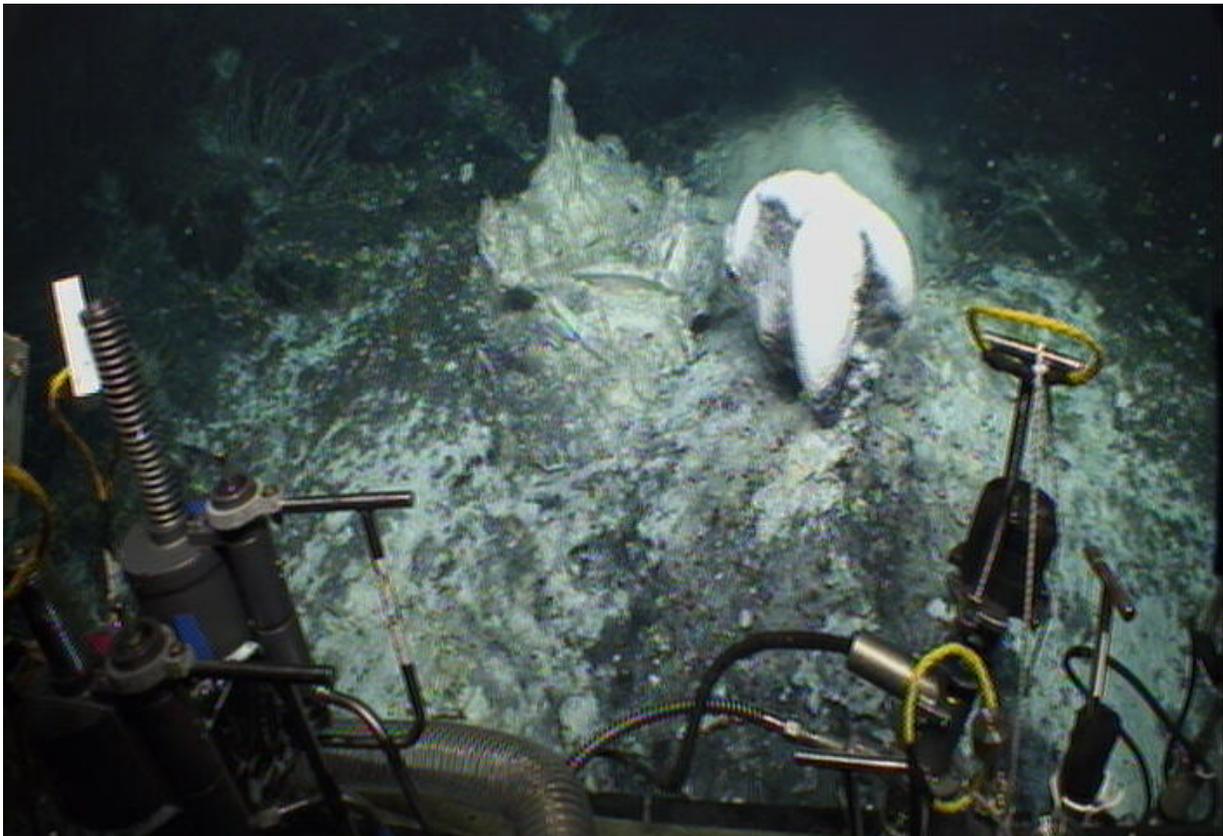


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1. NeMO 2012 Expedition Summary

The 2012 NeMO expedition was in real danger of being cancelled when the R/V *Thompson* suffered major damage to the Z-drive system and could not be repaired in time for the start date. We were extremely fortunate to have support from UNOLS, NSF, Lamont-Doherty Earth Observatory, the University of Washington and NOAA to quickly transfer the expedition from the *Thompson* to the R/V *Marcus Langseth*. Heroic efforts were involved to overcome both logistical and administrative obstacles. We are deeply grateful to Matt Heintz, Akel Kevis-Stirling and the stellar Jason group, Rose DuFour at NSF, Jon Alberts and others at UNOLS, Sean Higgins and all the staff at LDEO, Captain O'Loughlin and the crew of the *Langseth*, for making this expedition happen. The science party also went to great lengths to adapt to changing conditions. We were the only cruise to make seafloor observations at Axial Seamount this year, providing a critical look at the hydrothermal system 16 months after the April 2011 eruption.

The cruise involved multiple projects, including ODP drill-hole CORK instrument maintenance and optical communication work by Maurice Tivey and Norm Farr of WHOI, as well as a self-calibrating pressure sensor project by Glenn Sasagawa and Mark Zumberge of UCSD-SIO.

The ship departed Astoria at noon PDT on August 16 and arrived at Axial Seamount at 14:30 PDT on 8/17. USBL nav system calibration required 5 hours. Jason mechanical/hydraulic issues and repairs resulted in an overnight repair. We conducted the first CTD cast over ASHES at 08:00 local on 8/18. The Jason fiber optic cable was damaged during CTD ops and resulted in a further delay of the dive. A second CTD cast over Vixen/Coquille was done at 14:00 local. Jason was launched at 19:00 local on 8/18 for dive J2-660 at ASHES. This dive combined installation of Glenn Sasagawa's self-calibrating pressure instrument, deployment of a heat-flow blanket for Paul Johnson, Optical Comms hardware testing for the WHOI group, temperature recorder recovery and deployments, and extensive fluid chemistry/microbiology sampling around the ASHES field. The Jason winch level-winch was not operating properly from the beginning of this dive, resulting in significant delays during the descent and ascent. Following ROV recovery, a third CTD cast was done at a "background" site west of the caldera at 16:00 local on 8/19. The 4th CTD cast was done at 18:30 local on 8/19 over Castle vent. The second dive J2-661 entered the water on 8/19 just before midnight, and descent took 2 hours 20 minutes due to winch problems. We were able to complete a long transect from Trevi/Magnesia area to Vixen/Casper vent. One of the important observations was that the snow-blower vent activity had virtually ceased in many of the areas that were actively venting in 2011, but some low-level snowblower activity remained in the Boca vent area. Because the winch could not be operated safely, we were compelled to return to Astoria to repair it. After the ROV was recovered from dive 661, we made a transit north to deploy Maurice Tivey's ocean drifter buoys and then transited back south to Astoria to take on spare parts and a winch expert. With the amount of time lost due to mechanical problems and transit, the time remaining in the cruise would have to be spent at Middle Valley in order to get the minimum required work on the CORKs done. With no possibility of collecting additional samples and with uncertainties in the cruise end date due to potential weather delays, the chemistry/microbiology group and the SIO group elected to leave the ship during the short port call in Astoria and finish laboratory

experiments in Seattle. Maurice Tivey assumed chief scientist duty. After spending approximately 8 hours in port, the Langseth departed Astoria in transit to Middle Valley CORK sites 857D and 1025C, and completed two 10-hour dives. The Langseth returned to port on the originally scheduled date of 8/26.

2. Cruise Participants

Name	Employer	Role	Expertise
David Butterfield	U.W.	Chief Scientist	Chemistry
Maurice Tivey	WHOI	Co-Chief Scientist	Geophysics
Akel Kevis-Stirling	WHOI	Expedition Leader	Jason
Norman Farr	WHOI	PI	Engineering
Glenn Sasagawa	UCSD	PI	Geophysics
Marvin Lilley	U.W.	PI	Gas Chemistry
James Holden	U.Mass.	PI	Microbiology
Kevin Roe	U.W.	Senior Tech	Chemistry
Leigh Evans	O.S.U.	Senior Tech	Gas Chemistry
Edward Mitchell	O.S.U.	Senior Tech	Pharmacology
Oliver Vining	O.S.U.	Post-Doc	Pharmacology
Emily Reddington	MBL	Post-Doc	Microbiology
Lucy Stewart	U.Mass.	Grad Student	Microbiology
Coquille Rex	U.W.	Tech	Data/Photography
Ron Greene	O.S.U.	Senior Tech	CTD/helium
Seth Shuler	U.W.	Tech	Chemistry
Masako Tominaga	Mich. St. U.	PI	Geophysics
Jonathan Ware	WHOI	PI	Engineering
Clifford Pontbriand	WHOI	Tech	Engineering
Leo-Paul Pelletier	WHOI	Tech	Engineering
David Price	UCSD	Senior Tech	Geophysics
William Davis	UCSD	Engineer	Geophysics
James Varnum	WHOI	Jason Pilot	Engineering
Scott Hansen	WHOI	Jason Pilot	Engineering
Dara Scott	WHOI	Jason Pilot	Pilot / Navigation
Scott McCue	WHOI	Jason Data Mgr	Data / Navigation
Andrew Billings	WHOI	Jason Tech	Engineering
Robert Elder	WHOI	Jason Tech	Engineering
Mario Fernandez	WHOI	Jason Tech	Engineering
Korey Verhein	WHOI	Jason Tech	Engineering
Tom Spoto	LDEO	Marine Tech	Marine Tech
Bernard McKiernan	LDEO	Marine Tech	Marine Tech
Stephen Jalickee	U.W.	Marine Tech	CTD

3. Cruise Log MGL-1216

Note: Local time: 7 hrs behind GMT

<u>Date/Time</u> <u>UTC</u>	<u>Local</u> <u>Time</u>	<u>Comments</u>
19:00 jd=229 Thurs. Aug 16	Noon	Departed Astoria In transit all day Multibeam EM-122 turned on Waypoint: 45 deg 55.99'N, 129 deg 58.94' W, depth 1520m,
16:00 Aug 17 Fri. jd=230	09:00	Just received a message from the vessel Dependable (a cable layer ship for RSN Regional Scale Node cable) who is on site at Axial and requesting 2 mile radius for operations. Dave Butterfield spoke with Deb Kelley at UW and then radioed and spoke with the ship (via VHF). It looks like they are at 45 56.553'N 129 58.43'W with an ROV working on the cable for the next one or two days. We will need to change plans and dive at ASHES vent field first on the western caldera wall with approval from the cable ship. Details were agreed to by email and a second radio call.
20:25 Aug 17 Fri jd=231	13:25	Arrive on station at Axial Seamount ASHES site ASHES 45 deg 56.0' N, 130 0.05'W
20:28	13:28	Launch XBT probe Water depth 1547 m
		Navigation Survey to test/calibrate USBL setup – 5 hrs Drop acoustic beacon “Cassius” at: 45 deg 56.169'N, 130 deg 0.73'W Test ship’s DP system with Jason ops control – 1 hr
03:25 Aug 18 Sat jd=232	20:25	In the water with the Scripps bottom pressure recorder at ASHES vent site location using the CTD winch and a release. 45 deg 56.092'N 130 deg 0.658'W 1543 m depth
	21:19	Released Scripps bottom recorder Coming back at 55 m/min on winch
	21:53	CTD winch wire end and weight back on deck. Prep for Jason dive.
05:30 Aug 18	22:30	Problem with Jason hydraulics occurred during pre-dive. Cannot dive until fixed. Working on diagnosis. Ship standing by.
09:00 Aug 18	02:00	Scrub the dive. Will be fixing the hydraulic system on Jason. Will do a series of CTD’s

<u>Date/Time</u> <u>UTC</u>	<u>Local</u> <u>Time</u>	<u>Comments</u>
16:16 Aug 18	9:16	CTD #1 ASHES field 45 56.01'N 130° 00.82'W
18:17 Aug 18	11:17	CTD back on deck. Process samples. Prep for next CTD.
23:00 Aug 18 jd=232	16:00	CTD #2 Vixen vent 45 55.05'N 129 59.59'W
00:32 Aug 19	17:32	CTD back on deck
02:00 Aug 19 jd=233	19:00	START JASON DIVE 660 Launched Jason at the Scripps SCPR release location. We will check on the SCPR, move it if necessary, then deploy the thermal blanket. Jason will then move west into the ASHES field approximately 200 m to the SW for chemistry/microbiology sampling and temperature recorder recovery/deployment. 45 deg 56.2515'N 130 deg 0.7939'W 1537 m depth
		Moved the Scripps Self Calibrating Pressure Recorder (SCPR) to a flatter area. Checked acoustic comms to the SCPR to collect data.
07:11	00:11	Moved to new lava flow ~ 200 m south and deployed Thermal blanket 'K' at 45 deg 56.0386'N 130 deg 0.5951'W depth 1537 Proceed on to ASHES vent field for fluid sampling
19:07 Aug 19 jd=233	12:07	The SCPR secondary burnwire release worked. Jason released the acoustic nav transponder (Cassius) by pull-pin. Cassius and SCPR recovered on the surface.
20:00 Aug 19 jd=233	13:00	End of Jason dive, coming up
22:15 Aug 19 jd=233	15:15	Jason on deck END JASON Dive 660 Pull the transducer pole.
23:55 Aug 19 jd=233	16:55	CTD #3, Background west of caldera 45 deg 55.503'N 130 deg 02.986'W depth 1566 m
01:29 Aug 20 Jd=234	18:29	CTD#3 back on deck Move ship to next location

<u>Date/Time</u> <u>UTC</u>	<u>Local</u> <u>Time</u>	<u>Comments</u>
02:30 Aug 20 Jd=234	19:30	CTD#4 Launch at Castle vent: 45 deg 56.766'N 129 deg 59.088'W depth 1519.6 m
03:57 Aug 20 Jd=234	20:57	Recover CTD#4 Stand by for the next operation
07:11 Aug 20 Jd=234	00:57	START JASON Dive 661 Launch target is Trevi vent, eastern side of Axial caldera
09:29 Aug 20 Jd=234	02:57	Winch problems on descent. Jason now on bottom for sampling/observation transect on eastern side of Axial caldera. Depth 1518 m
11:45 Aug 21 Jd=235	04:45	END JASON DIVE 661 Jason on deck Head north to Middle Valley to begin magnetic drifter deployments while we figure out how to fix the level wind issue with the winch
22:30 Aug 21	15:30	Begin deployment of magnetic drifters
	15:33	Deploy "sleepy" (x19370) 47 deg 41.901'N 129 deg 04.048'W
	15:46	Deploy "grumpy" (x11070) 47 deg 42.929'N 129 deg 03.978'W
	15:58	Deploy "sneezy" (x66760) 47 deg 43.953'N 129 deg 04.000'W
	16:09	Deploy "doc" (x67740) 47 deg 44.938'N 129 deg 03.990'W
	16:20	Deploy "dopey" (x68760) 47 deg 45.940'N 129 deg 03.990'W
	16:31	Deploy "bashful" (x68740) 47 deg 46.930'N 129 deg 03.987'W
23:31 Aug 21 Jd=235	16:31	End of magnetic drifter deployments
23:40 Aug 21		Steaming into Astoria for repairs to Jason winch ETA at pilot buoy at 11:00 local Aug 22

<u>Date/Time</u> <u>UTC</u>	<u>Local</u> <u>Time</u>	<u>Comments</u>
20:40 Aug 22 Jd=236	13:40	Arrive in Astoria Work on repairing the winch. Dave Butterfield and NeMO science crew disembark. Glenn Sasagawa and SIO science group disembark.
02:46 Aug 23 Jd=237	19:46	Depart Astoria Will head out about 25 miles to 750 m deep water to test the winch and level wind.
06:20 Aug 23	23:20	Stop at water depth of ~900 m to run winch test Deploy Medea on its own and run the winch down to 650 m
07:30 Aug 23 Jd=237	00:30	Winch test is a success! Begin transit to CORK 857D Winds at 20kts, weather a potential issue
03:00 Aug 24 Jd=238	20:00	Arrive at CORK 857D Begin prep for Jason Dive Deploy USBL pole
04:00 Aug 24 Jd=238	21:00	Jason DIVE 662 Jason in the water and going down
05:30 Aug 24		Plug-in Jason ODI to CORK and begin download of data 1 hr 41 min download time Begin process to download the CORK data Following instructions: Use the HP mini computer booted into linux Run Konsole cd Cruises/Jason2012/mgl1216 >mlterm -l 12j857d_1.log >menu Hit I for info Hit D for download Started download File: 12j857d_1.raw

<u>Date/Time</u> <u>UTC</u>	<u>Local</u> <u>Time</u>	<u>Comments</u>
07:00 Aug 24		Download time is only 1 hr 45 mins Finished downloading 253812 sectors downloaded. Checked time offset Cork reported 86437.710 secs ahead (NOTE Computer was one day behind 86400 secs) so actual Did NOT reset clock on CORK Did NOT clear memory on CORK Z - to say bye - deploy the cork logger and disconnect. Turn power off to ODI connector Unplug ODI
08:00 Aug 24		Successful download of ODI (rs422) 857D Disconnect the Jason ODI and plug in the Optical Lander ODI modem
09:00 Aug 24		Move over to download the old 857D logger via the SeaCon connector. Have trouble at first with connection, but after a second go at plugging in we are successful in connecting and getting comms. Download the SeaCon data ~ 25 mins
09:26 Aug 24	02:26	Successful download of SeaCon (rs232) old 857D logger
09:31 Aug. 24	02:31	Now start testing of optical modem Not successful at first due to configuration issues
11:28 Aug 24 Jd=238	04:28	Had to replug into CORK with ODI a second time to check CORK logger was in the proper mode. Now recheck optical comms and things are working now. Optical modem acoustics was slamming the optical data.
12:42 Aug 24	05:42	Leave the bottom and coming up
14:20 Aug 24 Jd=238	07:20	JASON back on deck END JASON DIVE 662
16:10 Aug 24 Jd=238	09:10	CTD in the water at CORK 857D Optical comms head mounted on rosette Avtrak on for tracking Going down to 2300 m depth Test successful at slant ranges ~120 m Bring CTD back up
18:19 Aug. 24 Jd=238	11:19	CTD on deck Secure CTD on deck and then work on raising the USBL pole

<u>Date/Time</u> <u>UTC</u>	<u>Local</u> <u>Time</u>	<u>Comments</u>
19:00 Aug. 24 Jd=238	12:00	Begin transit to Hole 1025C Will find location of magnetic drifter "doc" who is not working properly and try and recover.
22:12	15:12	Spotted drifter 'doc'
22:34 Aug. 24 Jd=238	15:34	Recovered drifter 'doc' Continue transit to CORK 1025C
23:10 Aug 24	16:10	Arrive at CORK 1025C 47 deg 53.2470 'N 128 deg 38.9190'W
23:50 Aug 24 Jd=238	16:50	Deploy the CORK logger with a weight stack and 3 balls of floats Deploy the USBL pole over the side
01:09 Aug 25 Jd=239	18:09	Start JASON DIVE 663
02:43 Aug 25	19:43	Land at bottom near CORK logger floats. Depth 2610 m Drive over to 1025C CORK first to unload optical lander.
		Unload lander and look at where we need to plug in to on CORK
		Drive back to get CORK logger and floats Cut away floats and weights from CORK logger. Will come back and release floats at the end of the dive Drive over to CORK 1025C
		At CORK 1025C and deploy the CORK logger Undo the pressure connection and then try to connect to the well head stack. Difficult maneuver as the connection is almost hidden. Need to use the camera on the Schilling manip to view the connector while using the Kraft manip to plug in pressure connector. Success, although it is difficult to know if connector is in properly. Now plug in ODI from Optical modem to the CORK logger Move off and test optical download after some data has accumulated. Data seems to be OK.
08:31 Aug 25 Jd=239	01:31	Jason is on the way up. We have floats hitting the surface first, so recover those.
10:00 Aug 25	03:00	Jason on deck END of JASON DIVE 663

<u>Date/Time</u> <u>UTC</u>	<u>Local</u> <u>Time</u>	<u>Comments</u>
11:05 Aug 25	04:05	CTD in the water at 1025C 47 deg 53.2470 'N 128 deg 38.9190'W
		CTD down to 2500 m Do the optical comms tests. Successful download
12:50 Aug 25	05:50	CTD back on deck
13:05 Aug 25	06:05	Recover the USBL pole
13:15 Aug 25	06:15	Ship underway to Astoria.
15:09 Aug 26 Jd=239	08:09	Columbia River Pilot on board 46 deg 13.10'N 124 deg 15.78'W
18:00 Aug 26	11:00	At dock, Astoria END OF CRUISE

3.1 Cruise Operations Summary

Loading and setting up science gear on the ship took 2.5 days. The ship departed Astoria at noon on August 16. [A critical piece of science gear was missing and required a last-minute delivery from Seattle to the ship, but this resulted in only a 3-hour delay in departure time.] En route to Axial Seamount we learned that the cable ship "*Dependable*" was still on site at Axial installing the primary node near our intended first dive site. We negotiated a safe distance of 1.5 km with *Dependable* by radio communications and changed our dive plan to start at the ASHES field. We arrived at Axial at 14:30 on 8/17. USBL nav system calibration required 5 hours. Pre-dive check showed a major problem with Jason hydraulics. Diagnostics took until 2 a.m. local, followed by a demanding overnight repair. We conducted the first CTD cast over ASHES at 08:00 local on 8/18. The Jason fiber optic cable and the CTD both use the A-frame and an error in the CTD launch procedure resulted in damage to the Jason fiber-optic tether. This required further trouble-shooting and repair before Jason could be declared ready to dive. A second CTD cast over Vixen/Coquille was done at 14:00 local. Jason was launched at 19:00 local on 8/18 for dive 660 at ASHES. This dive combined installation of Glenn Sasagawa's self-calibrating pressure instrument, deployment of a heat-flow blanket for Paul Johnson, Optical Comms hardware testing, temperature recorder recovery and deployments, and extensive fluid chemistry/microbiology sampling around the ASHES field. The Jason winch level-wind was not operating properly from the beginning of this dive, resulting in significant delays during the descent and ascent. Dive 660 was 20 hours deck-to-deck with 14 hours of bottom time. After J2-660, a third CTD cast was done at a "background" site

west of the caldera at 16:00 local on 8/19. The 4th CTD cast was done at 18:30 local on 8/19 over Castle vent. Jason and ship's personnel worked on the winch level-wind problem while on deck. The second dive J2-661 entered the water on 8/19 just before midnight, and descent took 2 hours 20 minutes due to winch problems. It was decided during the dive that the temporary fix for the winch level-wind was not safe and we could not continue to use the winch until adequate repairs could be made. Because we were diving on flat terrain, we were able to continue the dive to cover a long transect from Trevi/Magnesia area to Vixen/Casper vent. We could not enter the International District vent field due to the high relief there. The second dive (661) was 28.5 hours deck-to-deck with 24 hours of bottom time. The only way to continue the ROV operations following the second dive was to return to Astoria after winch replacement parts could be delivered there. After the ROV was recovered from dive 661, we made a transit northeast to deploy the ocean drifter buoys and then transited back southeast to Astoria to take on spare parts and a winch expert. With the amount of time lost due to mechanical problems and transit, the time remaining in the cruise would have to be spent at Middle Valley in order to get the minimum required work on the CORKs done. With no possibility of collecting additional samples and with uncertainties in the cruise end date due to potential weather delays, the chemistry/microbiology group elected to leave the ship during the short port call in Astoria and finish laboratory experiments in Seattle. Maurice Tivey assumed chief scientist duty. The Langseth departed Astoria in transit to Middle Valley CORK sites 857D and 1025C after spending approximately 8 hours in port. Two dives were completed, each of about 10 hour duration, at the two CORK sites. The Langseth returned to port on the originally scheduled date of 8/26.

Major Cruise Operations

8/17 25 hours transit to Axial
8/17 7 hours Nav survey
8/17 4 hours Scripps mooring deployment
8/18 17 hours Jason hydraulics down time , 2 CTD casts
8/18 20 hour Jason dive around ASHES
8/19 2 CTD casts
8/20 26 hour Jason dive SE caldera
8/21 12 hr transit toward Middle Valley and drifter deployment
8/22 20 hr transit to Astoria for winch repair
8/23 depart Astoria and test winch
8/23 24 hr transit to Middle Valley
8/24 10 hr dive at 857D CORK plus CTD Optical Comms
8/24 10 hr dive at 1025C CORK plus CTD Optical Comms
8/25 26 hour transit to Astoria
8/26 Arrive Astoria

4. Background

Long-term Objectives of the NeMO Project at Axial Seamount

This cruise was a combination of several programs and multiple PIs funded by NSF, NOAA, and the Gordon and Betty Moore Foundation (GBMF) Marine Microbiology Initiative. David Butterfield of the University of Washington and NOAA Pacific Marine Environmental Lab was chief scientist, and in charge of the chemistry and microbiology work at Axial Seamount, with dives funded by NOAA to support the NeMO long-term observatory at Axial Seamount and additional science funding through a multi-investigator collaborative grant led by Julie Huber of the Marine Biological Lab at Woods Hole. Microbiologist Jim Holden, of U. Mass. Amherst, is also a PI on the GBMF project and was onboard to conduct sampling and shipboard experiments. NeMO and associated projects are collecting data to understand fundamental processes and rates in microbial ecology and to learn how hydrothermal ecosystems on undersea volcanoes evolve with volcanic eruption cycles. Axial Seamount erupted in 1998 and 2011. The NeMO project began in 1998 and has involved submersible operations in nearly every year since then. Monitoring instruments including geophysical sensors (hydrophones, bottom pressure and tilt recorders), temperature sensors, and chemical sampling instruments have been deployed and maintained over many years. We are interested in the long-term cycles and ecology of this volcanic/hydrothermal ecosystem. Other collaborating scientists include Bill Chadwick (PMEL/Oregon State, volcanology), Bob Dziak (PMEL/Oregon State, acoustics), Marv Lilley (U. Washington, gas chemistry), Giora Proskurowski (UW, isotope geochemistry of gases) and Kerry McPhail (Oregon State, pharmacology).

Geophysicist Glenn Sasagawa of UCSD is funded by NSF to develop, test and deploy a self-calibrating, high-precision pressure sensor, capable of measuring tsunamis or small vertical ground motions over long periods. Glenn and UCSD engineers were on board to deploy and test this new instrument.

Specific 2012 NeMO Objectives

Following the 2011 eruption, our goals were to:

- collect time-series samples for chemistry and microbiology
- document vent sites with video and still photography
- recover a time-series water sampler (RAS) mooring
- re-deploy time-series water sampler mooring
- recover and re-deploy temperature recorders from several vents
- collect biological materials (bacterial mats and vent fauna) for natural products research
- conduct shipboard microbiological culture experiments
- conduct shipboard chemical analysis of fluids
- CTD casts at multiple locations for plume time series

In spite of major technical problems, we were able to accomplish most of our goals.

Our pre-cruise plan was to have 3 Jason dives, equipped with the Hydrothermal Fluid and Particle Sampler, one or two titanium major samplers, up to 5 gas-tight samplers, small syringe samplers for microbial mats, and small bio-box for vent fauna, rock, or sulfide mineral collection. For efficiency, we integrated our operations with Mark Zumberge and Glenn Sasagawa's Self-Calibrating Pressure Recorder with a joint dive around the ASHES vent field. In the end, we fit as much work as possible into 2 dives at Axial.

Objectives of the CORK project

The overall goal of the 2012 CORK Optical Telemetry System (OTS) field program was to deploy and install two seafloor optical communication instruments at CORK instrumented borehole well-heads in the northeast Pacific. Maurice Tivey and Norman Farr of WHOI led this project. They are collaborating with Dr. Earl Davis of Pacific Geoscience Center, Sidney, BC on the CORK communication interface along with Keir Becker of RSMAS, Miami. The first planned site to be instrumented was CORK Hole 857D (48° 26.571247'N 128° 42.65207'W). At this site, after installation of the seafloor unit using ROV Jason, we will download pressure data from the CORK. Following recovery of Jason we plan to carry out a series of communication tests between the seafloor optical comms device and a ship-based lowered CTD instrument (using SDSL comms over CTD wire). If testing goes well, we will leave this optical-comms unit in place for a year and plan to revisit and recover it in the following year, 2013. The second planned seafloor optical communication unit will be installed at seafloor CORK Hole 1025C (47deg 53.2470'N 128deg 38.9190'W). We will install a new CORK data logger along with the seafloor optical unit. Again, following recovery of Jason, we plan to carry out a ship-based CTD comms operation to test the installed unit. This second CORK will also remain installed for a year. Norm Farr and Jon Ware also have a Jason dive to test their High Speed Optical communications by transmitting live realtime video between Jason and Medea (i.e. tetherless communications). This test will either be accommodated at Axial Seamount or at one of the CORK sites. Finally, 6 surface ocean drifter instruments were to be deployed on the western side of the Endeavour Ridge segment. . We also planned to include 2 days of optical comms testing using the autonomous underwater vehicle (AUV) Sentry. The plan was to have the Sentry carry out an optical "data mule" off load of data from the CORK autonomously. As described later, due to RV Thompson issues and a lack of space on the replacement vessel Langseth, the CORK team requested that we defer the AUV days until the 2013 season.

Pre-Cruise Breakdown of T.G. Thompson and Transfer of Cruise to Marcus Langseth

In late July, we learned that the intended ship for our cruise, *T.G. Thompson*, could not be repaired for several weeks to months, eventually resulting in cancellation of the entire Thompson schedule for the remainder of 2012. On August 1, Rose Dufour of NSF, Jon Alberts of UNOLS, and Sean Higgins of LDEO/Columbia suggested that the Marcus Langseth, in Astoria and available, could be a replacement ship. The Jason group had recently looked at the Langseth as a possible platform for ROV work. It was decided that the ship could not accommodate both Jason and Sentry, so the AUV project was removed from the cruise. A flurry of activity resulted in an astoundingly fast mobilization of equipment on the Langseth. The entire science group is extremely grateful for the extraordinary efforts put forth by Matt Heintz and the Jason group, the captain and crew of the

Langseth, the Langseth LDEO science support group, the University of Washington and *T.G. Thompson* personnel, NSF, UNOLS, and LDEO to make this cruise happen. It was far from certain that everything could be accomplished in time, and it is a testament to the dedication and skill of all of these people that we were able to make it happen.

Shipboard Setup

The *Langseth* is a specialized ship, optimally designed for seismic data collection. There is barely enough space on the deck to fit all of the ROV gear, and the laboratory space is not designed for a large interdisciplinary group. Consequently, it was very challenging to find suitable lab space for three large projects. A lab van from OSU was added on the upper deck mid-ship. The Jason control vans were located on the top deck aft. The 3 main science groups adapted and spread out into space on multiple decks.

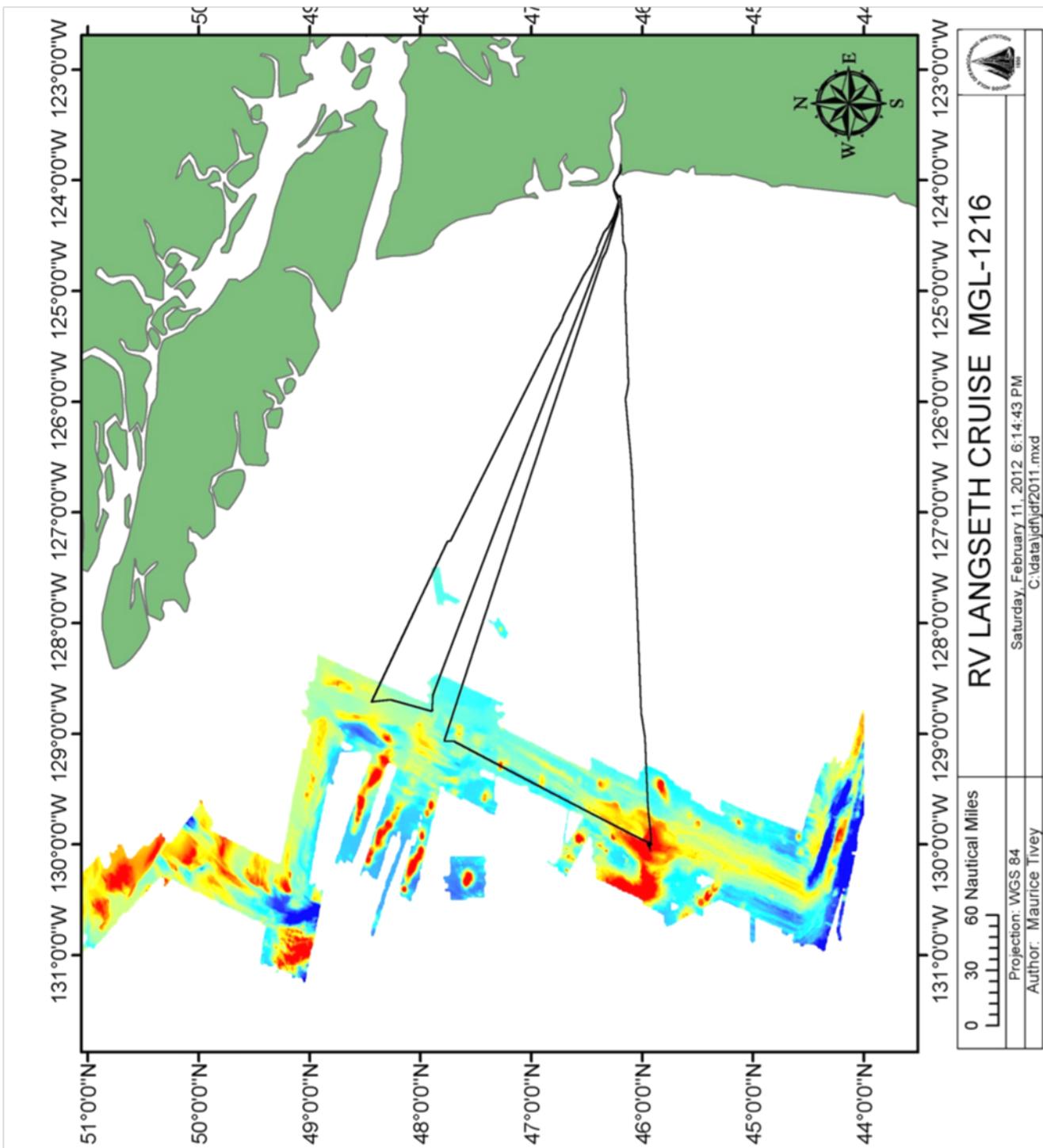


Figure 1 Cruise track and dive areas for MGL-1216.

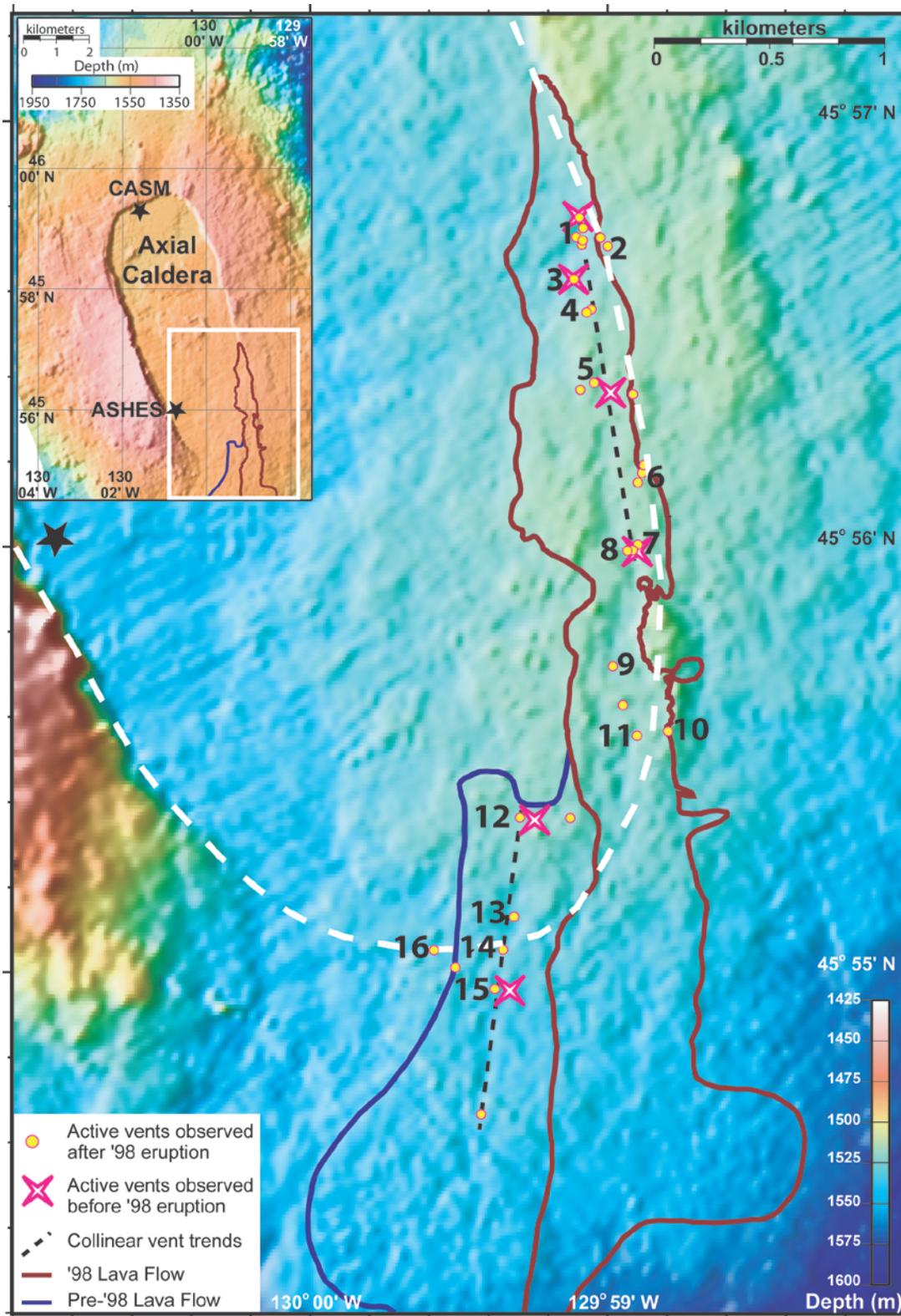


Figure 2 Axial Caldera map with vent sites (from Butterfield et al., 2004), showing pre-2011 bathymetry and outline of 1998 lava flow from Chadwick..

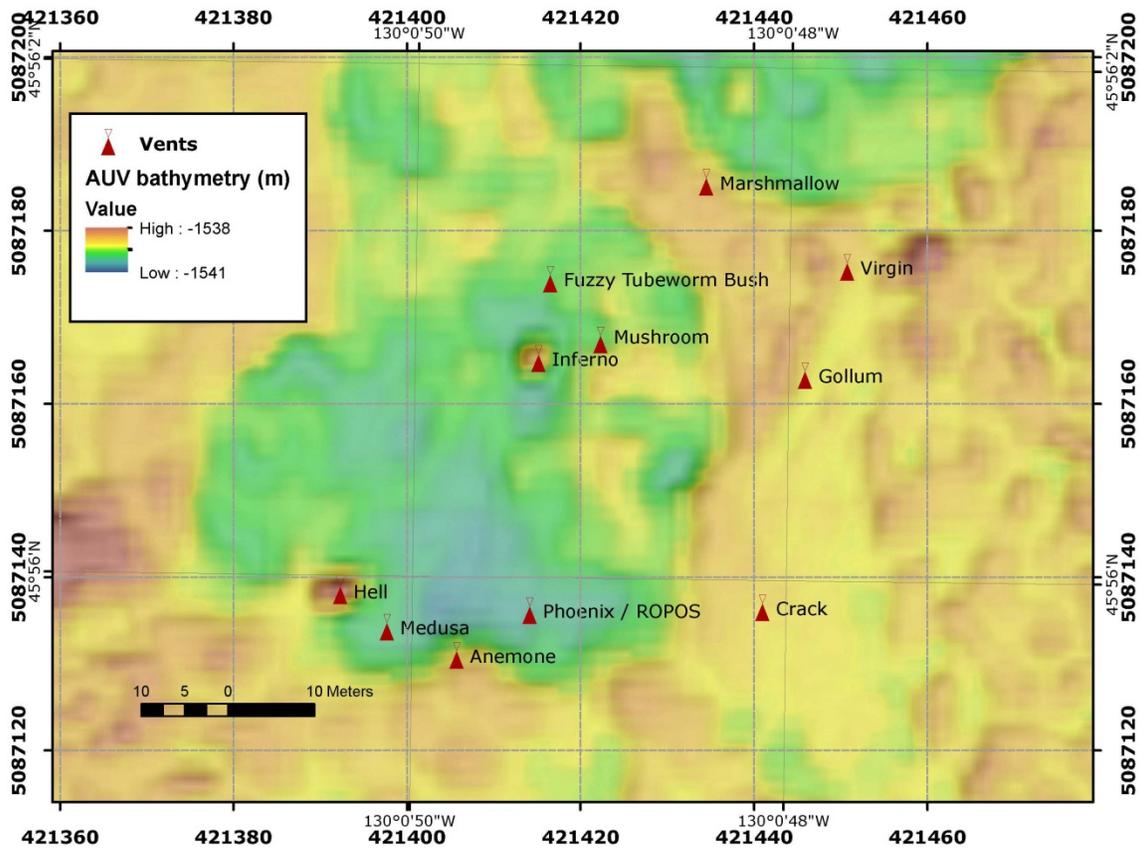


Figure 3 Bathymetric map of ASHES vent field, 2011 MBARI AUV multibeam data courtesy of Dave Clague. Map prepared by Andra Bobbitt. Latitude/Longitude and UTM X/Y coordinates are both shown.

5. Discipline Summaries

5.1 Water Column Survey

We intended to do 6 vertical CTD casts. However, due to the shortened time at Axial from the winch breakdown, we were only able to complete 4 casts. Ron Greene was in charge of conducting the CTD casts and collecting the water samples for helium and trace metals. Stephen Jalickee of UW set up the CTD and data recording. We used the UW CTD rosette and software, with WET Labs C-Star 401DR transmissometer (calibrated July 11, 2012). Based on observed temperature and light transmission, the ASHES plume was relatively weak (0.4% transmission anomaly) with plume top near 1350m, the Vixen plume was robust (up to 1.8% anomaly) with plume top near 1375m, the

Castle/I.D. plume was apparently dominated by diffuse sources (1.4% anomaly near bottom), and the background plume SW of the caldera had a 0.7% transmission anomaly at 1475 m.

Table CTD Cast Summary

Cast Number	Date/Time UTC	Latitude	Longitude	Site name
MGL1216-01	8/18/2012 16:20	45° 56.01'N	130° 00.82'W	ASHES
MGL1216-02	8/18/2012 22:59	45° 55.039'N	129° 59.580'W	Vixen/Coquille
MGL1216-03	8/19/2012 23:57	45° 55.502'N	130° 2.987'W	Background
MGL1216-04	8/20/2012 02:35	45° 56.766'N	129° 59.089'W	Castle/Int Dist

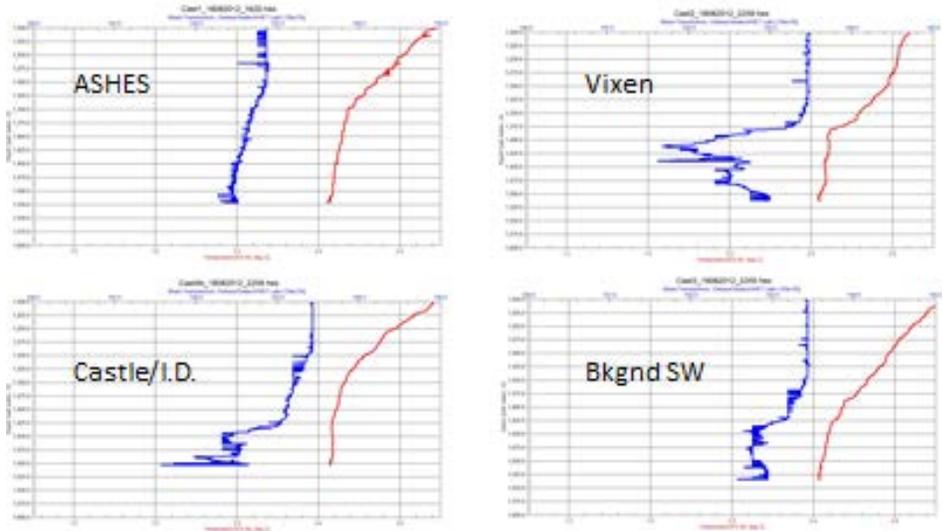


Figure 4 CTD cast data. Transmissometer in blue and temperature in red.

5.2 Sampling and Fluid Chemistry, Butterfield Lab

HFPS Setup

The Hydrothermal Fluid and Particle Sampler was configured very similarly to the previous two years. We installed the large volume bag (LVB) sampler in valve position 1, using a single large bag capable of holding approximately 4 liters. The LVB was first used 10 years ago, and we modified the plumbing and had new bags manufactured this year. This year we did not use any Sterivex filters for in-situ filtration, opting for the McLane 47mm flat filter holder with preservative reservoir filled with RNA-Later preservative. These RNA filters occupied positions 10,11 and 13-16. Valve positions 2-9 were pistons, with 2-6 being titanium cylinders with all Teflon lids/filter holders. Pistons 7-9 were PVC pistons with PVC and blue polypropylene filter holders. Positions 17-24 were collapsible bag samples. 17-18 had Teflon filter holder/lids while 19-24 had PVC/Polypropylene lid/filter holders. All even valve position water samples were filtered through Millipore 47mm 0.4 μ m pore size polycarbonate membrane filters. Odd valve position water samples were not filtered.

Shipboard processing

We set up the fluid sampler primarily in the dry lab on the main deck, but also used one table in the adjacent wet lab. Samples were processed in the dry lab. Care was taken to cover all bench surfaces with clean bench cote. The gas chromatograph, spectrophotometer, and wet chemistry were all located in the lab van on the upper deck. We asked for a general purpose lab van for the cruise, but the van delivered to the ship had previously been used as an isotope van. We did not split samples in the lab van because of the likelihood of isotope contamination.

Because of the large numbers of samples collected over 2 days and early departure from the ship, sample processing was not complete when we left the ship. Kevin Roe analyzed hydrogen sulfide by the methylene blue spectrophotometric method (modified from Cline 1969) on board. He also analyzed ammonia by indo-phenol spectrophotometric method and dissolved silica by molybdate blue spectrophotometric method. These methods are described further in Butterfield et al. 2004. Marv Lilley measured methane and hydrogen concentration on most of the HFPS samples on board. The remaining samples (RAS) were analyzed at the UW on 8/25. All of the vent fluid samples collected by HFPS were analyzed for sulfide and ammonia on board the Langseth. All samples were diluted in acid for later silica analysis. Samples for pH were transferred into 30ml plastic bottles without entraining air and with no headspace. No pH measurements were done on board. RAS samples were kept refrigerated in their original sample bags and not processed until we returned to shore. The shipboard methods were set up in the lab in Seattle and finished there. All HFPS vent fluid sample pH measurements were done on shore on 8/24 and 8/25. RAS samples were not finished before Butterfield and Roe left for the Lau Basin cruise on 9/3, so marker 33 RAS samples numbered 20-48 were stored at 4°C in sealed bags and measured when we returned (analysis date 9/26). Alkalinity titrations were started on 8/29, but the data quality was poor. Suspect samples were re-analyzed and the remainder of samples titrated after the NE Lau cruise between 10/1 and 10/5/2012.



Figure 5 Aft view of HFPS mounted on Jason before dive 660. Top row from L to R shows 3 PVC pistons with blue polypropylene filter holder lids, 5 titanium pistons with Teflon filter holder lids, and one rack of filter holders with RNA preservative. Lower rack holds 6 bag cylinders with blue PP filter holder lids, two bag samplers with Teflon filter holder lids and a rack of RNA filters. LVB connects to upper right manifold outlet. Vent fluid flows from L to R across upper manifold, then down, then R to L across lower manifold, then to T probe, strainer, and flush pump. Two gas-tight samplers (one partially visible) were connected to the manifold and mounted to the port side.

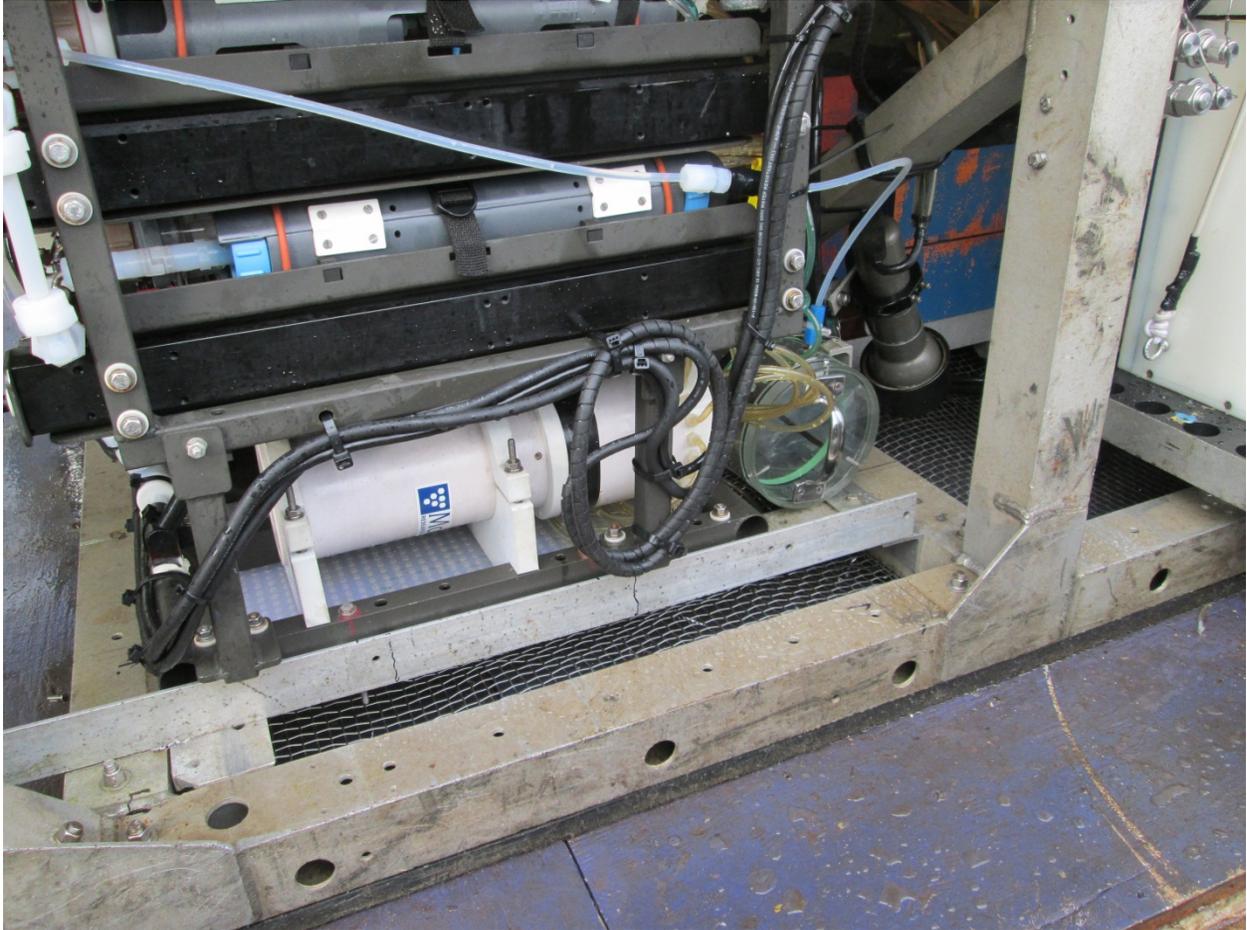


Figure 6 HFPS in aft starboard corner of Jason. Large volume bag sampler is the clear plastic cylinder with metal handle and green tape forward of HFPS.

A complete list of all samples taken at Axial follows in table form. This includes HFPS samples, as well as titanium majors and gas-tights, suction samples, bio grab samples, and chimney samples. A separate table gives a list of the types of fluid sub-samples preserved, water volumes and custody of each sample type.

NeMO 2012 Sample Metadata I						
Dive Sample #	HFS Sample #	Vent Site	Type	HFS Pos. #	Volume ml	Tmax/ Tavg °C
J660-1	J2-660B19	Anemone	unfiltered bag	19	551	30.2/28.8
J660-2	J2-660BF20	Anemone	filtered bag	20	551	32.0/28.1
J660-3	J2-660B21	Anemone	unfiltered bag	21	551	35.0/32.5
J660-4	J2-660LVB1	Anemone	LVB	1	4007	33.2/29.3
J660-5 (nude, GT11)	J2-660GT11HFS	Anemone	HFS Gas Tight	-	-	~30.7
J660-6	J2-660F10	Anemone	RNA filter	10	3047	31.9/29.6
J660-7	J2-660F11	Anemone	RNA filter	11	3004	31.6/28.0
J660-8	J2-660BF22	Fuzzy Tubeworm	filtered bag	22	550	28.6/28.4
J660-9	J2-660B23	Fuzzy Tubeworm	unfiltered bag	23	552	28.6/28.2
J660-10	J2-660F14	Fuzzy Tubeworm	RNA filter	15	3002	29.3/28.6
J660-11	J2-660F16	Fuzzy Tubeworm	RNA filter	16	3002	29.3/28.8
J660-12 (orange, GT16)	J2-660GT16	Inferno	Loose Gas Tight	-	-	
J660-13 (blue)	J2-660MB	Inferno	Major	-	-	
J660-14	J2-660PF4	Inferno	filtered piston	4	500	309.2/308.7
J660-15	J2-660P5	Inferno	unfiltered piston	5	500	309.8
J660-16	J2-660BIOGRAB	Inferno	worm grab	-	-	-
J660-17	J2-660PF2	Virgin Mound	filtered piston	2	250	246/227
J660-18	J2-660P3	Virgin Mound	unfiltered piston	3	250	220/213
J660-19 (blue, GT12)	J2-660GT12HFS	Virgin Mound	HFS Gas Tight	-	-	250
J660-20 (white, GT17)	J2-660GT17	Virgin Mound	Gas Tight	-	-	277
J660-21	J2-660CHIMNEY	Hell	active sulfide chimney	-	-	-
J660-22 (red)	J2-660MR	Hell	Major	-	-	274
J660-23 (red, GT9)	J2-660GT9	Hell	Loose Gas Tight	-	-	274
J660-24	J2-660B17	Hell	unfiltered bag	17	478	239/222
J660-25	J2-660BF18	Hell	filtered bag	18	500	268/260

NeMO 2012 Sample Metadata I						
Dive Sample #	HFS Sample #	Vent Site	Type	HFS Pos. #	Volume ml	Tmax/ Tavg °C
J660-26	J2-660MAT	Hell	lg. syringe - mat	-	-	-
J660-27	J2-660PF6	Background SW	filtered piston	6	700	2.4/2.4
J660-28	J2-660P7	Background SW	unfiltered piston	7	700	2.4/2.4
J661-1	J2-661PF4	Spanish Steps	filtered piston	4	502	123.7/ 123.0
J661-2	J2-661P5	Spanish Steps	unfiltered piston	5	502	126.7/ 124.5
J661-3 (white, GT17)	J2-661GT17	Spanish Steps	Loose Gas Tight white	-	-	195.5
J661-4 (blue)	J2-661MB	Spanish Steps	Major blue	-	-	195.5
J661-5	J2-661MAT	Spanish Steps	grab sample - blue mat on tubeworms	-	-	-
J661-6	J2-661PF2	Trevi	filtered piston	2	253	264.9/26 4.8
J661-7	J2-661P3	Trevi	unfiltered piston	3	253	264.8/26 4.8
J661-8 (blue, GT12)	J2-661GT12HFS	Trevi	HFS Gas Tight	-	-	271.1
J661-9	J2-661B17	Marker N3	unfiltered bag	17	503	20.2/20.1
J661-10	J2-661BF18	Marker N3	filtered bag	18	505	20.2/20.1
J661-11	J2-661F15	Marker 33	RNA filter	15	3001	16.9/14.9
J661-12	J2-661BF22	Marker 33	filtered bag	22	531	13.5/12.4
J661-13	J2-661B23	Marker 33	unfiltered bag	23	502	14.5/13.7
J661-14	J2-661F15	Marker 33	RNA filter	16	3000	14.2/12.1
J661-15	J2-661SYR1	Marker 33	lg. syringe - orange mat	-	-	-
J661-16	J2-661SYR2	Marker 33	lg. syringe -white mat	-	-	-
J661-17	J2-661P9	Boca	unfiltered piston	9	501	9.9/9.8
J661-18	J2-661BF24	Boca	filtered bag	24	502	10.1/9.8
J661-19	J2-661F13	Boca	RNA filter	13	3002	10.0/9.8
J661-20	J2-661F14	Boca	RNA filter	14	3002	10.1/9.8
J661-21 (red, GT9)	J2-661GT9	Boca	Loose Gas Tight	-	-	10
J661-22	J2-661SYR3	Boca	sm. Syringe - brown mat	-	-	-
J661-23	J2-661ROCK	Boca	fresh basalt	-	-	-
J661-24	J2-661PF6	Skadi	filtered piston	6	650	47.4/45.0

NeMO 2012 Sample Metadata I						
Dive Sample #	HFS Sample #	Vent Site	Type	HFS Pos. #	Volume ml	Tmax/ Tavg °C
		Tubeworms				
J661-25	J2-661B19	Marker 113	unfiltered bag	19	551	28.0/27.9
J661-26	J2-661BF20	Marker 113	filtered bag	20	552	28.4/28.3
J661-27	J2-661B21	Marker 113	unfiltered bag	21	553	28.5/28.3
J661-28 (nude?, GT11)	J2-661GT11HFS	Marker 113	HFS Gas Tight	-	-	28.5
J661-29	J2-661LVB1	Marker 113	LVB	1	3873	28.4/28.1
J661-30	J2-661F10	Marker 113	RNA filter	10	3000	28.5/28.2
J661-31	J2-661F11	Marker 113	RNA filter	11	3002	28.3/28.0
J661-32	J2-661SLURP	Marker 113	slurp gun - blue mat	-	-	-
J661-33	J2-661P7	Vixen	unfiltered piston	7	251	345.3/ 345.2
J661-34	J2-661PF8	Vixen	filtered piston	8	251	345.3/ 345.2
J661-35 (orange, GT16)	J2-661GT16	Vixen	Loose Gas Tight	-	-	352.1

NeMO 2012 Sample Metadata, II										
Dive Sample #	Date UTC	Latitude degrees	Latitude minutes	Longitude degrees	Longitude minutes	Depth m	Heading	Start UTC	Stop UTC	Virtual Van#
J660-1	8/19/2012	45	55.99205	130	0.82539	1543.5	307	9:20	9:23	
J660-2	8/19/2012	45	55.99205	130	0.82539	1543.5	307	9:24	9:28	
J660-3	8/19/2012	45	55.99205	130	0.82539	1543.5	307	9:29	9:32	453
J660-4	8/19/2012	45	55.99205	130	0.82539	1543.5	307	9:33	9:53	
J660-5	8/19/2012	45	55.99205	130	0.82539	1543.5	307	9:55	9:55	
J660-6	8/19/2012	45	55.99205	130	0.82539	1543.5	307	10:02	10:25	
J660-7	8/19/2012	45	55.99205	130	0.82539	1543.5	307	10:25	10:48	508
J660-8	8/19/2012	45	56.01590	130	0.82140	1544	344	11:38	12:02	
J660-9	8/19/2012	45	56.01590	130	0.82140	1544	344	12:04	12:07	594
J660-10	8/19/2012	45	56.01590	130	0.82140	1544	344	12:11	12:32	
J660-11	8/19/2012	45	56.01590	130	0.82140	1544	344	12:33	12:54	
J660-12	8/19/2012	45	56.01380	130	0.82445	1539.1	248	14:05		862
J660-13	8/19/2012	45	56.01380	130	0.82445	1539.1	248	14:05		
J660-14	8/19/2012	45	56.01380	130	0.82445	1539.1	248	14:11	14:16	881
J660-15	8/19/2012	45	56.01380	130	0.82445	1539.1	248	14:16	14:20	
J660-16	8/19/2012	45	56.01300	130	0.82100	1539.75	350	14:35		
J660-17	8/19/2012	45	56.02010	130	0.79413	1541.6	119	15:21		
J660-18	8/19/2012	45	56.02010	130	0.79413	1541.6	119	15:24	15:25	955
J660-19	8/19/2012	45	56.02010	130	0.79413	1541.6	119	15:30		
J660-20	8/19/2012	45	56.02010	130	0.79413	1541.6	119	15:41		
J660-21	8/19/2012	45	56.00000	130	0.83600	1540.1	272	16:14		

NeMO 2012 Sample Metadata, II										
Dive Sample #	Date UTC	Latitude degrees	Latitude minutes	Longitude degrees	Longitude minutes	Depth m	Heading	Start UTC	Stop UTC	Virtual Van#
J660-22	8/19/2012	45	56.00000	130	0.83600	1540.1	272	16:33		1080
J660-23	8/19/2012	45	56.00000	130	0.83600	1540.1	272	16:48		
J660-24	8/19/2012	45	56.00000	130	0.83600	1540.1	272	17:01	17:04	
J660-25	8/19/2012	45	56.00000	130	0.83600	1540.1	272	17:07	17:11	
J660-26	8/19/2012	45	55.99800	130	0.83270	1542.9	262	17:24		
J660-27	8/19/2012	45	56.07500	130	0.76400	1542.5	57	18:00	18:04	
J660-28	8/19/2012	45	56.10100	130	0.74300	1541.9	58	18:07	18:14	
J661-1	8/20/2012	45	56.75990	129	59.02098	1520.2	357	10:04	10:07	1358
J661-2	8/20/2012	45	56.75990	129	59.02098	1520.2	357	10:08	10:12	
J661-3	8/20/2012	45	56.75990	129	59.02098	1520.2	357	10:17		
J661-4	8/20/2012	45	56.75990	129	59.02098	1520.2	357	10:21		1373
J661-5	8/20/2012	45	56.76190	129	59.01792	1519.5	177	10:31		1382
J661-6	8/20/2012	45	56.77350	129	59.02357	1520.9	144	10:52	10:53	1419
J661-7	8/20/2012	45	56.77350	129	59.02357	1520.9	144	10:54	10:56	
J661-8	8/20/2012	45	56.77350	129	59.02357	1520.9	144	10:57		1426
J661-9	8/20/2012	45	56.62538	129	59.11103	1522.3	312	13:04	13:07	1531
J661-10	8/20/2012	45	56.62538	129	59.11103	1522.3	312	13:09	13:12	
J661-11	8/20/2012	45	55.98840	129	58.93769	1515.6	162	17:01	17:23	1791
J661-12	8/20/2012	45	55.98840	129	58.93769	1515.6	162	17:27	17:31	1795
J661-13	8/20/2012	45	55.98840	129	58.93769	1515.6	162	17:36	17:39	1806
J661-14	8/20/2012	45	55.98840	129	58.93769	1515.6	162	17:47	18:09	1818

NeMO 2012 Sample Metadata, II										
Dive Sample #	Date UTC	Latitude degrees	Latitude minutes	Longitude degrees	Longitude minutes	Depth m	Heading	Start UTC	Stop UTC	Virtual Van#
J661-15	8/20/2012	45	55.98799	129	58.93621	1516.6	203	18:38		1850
J661-16	8/20/2012	45	55.98800	129	58.93621	1516.2	312	18:55		1869
J661-17	8/20/2012	45	55.66589	129	58.95752	1518.7	131	23:46	23:50	2146
J661-18	8/20/2012	45	55.66589	129	58.95752	1518.7	131	23:52	23:55	
J661-19	8/21/2012	45	55.66589	129	58.95752	1518.7	131	23:57	0:15	2158
J661-20	8/21/2012	45	55.66589	129	58.95752	1518.7	131	0:16	0:36	
J661-21	8/21/2012	45	55.65870	129	58.94478	1518.3	131	0:39		2186
J661-22	8/21/2012	45	55.64835	129	58.94894	1518.5	115	1:10		2222
J661-23	8/21/2012	45	55.64566	129	58.94910	1518.8	30		1:31	2248
J661-24	8/21/2012	45	55.40633	129	58.99175	1519.6	222	3:56	4:00	2473
J661-25	8/21/2012	45	55.36560	129	59.29630	1520.7	74	5:29	5:33	2638
J661-26	8/21/2012	45	55.36534	129	59.29562	1520.7	74	5:34	5:37	
J661-27	8/21/2012	45	55.36534	129	59.29562	1520.7	74	5:39	5:43	2659
J661-28	8/21/2012	45	55.36534	129	59.29562	1520.7	74			
J661-29	8/21/2012	45	55.36534	129	59.29562	1520.7	74	5:53	6:10	2680
J661-30	8/21/2012	45	55.36534	129	59.29562	1520.7	74	6:13	6:32	
J661-31	8/21/2012	45	55.36534	129	59.29562	1520.7	74	6:33	6:53	
J661-32	8/21/2012	45	55.36369	129	59.29289	1522.4	3	7:04		2732
J661-33	8/21/2012	45	55.03653	129	59.57332	1534.3	334	9:10	9:12	2904
J661-34	8/21/2012	45	55.03653	129	59.57332	1534.3	334	9:13	9:14	
J661-35	8/21/2012	45	55.03653	129	59.57332	1534.3	334	9:19		

Hydrothermal Fluid Sample Split Volumes

Dive	HFS	Comment	gas head vol	gas H2O	H2S/Si	pH/alk	Nutrient	Majors	Microbio	Total DIC	Trace Metal	Sulfur isotopes	O/H isotopes	DOC	tally volume	vol by weight
J660-1	J2-660B19		ML	ML	DB	DB	DB	DB	JH/ER	GP	DB	DB	DB		540	615
J660-3	J2-660B21		0	8	25	35	50	35	540	10	250	45	15		563	604
J660-4	J2-660LVB1							35	3800							
J660-8	J2-660BE22		0	8	25	35	50	35		10	250	45	15		473	554
J660-9	J2-660B23		0	10	20	35	45	35	210	20	125	45	10	60	615	
J660-13 (blu)	J2-660MB		0	0	20	35	45	35		25	300	45	15	125	645	
J660-14	J2-660PF4	seawater	0	0	35	50		35			500				620	
J660-15	J2-660P5		0	11	10	35	40	35		10	300		15		456	
J660-17	J2-660PF2						40	55		20	125	45	10		330	
J660-22 (rel)	J2-660MR		0	0	20	35	45	35		20	500	45	15		700	
J660-24	J2-660B17		30	17	15	35	50	35		10	250	45	15		472	547
J660-25	J2-660BF18			8	15	35	45	35		10	150	45	15		358	419
J660-27	J2-660PF6	bkgnd	0	8	15	35	45	35		10			15		163	
J660-28	J2-660P7	bkgnd	0		25	35	45	35	90		500		15		745	
J661-1	J2-661PF4		11	13	30	40	45	35		20	123	45			351	
J661-2	J2-661P5		54	15	25	35	45	35		20	355	45			575	
J661-4 (blu)	J2-661MB				22	35	45	35			300			125	562	
J661-7	J2-661P3	gassy, smd	446	7	20	35	25	35			125				247	
J661-9	J2-661B17		34	18	30	35	45	35	90	20	110			100	483	524
J661-10	J2-661BF18	dir leaked /	60	15	30	35	45	35		20	250	45	15		490	514
J661-12	J2-661BF22			15	30	35	50	35		20	200	45			430	554
J661-13	J2-661B23	small sample 150ml		10	20	18		35	26		33				107	107
J661-17	J2-661P9		0	15	35	35	40	35	190	20	130	45			545	
J661-18	J2-661BF24		0	17	25	35	85	35			125	45	15	110	492	534
J661-24	J2-661PF6	duplicate n	0	10	30	35	85	35		40	307	90	10		642	
J661-25	J2-661B19	Near top ed	0	9	30	35	45	35	400	20	120				694	594
J661-27	J2-661B21		0	10	30	35	45	35	110	20	110	45	15	100	555	566
J661-33	J2-661P7	small samp	160	10	25	35	25	35			79				209	
J661-34	J2-661PF8	gassy, smd	302	10	25	35		35		gas lost nd	90	45	10		250	
Split volumes in milliliters																
Custody indicates who analyzed or retained the sample																
ML=Marv Lilley, DB=Dave Butterfield, JH=Jim Holden, ER=Emily Reddington, GP=Giora Proskurowski																

Temperature Recorders Recovered and Deployed During NeMO 2012

High-Temperature Recorders Deployed or Recovered in 2012				
Vent/Marker	Temp Probe	Dive Deployed	Dive Recovered	Comments
<i>Recovered in 2012</i>				
Virgin	MISO 103	J2-580	J2-660	In good position when recovered
Trevi	MISO 135	J2-581	J2-661	In good position when recovered
<i>Deployed in 2012</i>				
Virgin	MISO 129	J2-660		
Trevi	MISO 104	J2-661		
Vixen	MISO 101	J2-661		
<i>Still in the field:</i>				
Vixen	MISO 147	J2-581		Not seen, must be buried in anhydrite
Casper	MISO 141	J2-581		Still in vent, not recovered, looks OK
Diva	HOBO 153	J2-583		Unable to visit this vent in 2012
Castle	MISO 102	J2-583		Unable to visit this vent in 2012
All 2012 MISO recorders set to 40 min interval, 903 day duration				

Mini-Temperature Recorders Deployed or Recovered in 2012				
Vent/Marker	Temp Probe	Dive Deployed (year)	Dive Recovered	Comments
<i>Recovered in 2012</i>				
Mkr 68 near Hell	MTR 3054	J2-521 (2010)	J2-660	MTR from tubeworm bush 30cm from marker 68 near Hell chimney, deployed in 2010. Picked up 08:24 8/19/2012.
Anemone vent	MTR 4096	J2-580 (2011)	J2-660	HFS sampling site for chem/micro
NW of Inferno, tubeworm bush	MTR 3048	R-545 (2000)	J2-660	Picked up just north of Fuzzy Tubeworm sample site, number not visible, looks old
Marker N3	MTR 3312	J2-581 (2011)	J2-661	N3 area in 2011 lavas. No large marker here.
Marker 33 RAS	MTR 3197	J2-581 (2011)	J2-661	Attached to RAS intake 2011-12. hdFrameGrab: RGB.20120820_160903_229.tif
Marker 33 RAS	MTR 4097	J2-581 (2011)	J2-661	Attached to RAS intake 2011-12.
Marker 33	MTR 4094	J2-581 (2011)	J2-661	In 2011 lavas, close to RAS intake (2012 hdFrameGrab: RGB.20120820_164212_783.tif)
Boca	MTR 3043	J2-583 (2011)	J2-661	In 2011 lavas - snowblower vent
Mkr113 Vent (Mkr 62)	MTR 4128	J2-520 (2010)	J2-661	Deployed about 1 m east of Marker 62. MTRs deployed in 2010 will record 2 years hdFrameGrab: RGB.20120821_045840_896.tif
<i>Deployed in 2012</i>				
Hell Marker 68	MTR 4098	J2-660		deployed near marker 68 9 hours after 3054 was recovered
Anemone vent	MTR 4099	J2-660		Placed where 4096 was
Fuzzy tubeworm bush	MTR 3040	J2-660		Between Inferno and Mushroom vents, deployed in 2012 sampling spot

Mini-Temperature Recorders Deployed or Recovered in 2012				
Vent/Marker	Temp Probe	Dive Deployed (year)	Dive Recovered	Comments
Marker N3	MTR 3332	J2-661		Deployed in same spot where 3312 was recovered. "153" on float on polypro line RGB.20120819_082432_706.tif
Marker 33	MTR 4095	J2-661		Installed in spot where RAS intake was for 2011-12. hdFrameGrab: RGB.20120820_164212_783.tif and hdFrameGrab: RGB.20120820_182317_542.tif
Boca	MTR 4001	J2-661		"52" on float on polypro line hdFrameGrab: RGB.20120821_005841_211.tif
Mkr113 Vent (Mkr 62)	MTR 4127	J2-661		At southern point top of pillar near HFPS sampling spot
<i>Still in the field:</i>				
Fuzzy tubeworm bush	MTR 3041	J2-580 (2011)		not recovered. Need to find next year.
Marshmallow	MTR 3334	J2-580 (2011)		Did not visit in 2012. Not recovered.
<i>MTRs lost in 2011 eruption:</i>				
Mkr 33 Benchmark	MTR ???	???	LOST	MTR in the tubeworm bush visible from the pressure benchmark, not recovered in 2010.
Mrk N3 vent	MTR 3049	J2-525	LOST	Put in same vent as previous MTR and where fluid sample was taken in 2010
Mkr 33	MTR 3039	J2-524	LOST	In crack, under RAS cover
Mkr 33	MTR 3327	J2-524	LOST	Deployed near RAS intake in 2010
Mkr 33	MTR 3292	J2-524	LOST	On top of RAS cover
Bag City	MTR 3087	J2-520	?	Couldn't find in 2011.

5.3 Microbiology, Huber Laboratory

Experiments and Sampling Carried out by Emily Reddington

Experimental Goals: Our goals on this cruise were the following:

Conduct stable isotope probing experiments with diffuse vent fluids from Axial enriched with labeled DIC under various temperature to determine which microbes are actively fixing carbon at Axial. Also carry out in background seawater.

Collect diffuse fluids that are *in situ* filtered and preserved (with RNALater, in duplicate) to determine and quantify functional repertoire of total active microbial communities and compare to SIP experiment.

Preserve all diffuse fluid samples collected for single cell genomics analyses.

Collect samples for virus cell enumeration by L. Zeigler (carried out by J. Holden's group)

To carry out the above goals, two important modifications to the HFPS were made. First, we used a large volume bag sampler with a ~4L bag to sample higher volume of whole water from individual vents. The bags were custom made by Murrell Selden at Pollution Measurement Corp (Tedlar 40.5 cm long x 24 cm with ¼" Jaco fitting). We were able to put 1 of these units on per dive. The second modification was the replacement of all filter holders on the HFPS for microbiology with filter holders from McLane that allow for in-situ preservation of filters on the seafloor. We were able to put 6 of these units on per dive.

As shown in Table 1, we successfully carried out 2 SIP experiments- 1 from Anemone and 1 from background seawater. The Large Volume Bag broke on Dive 661- the bottom seam split- so no SIP experiment was carried out. We collected duplicate RNA filters from 5 vents, as well as fluids for single cell genomics from these same 5 vents.

Table 1. An overview of samples collected for chemistry and microbiology. SCG=Single Cell Genomics; SIP=Stable Isotope Probing experiment; RNA/DNA=Biomass collected on a 0.22 µm filter for nucleic acid analyses; DB=Chemistry for Butterfield and Proskurowski; JH_TCC=Holden Total Cell Counts; JH_MPN=Holden Most Probable Number estimates; JH_INC=Holden Hydrogen Incubation experiment; LZ=Zeigler Total Virus Cell Counts

	Huber Sample #	Butterfield #	HFS Pos. #	Sample type	Type	SCG	SIP	RNA/DNA	Culture	DB	JH_TCC	JH_MPN	JH_INC	LZ	Vent
J2-660		J660-1	19	unfiltered bag	DF				X	X	X	X	X	X	Anemone
		J660-3	21	unfiltered bag	DF					X	X			X	Anemone
	FS857	J660-4	1	LVB	DF	X	X			X					Anemone
	FS857	J660-6	10	RNA Filter	DF			X							Anemone
	FS857	J660-7	11	RNA Filter	DF			X							Anemone
		J660-9	23	unfiltered bag	DF				X	X	X	X		X	Fuzzy Tubeworm Bush
	FS858	J660-10	15	RNA Filter	DF			X							Fuzzy Tubeworm Bush
	FS858	J660-11	16	RNA Filter	DF			X							Fuzzy Tubeworm Bush
	J660-28	7	unfiltered piston	BG Water					X	X			X	BG Water	
J2-661	FS859	J661-11	15	RNA Filter	DF	X		X							Marker 33
		J661-13	23	unfiltered bag	DF					X	X				Marker 33
	FS859	J661-14	16	RNA Filter	DF			X							Marker 33
	FS860	J661-17	9	unfiltered piston	DF	X			X	X	X	X		X	Boca
	FS860	J661-19	13	RNA Filter	DF			X							Boca
	FS860	J661-20	14	RNA Filter	DF			X							Boca
	FS861	J661-25	19	unfiltered bag	DF	X				X			X		Marker 113
		J661-27	21	unfiltered bag	DF				X	X	X	X		X	Marker 113
	FS861	J661-30	10	RNA Filter	DF			X							Marker 113
	FS861	J661-31	11	RNA Filter	DF			X							Marker 113
FS862	J661-9	17	unfiltered bag	DF	X				X	X			X	Maker N3	
CTD001	MMI-BG1		n/a	niskin bottles 14-16	CTD	X	X	X		X	X	X	X	X	BG Water

At the end of each time point, all of the fluid in the bottle was pumped through a Sterivex 0.22 μm filter, which was immediately filled with ~ 3 ml of homemade RNALater and placed at 4 $^{\circ}\text{C}$. After ~ 18 -24 hours, the filter was moved to -80 $^{\circ}\text{C}$. Time intervals for this sampling are shown below.

Bottle	Time (hours)			
	9	18	36	66
FS857-13C-TP1-30			X	
FS857-13C-TP1-55		X		
FS857-13C-TP1-80	X			
FS857-13C-TP2-30				X
FS857-12C-TP2-30				X
FS857-13C-TP2-55			X	
FS857-12C-TP2-55			X	
FS857-13C-TP2-80		X		
FS857-12C-TP2-80		X		

The pH of the vent fluid at the beginning of the experiment was about 7 and at the end, about 8. This suggests the bicarbonate we added was not buffered low enough (we used 12N HCl) and is impacting the pH of the experiment too strongly. In addition, there was visible black precipitate in the 80 $^{\circ}\text{C}$ experiment, suggesting precipitation during the experiment. It won't be until we examine these experiments in detail that we will know if it was successful.

SIP experimental details from Background Seawater

Fluids from an off-axis background CTD cast at $\sim 1300\text{m}$ were used in a SIP experiment. The experimental set-up was as follows:

Background CTD Cast

MMI-BG1

Experimental Set up

Volume Sample	425 ml per bottle
Final Conc. NaHCO_3	2 mM DIC, 1.6 ml per bottle
Temp. and Duration	4 $^{\circ}\text{C}$ for 144 hours
Temp. and Duration	30 $^{\circ}\text{C}$ for 72 hours

Bottle Labels

4 $^{\circ}\text{C}$	BG1- ^{13}C -TP1-4	BG1- ^{13}C -TP2-4	BG1- ^{12}C -TP1-4	BG1- ^{12}C -TP2-4
30 $^{\circ}\text{C}$	BG1- ^{13}C -TP1-30	BG1- ^{13}C -TP2-30	BG1- ^{12}C -TP1-30	BG1- ^{12}C -TP2-30

CTD water was collected in a sterile cubit container, connected to a peristaltic pump and 425 ml water was aseptically pumped into each of 9 sterile, purged, rubber-stoppered bottles, labeled as above. After fluids were pumped in, labeled and unlabeled sodium bicarbonate was added to a final concentration of 2 mM. Once all bottles received label, they were shaken and placed at the

appropriate temperature. TOC sampling was carried out as described above, according to the schedule below.

Bottle	Time (hours)				
	12	24	36	48	84
BG1-¹³C-TP1-4		BG1-A		BG1-B	BG1-C
BG1-¹³C-TP2-4					BG1-D
BG1-¹²C-TP1-4		BG1-G		BG1-H	BG1-I
BG1-¹²C-TP2-4					BG1-J
BG1-¹³C-TP1-30	BG1-L	BG1-M	BG1-N		
BG1-¹³C-TP2-30			BG1-O	BG1-P	BG1-Q
BG1-¹²C-TP1-30	BG1-R	BG1-S	BG1-T		
BG1-¹²C-TP2-30			BG1-U	BG1-V	BG1-W

At the end of each time point, all of the fluid in the bottle was pumped through a Sterivex 0.22 µm filter, which was immediately filled with ~3 ml of homemade RNALater and placed at 4 °C. After ~18-24 hours, the filter was moved to -80 °C. Time intervals for this sampling are shown below.

Bottle	Time (hrs)	
	36	84
BG1-¹³C-TP1-4		X
BG1-¹²C-TP1-4		X
BG1-¹³C-TP1-30	X	
BG1-¹³C-TP2-30		X
BG1-¹²C-TP1-30	X	
BG1-¹²C-TP2-30		X

This experiment was terminated early due to the problems with the winch.

The pH of the fluid at the beginning of the experiment was about 7-7.5 both at the beginning and end of the experiment.

5.4 Microbiology, Jim Holden Lab

Experiment #: LCS014

Experiment Description: 2012 Axial Volcano expedition

Date: 16 August-17 September 2012

Run by: Lucy Stewart, Jennifer Lin and Jim Holden

Experimental goals: Our goals on this cruise were the following:

- 1) Determine the culture-dependent abundances of four key metabolic groups of anaerobes that can grow at 55°C and 80°C in hydrothermal vent fluids at Axial Volcano hydrothermal vent sites using MPNs,
- 2) Conduct a trial experiment to determine whether methanogens are capable of growth in hydrothermal fluid amended with either different H₂ concentrations or with NH₄Cl, also at 55°C and 80°C,
- 3) Enrich for and isolate new strains of thermophiles and hyperthermophiles, and
- 4) Determine the total prokaryotic cell concentrations in all diffuse and background seawater samples collected.

The four groups of anaerobes enriched for were hydrogenotrophic Fe(III) oxide reducers, hydrogenotrophic sulfur/thiosulfate reducers, hydrogenotrophic methanogens, and heterotrophic sulfur reducers. Selected positive MPN tubes were used to purify new thermophile and hyperthermophile strains, and both pure cultures and mixed cultures were frozen as glycerol stocks for future use.

Summary of results:

- 1) Methanogenic coccoids were found in MPNs at Marker 113 (80°C) and at Boca (55°C), but not in either ASHES vents (Anemone and Fuzzy Tubeworm Bush),
- 2) Methanogens from Marker 113 grew at 55°C in natural fluids when amended only with 2 atm of H₂:CO₂ (80:20) and with 2 atm of N₂:CO₂ with an exchange of 1 ml of H₂:CO₂ (~20 μM H₂ final conc.), with 10× higher CH₄ in the higher H₂-containing bottle,
- 3) Autotrophic 'sulfur' reducing rods were found at Boca and Fuzzy Tubeworm Bush that grow at 55°C but nowhere else, and there was no growth of autotrophic sulfur reducers at 80°C,
- 4) Iron reducers were found at all sites, especially at 80°C at Marker 113,
- 5) Heterotrophs were found at all sites at nearly all temperatures with hydrogenogenic coccoids predominant at 80°C and non-hydrogen producing rods predominant at 55°C,
- 6) Two new strains of methanogens (80°C Marker 113 and 55°C Boca) were purified each with three dilution-to-extinction series and frozen in glycerol,
- 7) We are working to purify new iron reducer strains from the positive enrichments,
- 8) Nine mixed heterotroph enrichments were frozen in glycerol following repeated transfers.

Media and methods:

Growth media. Four types of media were used for our MPN enrichments. The methanogen medium was based on DSMZ medium 282 and contained the following (per liter in ddH₂O): 0.14 g of K₂HPO₄, 0.14 g of CaCl₂·7H₂O, 0.25 g of NH₄Cl, 3.4 g of MgSO₄·7H₂O, 5.1 g of MgCl₂·6H₂O, 0.34 g of KCl, 0.05 mg of NiCl₂·6H₂O, 0.05 mg of Na₂SeO₃·5H₂O, 30 g of NaCl, 1 g of NaHCO₃, 1 g of Na₂S₂O₃, 0.24 g of Na₂MoO₄·2H₂O, 10 ml of Wolfe's minerals, 10 ml of Wolfe's vitamins, and 50 µl of resazurin. It was pH balanced to 6.0, reduced with 0.0002% (NH₄)₂Fe(SO₄)₂, 0.025% cysteine and 0.025% Na₂S·9H₂O, and pressurized with 2 atm of 80:20 H₂:CO₂ headspace. There was no growth in any of this media, presumably due to the added molybdate that was intended to inhibit the growth of sulfate reducers. While *Methanocaldococcus* strain JH146 and *Methanothermococcus* strain Bush11, both isolated from Axial Volcano, grew in the medium with molybdate, the medium may have been too harsh for non-laboratory adapted strains. The sulfur-reducer medium was the same as the methanogen medium except that 10 g/l of elemental sulfur were added, no excess molybdate was added, and the medium was reduced with 0.5 mM cysteine. The iron-reducer medium was based on Kashefi marine medium C and contained the following (per liter): 19 g of NaCl, 9 g of MgCl₂·6H₂O, 0.3 g of CaCl₂·2H₂O, 0.5 g of KCl, 0.42 g of KH₂PO₄, 0.02 g of KBr, 0.15 g of MgSO₄·7H₂O, 0.1 g of (NH₄)₂SO₄, 2.5g of NaHCO₃, 2 g of yeast extract, 100 ml of Fe(III) oxide solution, 10 ml of Wolfe's vitamins, and 10 ml of Wolfe's minerals. It was pH balanced to 6.8, reduced with 0.5 mM cysteine and 1.3 mM FeCl₂, and pressurized with 2 atm of 80:20 H₂:CO₂ headspace. The heterotroph medium was based on the Adams lab recipe and contained the following (per liter): 0.14 g of K₂HPO₄, 0.14 g of CaCl₂·7H₂O, 0.25 g of NH₄Cl, 3.4 g of MgSO₄·7H₂O, 5.0 g of MgCl₂·6H₂O, 0.34 g of KCl, 2.7 g of Na₂SO₄, 18 g of NaCl, 1 g of NaHCO₃, 0.0002% of (NH₄)₂Fe(SO₄)₂/(NH₄)₂Ni(SO₄)₂ solution, 10 µM of Na₂WO₄/Na₂SeO₄ solution, 1 g of yeast extract, 5 g of maltose, 10 ml of Adams' minerals, 10 ml of Wolfe's minerals, 50 µl of resazurin, and 10 g of elemental sulfur. It was pH balanced at 6.8, reduced with 0.025% cysteine-HCl and 0.025% Na₂S·9H₂O, and pressurized with 2 atm of 80:20 N₂:CO₂.

Sample collection. Samples were collected from the ASHES and Eastern Caldera hydrothermal vent fields at Axial Volcano on the Juan de Fuca ridge between 19 August and 21 August 2012. Diffuse hydrothermal fluid samples were collected from the Anemone and Fuzzy Tubeworm Bush (ASHES) and Marker 113 and Boca (Eastern Caldera) hydrothermal vents using the remote-operated vehicle *Jason II*. Background water samples were taken from a 10 L Niskin bottle on a CTD cast outside the main caldera at a depth of 1,300 m.

MPN analyses. Three-tube Most-Probable-Number (MPN) analyses were used by adding 3.3 ml, 0.33 ml, and 0.03 ml of the hydrothermal fluid samples in triplicate to the four types of media described above. After inoculation, the tubes were incubated at 55°C or 80°C for up to 2 weeks (1-3 days on ship; 2 days in Seattle; and 3-9 days in Massachusetts). Growth in the tubes was confirmed for all four types of media by using phase-contrast light microscopy (methanogen, sulfur-reducer, and heterotroph media) and epifluorescence microscopy (iron-reducer medium). Growth of dissimilatory iron reducers was determined by testing for the biotic production of magnetic iron and spectrophotometrically using the ferrozine method to look for Fe(II) production. Growth of methanogens and H₂-producing heterotrophs was determined by analyzing for CH₄ and H₂, respectively, in the headspace using gas chromatography. Growth of sulfur reducers was determined spectrophotometrically by testing for the production of HS⁻ using the methylene blue method.

Incubation analyses. 25 ml of hydrothermal fluid was added to a sealed 60 ml serum bottle flushed with either H₂:CO₂ (high hydrogen and high hydrogen/high ammonia analyses) or

N₂:CO₂ (low hydrogen and no hydrogen analyses). 1 ml of H₂:CO₂ was added to the N₂:CO₂ bottles to produce a concentration of approximately 20 μM hydrogen in the fluid sample (discounting any present originally). 0.25 ml of 0.47 M ammonia was added to the high hydrogen/high ammonia bottles to produce a nitrogen concentration of 4.7 mM (the same as our standard media). Hydrothermal fluid samples were taken from the same sample bags for all incubation sites except Marker 113, where they were taken from a second fluid sample from the same vent. Duplicates of each condition (high H₂, high H₂/high NH₄⁺, low H₂, no H₂) were incubated at 55°C or 80°C for four weeks total, with the same incubation interruptions as the MPN incubations. Growth of methanogens was determined by analyzing for CH₄ in the headspace using gas chromatography.

Total cell counts. Total cell counts were done by preserving 18 ml of hydrothermal fluid with 1.8 ml of 37% formaldehyde in 20 ml glass scintillation vials. Samples were stored at 4°C for less than a month prior to counting. 3-5 ml of sample were filtered onto a 0.2-μm pore size nucleopore filter prestained with Irgalan black (Sterlitech), stained with acridine orange, and rinsed with filter-sterilized artificial seawater. The cells present were counted using an epifluorescent microscope equipped with a 100× adjustable-iris objective lens and a CCD camera.

Results:

Table 1. Total number of cells in each diffuse fluid sample collected

<u>J#</u>	<u>Bottle #</u>	<u>Amt. Filtered</u>	<u>Avg/field</u>	<u>Cells/ml</u>	<u>Site</u>
660	21a	5 ml	2.10	3.74 × 10 ⁴	Anemone
660	21b	5 ml	6.53	1.16 × 10 ⁵	Anemone
660	19a	5 ml	2.37	4.21 × 10 ⁴	Anemone
660	19b	5 ml	6.67	1.19 × 10 ⁵	Anemone
660	23a	5 ml	2.50	4.45 × 10 ⁴	Fuzzy Tubeworm Bush
660	23b	5 ml	2.80	4.98 × 10 ⁴	Fuzzy Tubeworm Bush
661	9a	5 ml	13.83	2.46 × 10 ⁵	Boca
661	9b	5 ml	12.00	2.14 × 10 ⁵	Boca
661	17a	5 ml	10.77	1.92 × 10 ⁵	Marker N3
661	17b	5 ml	5.93	1.06 × 10 ⁵	Marker N3
661	21a	3 ml	11.00	3.30 × 10 ⁵	Marker 113
661	21b	3 ml	12.20	3.60 × 10 ⁵	Marker 113
661	21b	5 ml	20.30	3.61 × 10 ⁵	Marker 113
661	23a	5 ml	2.37	4.21 × 10 ⁴	Marker 33
661	23b	5 ml	8.43	1.50 × 10 ⁵	Marker 33
660	7a	5 ml	5.93	1.06 × 10 ⁵	Bkgd. Seawater
660	7b	5 ml	8.20	1.46 × 10 ⁵	Bkgd. Seawater
CTD	a	5 ml	1.17	2.08 × 10 ⁴	Seawater @ 1,300 m
CTD	b	5 ml	1.57	2.79 × 10 ⁴	Seawater @ 1,300 m

Table 2. Most-Probable-Number (MPN) estimates for the 2012 Axial Volcano Cruise. Cell concentrations are in cells L⁻¹, with the three-tube MPN scores in brackets

Sample	282 medium + S ⁰			Fe medium		Adams medium + S ⁰			Total cells
	cells	S ²⁻	CH ₄	cells	Fe ²⁺	cells	H ₂	CH ₄	
80°C incubations:									
J660-UB19 (Anemone)	270 (2-0-0)	ND (0-0-0)	ND (0-0-0)	? (1-2-3)	90 (0-1-0)	7,200 (3-3-0)	2,790 (3-2-0)	ND (0-0-0)	7.9 × 10 ⁷
J660-UB23 (Fuzzy TWB)	1,290 (3-1-0)	ND (0-0-0)	ND (0-0-0)	1,290 (3-1-0)	ND (0-0-0)	2,790 (3-2-0)	2,790 (3-2-0)	ND (0-0-0)	4.7 × 10 ⁷
J661-UP19 (Boca)	270 (2-0-0)	ND (0-0-0)	ND (0-0-0)	>840 (2-3-2)	ND (0-0-0)	690 (3-0-0)	ND (0-0-0)	ND (0-0-0)	2.3 × 10 ⁸
J661-UB21 (Marker 113)	210 (1-1-0)	ND (0-0-0)	120 (1-0-0)	33,000 (3-3-2)	13,800 (3-3-1)	2,790 (3-2-0)	210 (1-1-0)	ND (0-0-0)	3.5 × 10 ⁸
Off-summit CTD (1,300 m)	ND (0-0-0)	-	-	ND (0-0-0)	-	ND (0-0-0)	-	-	2.5 × 10 ⁷
55°C incubations:									
J660-UB19 (Anemone)	270 (2-0-0)	ND (0-0-0)	ND (0-0-0)	210 (1-1-0)	ND (0-0-0)	690 (3-0-0)	ND (0-0-0)	ND (0-0-0)	7.9 × 10 ⁷
J660-UB23 (Fuzzy TWB)	33,000 (3-3-2)	270 (2-0-0)	ND (0-0-0)	630 (2-2-0)	90 (0-1-0)	270 (2-0-0)	270 (2-0-0)	ND (0-0-0)	4.7 × 10 ⁷
J661-UP19 (Boca)	450 (2-1-0)	90 (0-1-0)	120 (1-0-0)	>6,300 (3-2-3)	450 (2-1-0)	270 (2-0-0)	ND (0-0-0)	ND (0-0-0)	2.3 × 10 ⁸
J661-UB21 (Marker 113)	270 (2-0-0)	ND (0-0-0)	ND (0-0-0)	33,000 (3-3-2)	ND (0-0-0)	ND (0-0-0)	-	-	3.5 × 10 ⁸
Off-summit CTD (1,300 m)	ND (0-0-0)	-	-	ND (0-0-0)	-	ND (0-0-0)	-	-	2.5 × 10 ⁷

ND, not detected; “-“, was not analyzed.

**There was no growth in any of the DSM 282 medium tubes containing excess molybdate as a sulfate reducer inhibitor.

Table 3. Methane GC peak areas found following direct incubation of hydrothermal fluid with varying amounts of H₂ in the headspace with and without the addition of 4.7 mM NH₄Cl

Incubation conditions	J660 UB-19 (Anemone)		J660 UB-23 (Fuzzy Tubeworm Bush)		J661 UB-19 (Marker 113)		Off-summit CTD (1,300 m depth)	
	55°C	80°C	55°C	80°C	55°C	80°C	55°C	80°C
H ₂ :CO ₂	ND	ND	ND	ND	210,381	567/1204	ND	ND
H ₂ :CO ₂ + 4.7 mM NH ₄ Cl	ND	ND	ND	ND	633	1197/624	ND	ND
N ₂ :CO ₂ + 1 ml H ₂ :CO ₂	ND	ND	ND	ND	15,357	678/1215	ND	ND
N ₂ :CO ₂	ND	ND	ND	ND	667	ND/950	ND	ND

ND, no peak(s) detected

*The 80°C incubations for Marker 113 were in duplicate, while the 55°C incubations for Marker 113 were singles due to low sample volume. All other incubations at both temperatures were in duplicate.

**The low methane peaks detected in the Marker 113 samples are due to background CH₄, based on Marv's analysis of the original diffuse fluid from this site.

6. ROV Dives

6.1 ROV Dive Maps

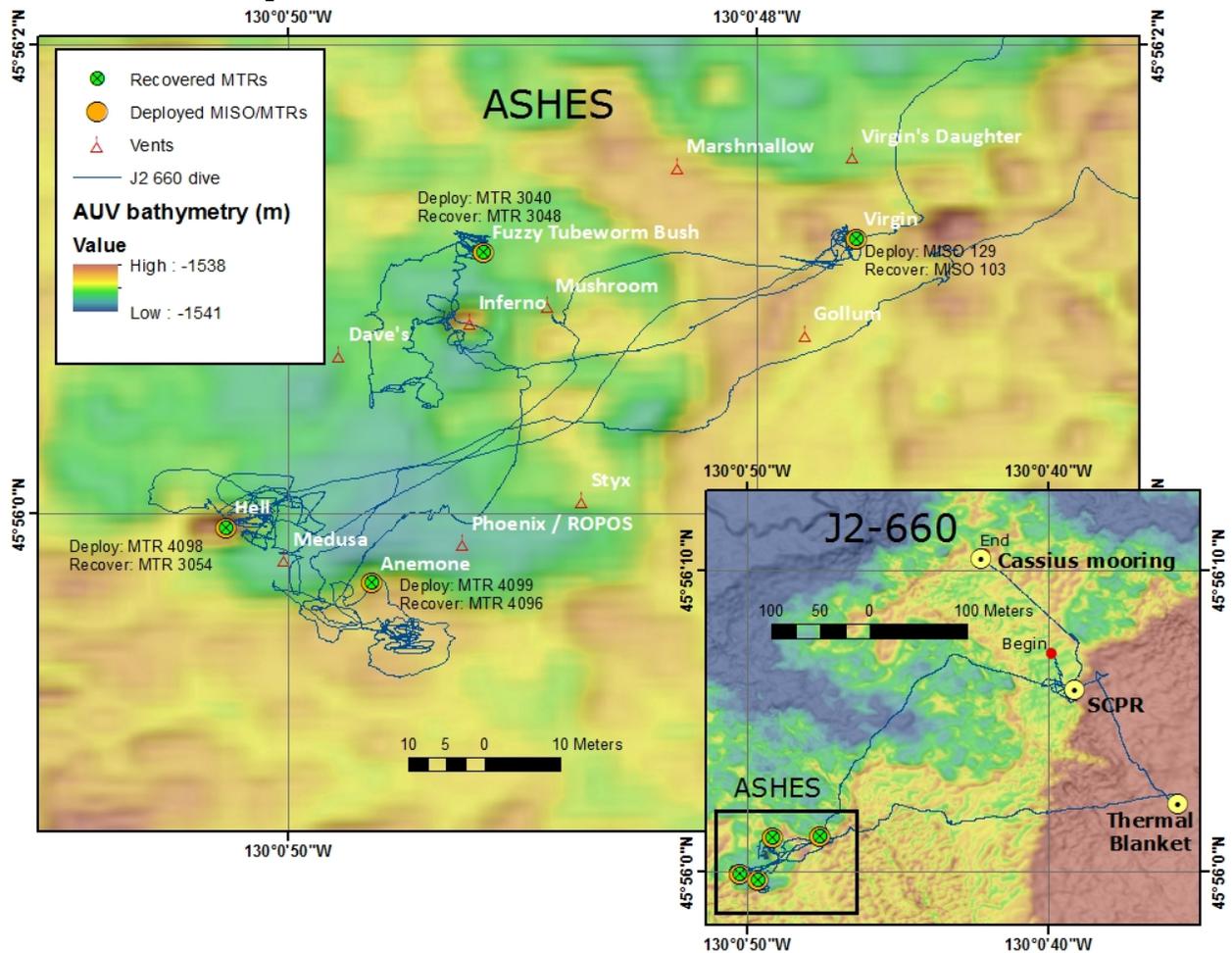


Figure 7 Map of Jason dive 660 in and around ASHES vent field. Self-Calibrating Pressure Recorder was deployed and recovered, a thermal blanket deployed on the 2011 lava flow, temperature recorders deployed and recovered, and multiple vents sampled for chemistry and microbiology.

ROV positions were determined using the Jason acoustic USBL system referenced to GPS. Reprocessed navigation data was very close to original navigation data. The reprocessed dive tracks were exported and plotted on map figures 5 and 6.

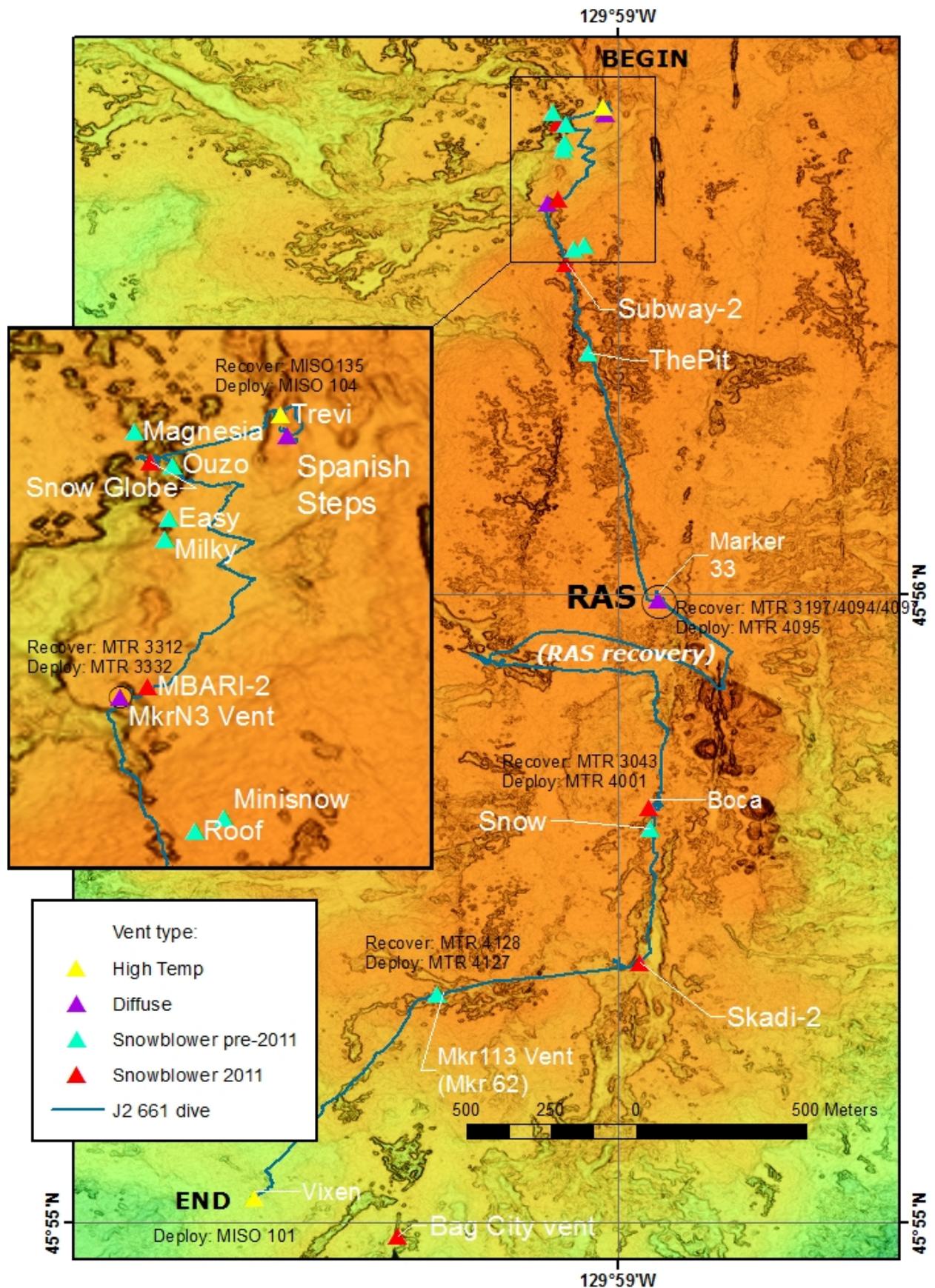


Figure 8 Jason Dive 661 (previous page), Axial SE Caldera. Bathymetry is 2011 MBARI AUV data courtesy of Dave Clague and Dave Caress. Snow-blower vent locations are from 1998/99 NeMO cruises, the 2011 and 2012 NeMO cruises, the 2011 RSN cruise (Giora Proskurowski, personal communication) and the 2011 MBARI cruise (Dave Clague, personal communication). Map prepared by Andra Bobbitt.

6.2 ROV Dive Summaries

Summary of Dive 660 near ASHES

The dive began at 02:15 UTC 8/19/2012 after approximately 24 hours of delay due to a Jason hydraulics problem (replaced hydraulic motor) and damage to the Jason fiber-optic tether during CTD operations. The descent was slow because of problems with the winch level-wind. Scott Hansen worked out a way to keep the level wind moving with some manual intervention, but it required watching and slowed down operations. Upon reaching the seafloor at 05:00 (2hr 45min descent!), we homed in on the **Self-Calibrating Pressure Recorder (SCPR)** by acoustic modem. The SCPR was easily found and moved from its landing position on pillow lava to a flat spot with thin sediment cover. Testing of the instrument was done with acoustic comms. Some time was spent with all the lights turned off to conduct optical comms testing between Jason and Medea using the new WHOI optical modem equipment. Work on the SCPR was done by 06:35. We then headed south toward a position on the 2011 lava flow east of the ASHES field to **deploy Paul Johnson's heat flow donut** on some flat lobate lava. The deployment took less than 10 minutes, captured some on HD video. We then headed toward Virgin Mound to verify position in the field, and from Virgin headed SSW toward Anemone vent. We were a little off course and encountered Hell vent, briefly took some video there, and noticed that there was an instrument with an encrusted line (small block labeled 92W) less than 1 meter from **marker 68**. We **recovered this MTR (number 3054)**, with data from 2010 to 2012 at 08:24. After picking up this MTR, we moved directly to **Anemone vent**, observed MTR 4096 with lots of filamentous bacteria and some limpets on the float/line. We set up for **full suite of HFPS samples** and between 09:20 and 10:48 collected bags 19, 20, 21, large volume bag 1, GT11 on HFS, and RNA filters 10 and 11. Temperatures were 30-32°C max. After sampling, we **collected MTR 4096 and deployed MTR 4099** in the same spot. We left Anemone at 10:58. On the way to Fuzzy Tubeworm north of Inferno, we drove by Mushroom vent and took some video of an instrument deployed there for Pete Girguis at 11:20. We were at **Fuzzy Tubeworm** by 11:25 and started taking temperature measurements, finding 27-28°C max. We collected HFPS bags 22 and 23 and RNA filters 14 and 16. Following sampling, at 13:00 we **deployed MTR 3040** in the vent that we sampled. We then moved approximately 2 meters and at 13:07 **recovered old MTR (later determined to be 3048, deployed in 2000 NW of Inferno)**. **MTR 3041** was deployed at Fuzzy Tubeworm in 2011, but was not seen and not recovered in 2012. We then moved a few meters south to Inferno and from 13:xx to 13:24 conducted a **video survey and photomosaic of the north side of Inferno**. From 13:27 to 13:33, we did a video and **photomosaic of the south side of Inferno**. From 13:35 to 13:45, we attempted to collect a sulfide chimney piece from Inferno, but were not able to get a solid piece. We noticed that there was a HoBO probe here and we tried not to disturb it. We found up to 319.4 deg C on the North side approximately 1 m below the summit, depth 1539, heading 248. We took the orange gas-tight 16, blue major, and pistons 4 and 5 at this vent from 14:05 to 14:35. Temperatures measured

during pistons 4 and 5 were 309C. (A valve was knocked off piston 4 prior to sampling and it collected seawater because of the leak.) Following water sampling at Inferno, at 14:34 we collected a **grab of tubeworms with blue mat** from the south side of the chimney at the same depth (1539.7). At 14:38 we headed for Virgin Mound and took some HD video before disturbing the vent. After an ROV watch change, we **recovered HoBO/MISO 103 from Virgin at 15:00**. We measured a max T of 277 at Virgin with the Jason T probe. Temperatures during HFPS sampling were slightly lower indicating some seawater entrainment. We took pistons 2 and 3 and the port GT on HFS plus the white GT from the basket. **MISO 129 was deployed** in the vent at 15:46 after fluid sampling. From Virgin, we drove to **Hell vent**, looked around the chimney and chose a hot vent on the east side about 1 meter down from the summit to sample. Max T was 274 with the Jason T probe, vent orifice >2 cm diameter. Took red major, red gas-tight, HFPS bags 17 and 18. Finished sampling at Hell in 30 minutes, and moved about 2 meters south to **marker 68** where we took one of the 2 large McPhail syringe samples for **microbial mat** and **deployed MTR 4098**, in the same site where we picked up the old MTR at the beginning of the dive. We then drove back NE to the SCPR instrument. The UCSD/SIO group had determined that the instrument had a slow water leak that would cause the instrument to fail with damage, so it was recovered at the end of the dive after activating the secondary burnwire, along with the "Cassius" sonar beacon (pull-pin release) used to calibrate the USBL nav system. We left the bottom at 19:04 UTC on 8/19 (14 hours bottom time). Jason was on deck at 22:15.

Summary of Dive 661, Trevi to Vixen

The purpose of this dive was to make observations of hydrothermal activity along the 2011 eruption zone, take samples, recover and deploy temperature recorders, and recover the RAS sampler at marker 33 vent. Jason was in the water at 07:11 UTC on 8/20/2012 after being on deck for approximately 9 hours between dives. We conducted 2 CTD casts while Jason was on deck. The winch was still not working correctly. Jason was on the bottom near Trevi vent at 09:29. At 09:37 we arrived at **Spanish Steps**, a sulfide structure about 1 m high and 1.5 m long, oriented roughly NE-SW, seeing marker 155 on the vent from heading 130. We measured temperatures up to 196 on a flat flange on the south end of the structure, about halfway down. We took HFPS pistons 4 and 5, the white gas-tight and the blue major at this vent, approximately 125°C. From the north end of Spanish Steps, we took a bio grab sample of worms with blue protist mat into the starboard bio box. At 10:41, we arrived back at **Trevi**. Measured a maximum temperature of 270C with the Jason probe. At Trevi, we took HFPS pistons 2 and 3 and the "blue" gas-tight on HFS. We **recovered HOBO/MISO 135 and deployed MISO 104**. From Trevi, we drove at heading 240 over lava pillars and collapse area, with some orange hydrothermal staining, toward the "Snow Globe" snowblower area. The navigation indicated that we were **at Snow Globe**, but there was **no snowblower activity and no floc in the water**. We drove at heading 130 from Snow Globe, passing over lobate lavas with mostly orange hydrothermal staining in the crevices. There was at least on distinct contact boundary between fresh black pillow lavas and older sedimented sheet/lobate lavas. When we got close to the **N3 site**, staining became white. We found the MTR placed where we had sampled in 2011, recorded some HD video before touching the vent, then **recovered MTR 3312**. We took HFPS bags 17 and 18 and **deployed MTR 3332** in the same spot where 3312 was. We left marker N3 area at 13:25 and drove toward marker 33. While en route, the WHOI group tested

optical comms between Jason and Medea. We saw consistent orange staining with some white areas in transit, but did not see active venting of snowblowers. At 15:49, we arrived at the RAS at marker 33 vent (now marker 166 deployed in 2011). We did a temperature survey with the Jason probe around the RAS intake. Removed a new MTR out of the bio box to place here. Picked up the RAS intake and removed the 2 MTRs attached to a titanium tube (pulled the intake line out of this tube). **Recovered MTRs 3197 and 4097** from the RAS intake. Tubeworms several inches long were growing on the titanium tube that was part of the RAS intake. **Recovered separate MTR 4094** from a crevice approximately 20cm away from RAS intake. From 16:56 to 18:12, we sampled two **RNA filters**, and two **HFPS bag samples** at the RAS vent, temperatures 14-17C. We **installed MTR 4095** in the spot where the RAS intake was. Took a successful sample of orange mat with the large green **McPhail syringe sampler**. Took a sample of white mat with the other McPhail large syringe sampler, but could not tell how much material was collected. Temperature was 18.4 in the white mat area. The ship and ROV got into recovery position and we released the RAS mooring at 19:35, Jason then came up 106 m off the bottom. RAS reached the surface at 19:58. There was a delay getting back to the seafloor pending a discussion of how to continue without reeling in/out with the winch. We were back on the bottom (approx. 500 m west of marker 33 due to drift during mooring recovery) at 21:00 with the understanding that the next Jason dive after this would not happen until after we returned to Astoria to fix the winch. We passed over pillars/collapse area driving back east to the eruptive fissure/snowblower vent line, then turned south toward Boca. There were a few weak cloudy vents causing some cloudy water, but no floc. Found marker 170 at 23:27, with an MTR in Boca vent about 2 m east of the marker. **Boca** vent was still producing cloudy water and floc, but much slower than in 2010. Measured temperature with HFPS in Boca vent, finding ~9C. Bumping the seafloor with Jason caused a huge snowstorm, so there is still plenty of floc below the seafloor, but it is not being flushed out very much at steady state. We took HFPS piston 9, bag 24, RNA filters 13 and 14, and hand-held red gas-tight at Boca. We **recovered MTR 3043** from the inner edge of Boca vent. We **deployed MTR 4001** very close to the same spot where the previous MTR was located. This finished our work at Boca, and we drove slowly at heading 130 for less than 2 minutes and found an area of flat hydrothermal mat roughly 4 m in diameter. We measured temperatures up to 15.7°C with the Jason probe and took a small (yellow tape) McPhail syringe sample of brown mat. We sampled a flat piece of fresh basalt approximately 30x15x1.5cm for Maurice Tivey's colleague to do magnetic measurements. We circled the Boca area of venting looking for more vents, but found only smoky water and low-level activity, and then continued our transect south toward Skadi vents. We passed over skylights, collapse areas and pillars with occasional cloudy water, lots of orange hydrothermal staining, and a few areas of light staining/mat. Compared to the area north of marker 33, there are more signs of venting between Boca and Skadi. We passed over a short section of striated sheet flow with depth 1526.5m leading into a rough area where **triangle marker A** was found, next to (above) an opening (lava tube?). This is the **Skadi** vent area. Lots of staining/mat here with cloudy water slowly wafting out of the hole. Skinny tube worms next to the opening, measured temperatures of 16°C in the worms, but not much visible flow. We did not have enough sample capacity left to take any water samples here (and could not find a temperature above 5 with HFPS). Leaving marker A at heading 280, we found more intense white staining, cloudy water, then a **small sulfide mound approximately 1 m high, covered with tubeworms** and white staining. We found 45-48°C water here and sampled one

piston here, calling it "Skadi tubeworms". We drove from Skadi to **Marker 113** on heading 248, finding abundant clams before seeing the pillar vents at **marker 62** (the replacement for 113). The vent appeared unchanged following the 2011 eruption. There is no new lava around the base of the pillars. We **recovered MTR 4128** (heading 325, depth 1520.5). Jason temp probe in that spot measured 19.4°C. We moved slightly to the SW point at the top edge to sample fluids. Marker 113 was one of the key sampling targets, and we took HFPS bags 19, 20, 21, "white" ram gas-tight on HFS, and the large volume bag (3872ml), then RNA filters 10 and 11. In-line temperatures stayed near 28.5 for most of the sampling. We then used the suction sampler to collect blue mat from rock surfaces. Finally, **deployed MTR 4127** near the sampling spot on the southern point (heading 18, depth 1521.7). We left marker 113 at 07:21 for Vixen vent, heading 220, and arrived at 08:43. **Casper** had a white anhydrite spire, approx. 1 meter high, and the HoBO/MISO probe was visible from heading 140. **Vixen**, a few meters south of Casper, had some large white/yellow blocky material and unusual black/white growth on the hottest vent. *The HoBO probe left at Vixen was not visible.* Jason temperature probe read 352.1 in Vixen. We took HFPS pistons 7 and 8 with in-line temperature of 345.3, then the orange hand-held gas-tight. We **deployed HoBO 101 at Vixen** from the south side, with the body of the recorder pointing from the hot vent to the west. Went back to Casper and found the HoBO with the body partially buried, viewing the recorder straight on from heading 103 with the spire and blocky deposits behind it. We left it in place to continue data collection. Dive over. Jason left the bottom at 9:44 (24hrs15min bottom time) and was on deck 11:41, 8/21/2012.

6.3 NEMO 2012 ROV Dive Images

Dive J2-660, ASHES field

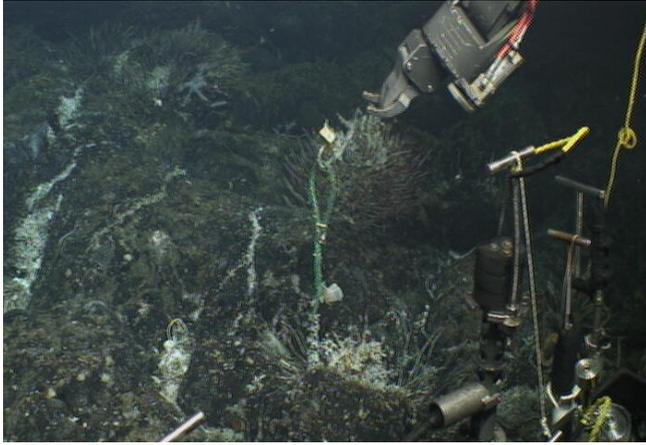


Figure 9 Recovering MTR found in tubeworm bush, 8/19/2012 08:24 45 55.9935 130 0.83253 hdg 230 depth 1545. This is next to marker 68 near Hell, a vent referred to as Medusa in 2010, when this MTR was deployed along with the marker, just a few meters south of Hell chimney.

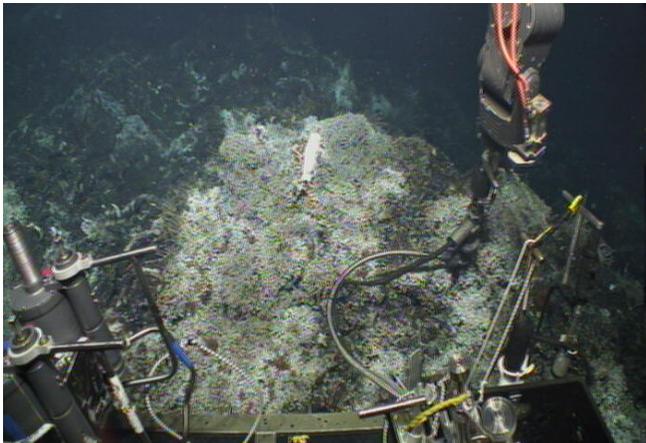


Figure 10 Sampling fluids at Anemone vent, Aug 19 2012 09:30, J2 Dive 660. Temperature 30-35C. Heading 307.

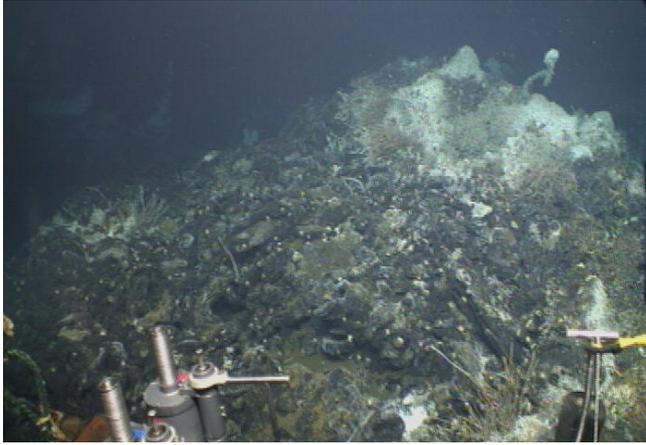


Figure 3 Anemone vent, ASHES, 8/19/12 08:30, hdg 136 depth 1544, encrusted line of MTR 4096 visible.

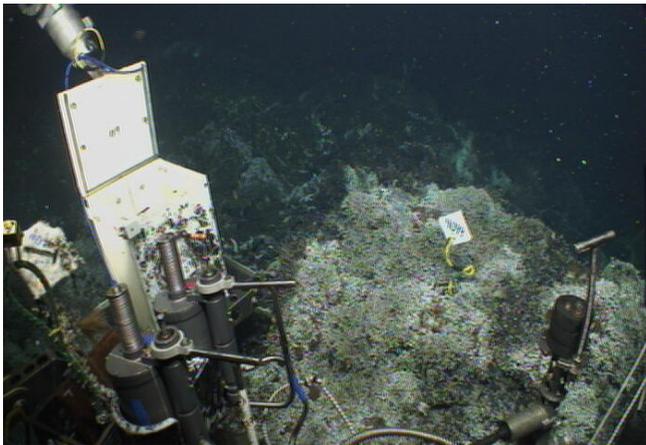


Figure 11 Anemone vent, MTR 4099 deployed after MTR 4096 recovered.

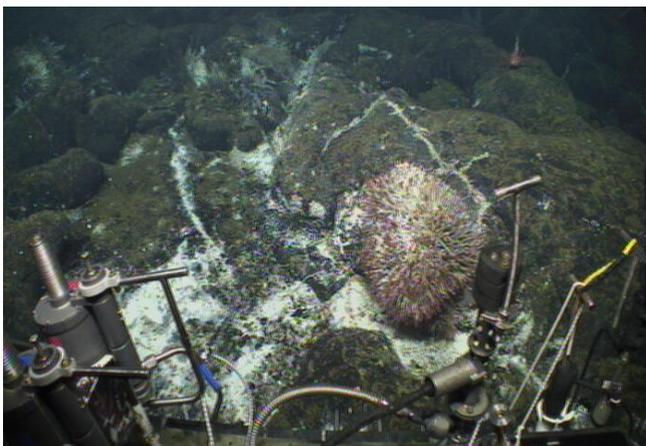


Figure 12 Fuzzy Tubeworm bush, ASHES N of Inferno, J2 Dive 660, Aug 19, 2012. Heading 337.

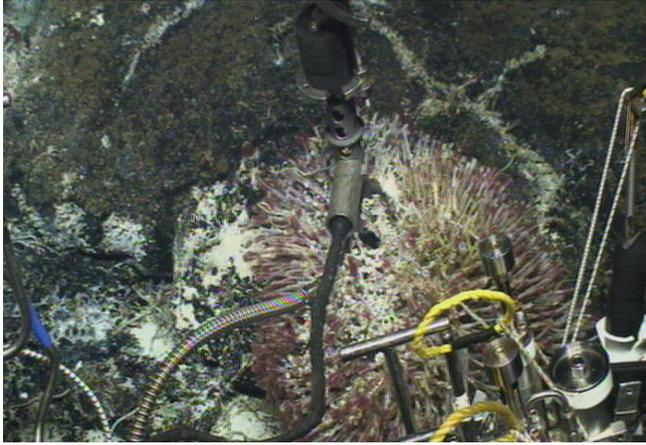


Figure 13 Fluid sampling at Fuzzy Tubeworm, ASHES, J2 660. 8/19/2012, 12:00 UTC.

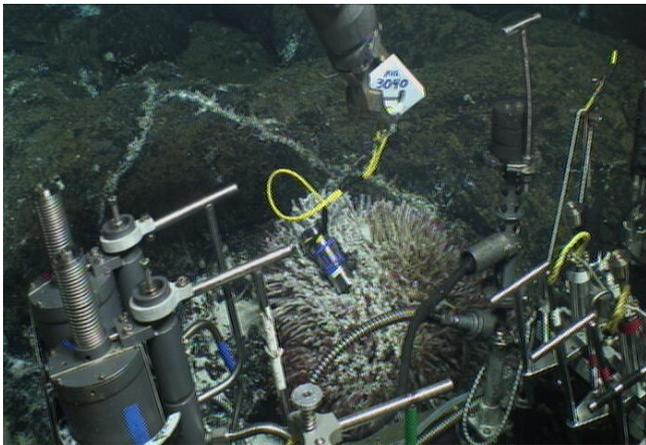


Figure 14 MTR deployed at Fuzzy Tubeworm Aug 19, 2012, J2-660.

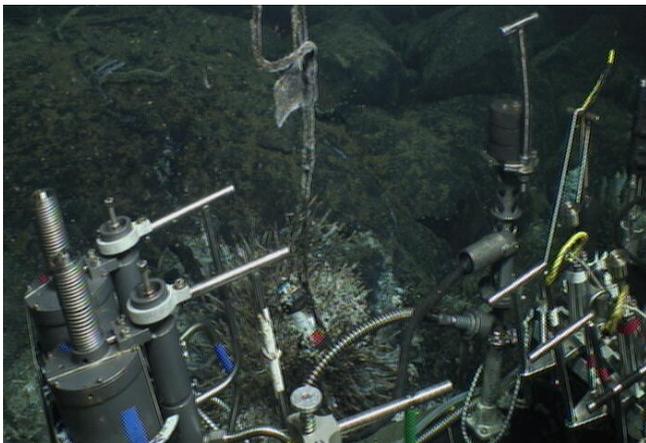


Figure 15 Recovering MTR with red tape from Fuzzy tubeworm, Aug 19, 2012. This vent is within about 2 meters of the vent sampled in 2012, but is a separate worm bush. This is an old MTR with T data from 2000-2002, deployed on ROPOS545. The MTR deployed in 2011 was not seen or recovered. Will look in 2013.



Figure 16 Inferno chimney, ASHES field, heading 250, temperature measured 319C.



Figure 17 Blue major sampler taken near top of Inferno, heading 248 depth 1539, J2 660, Aug 19, 2012. An encrusted HoBO T recorder (not recovered) is visible to left of major.



Figure 18 Bio-grab sample for tube worms growing on Inferno near the smoker site sampled.



Figure 19 Virgin Mound, 8/19/2012 08:03 hdg 227, first entry into field.



Figure 20 Virgin Mound vent, ASHES field, J2 660. Hobo T recorder is in place but tip may not be in the flow.



Figure 21 Closeup of Virgin vent with HOBOT T recorder in good position.

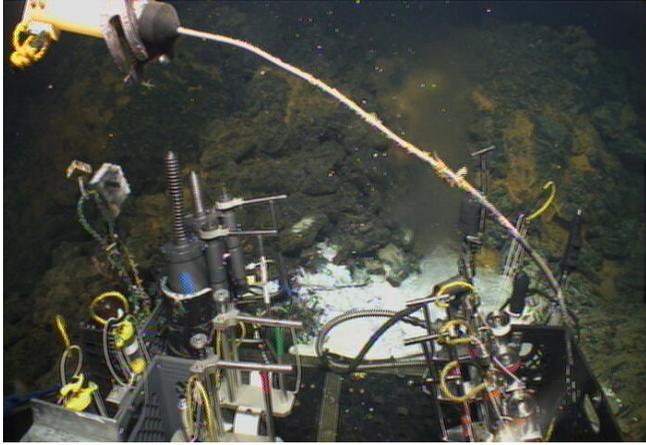


Figure 22 HOB0/MISO 103 recovered from Virgin vent.

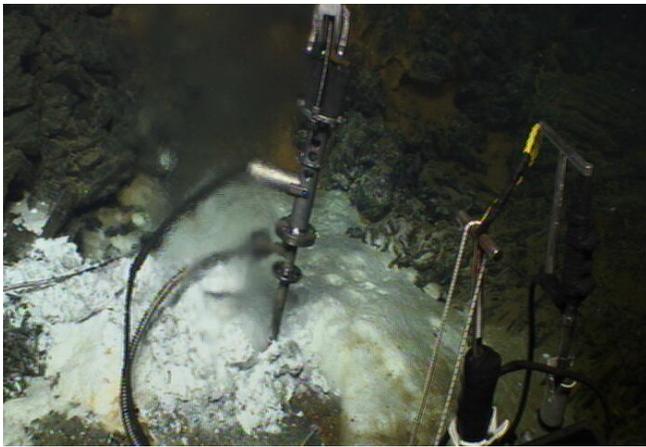


Figure 23 Sampling Virgin vent with HFS. Took 2 pistons (one failed to fill), one HFS-mounted GT and one discrete GT.

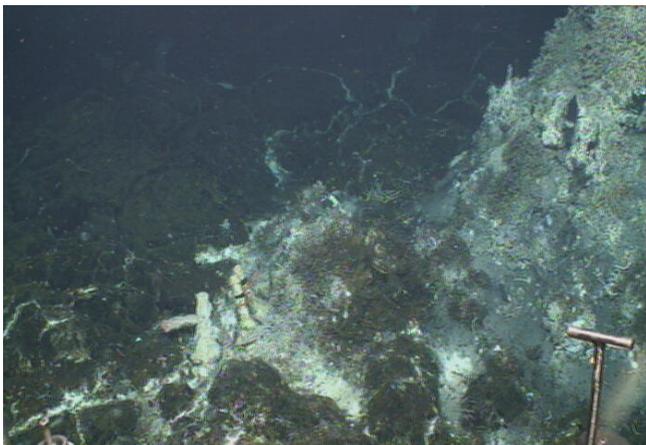


Figure 24 Experiment deployed on south side of Mushroom vent (Girguis lab?).

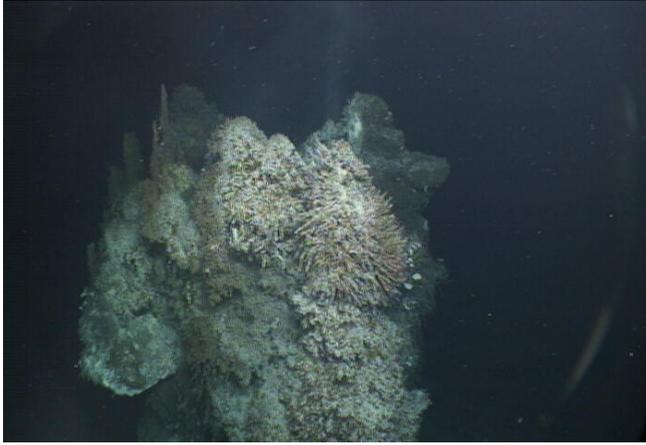


Figure 25 Hell vent, ASHES, Aug 19, 2012. Heading 20, depth 1539.

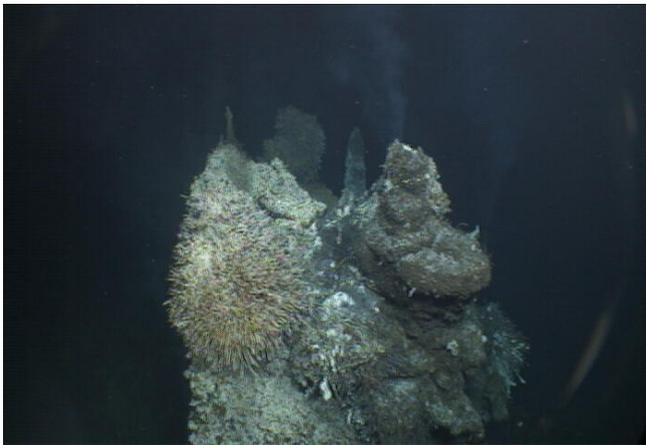


Figure 26 Hell vent, heading 320, depth 1539.

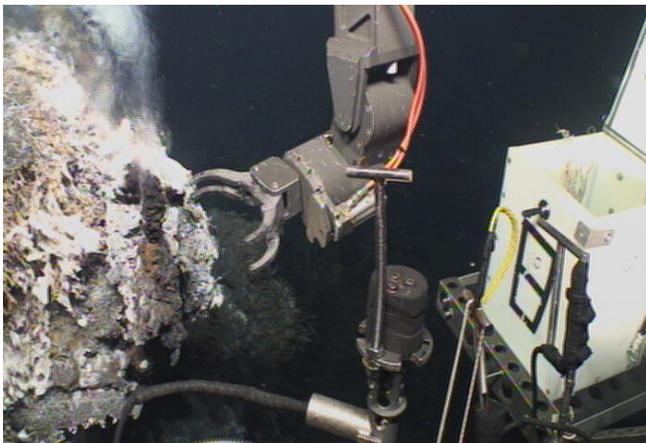


Figure 27 Attempt to grab sulfide chimney from Hell. Friable chimney crumbled (same result as Inferno).



Figure 28 Temperature measurement at Hell. Max 274C (lower than last year).

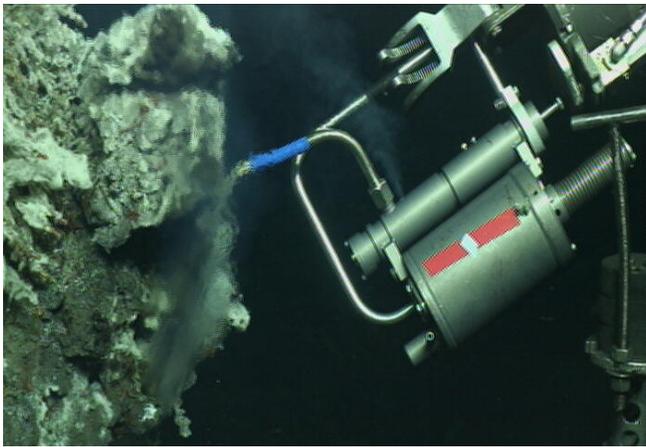


Figure 29 Red major taken at Hell vent 274C, approx 1 m down from top on east side, heading 272, depth 1540.0



Figure 30 MTR#4098 deployed near Hell vent, heading 264, depth 1543

DIVE 661 SE CALDERA FROM MAGNESIA TO VIXEN

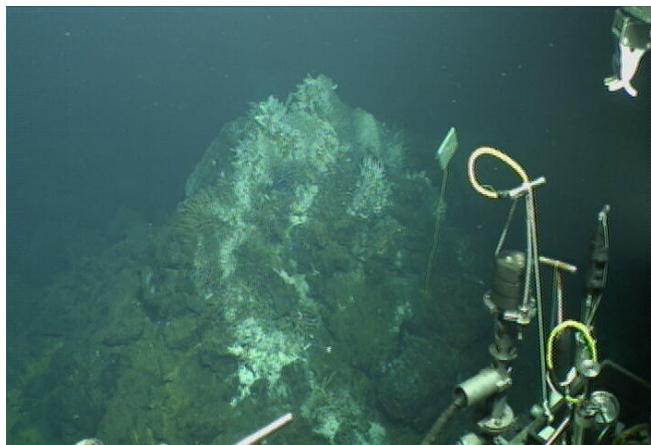


Figure 31 Spanish Steps, with marker 155, start of dive 661. Depth 1519, heading 129.

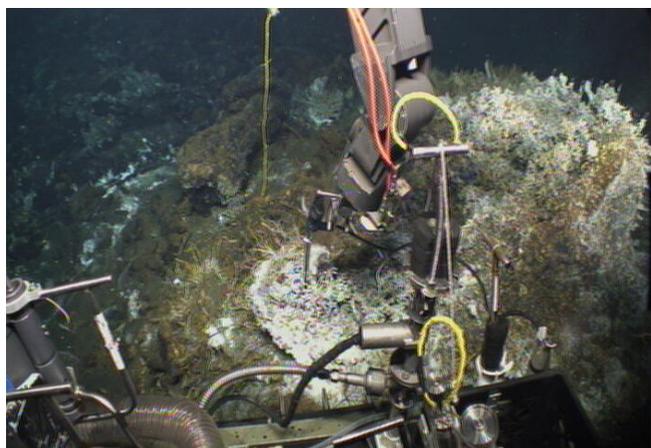


Figure 32. Temperature measurement with Jason probe in hotter part of Spanish Steps (max 195.4C), heading 357, depth 1520.2

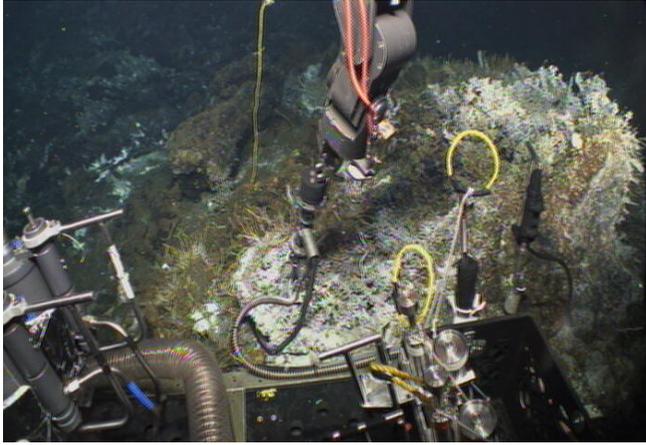


Figure 33 Sampling with HFS (pistons 4 and 5) at the same spot where temperature probe was used.

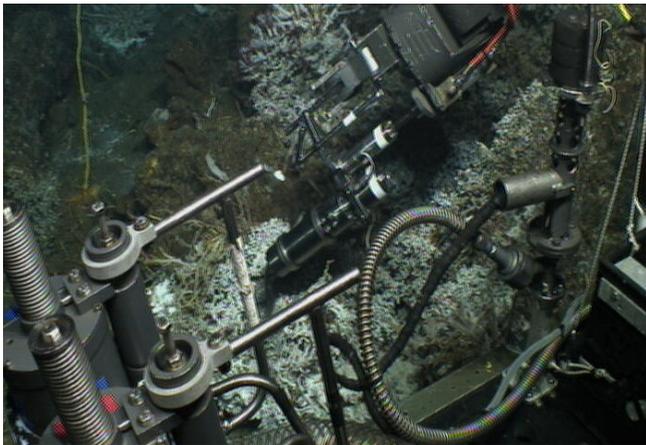


Figure 34 White gas-tight (GT17) sample at Spanish Steps.

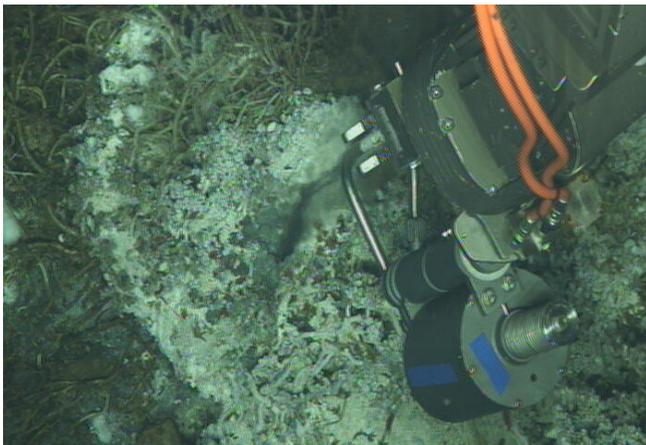


Figure 35 Blue major sampler at Spanish Steps, J2-661, 8/20/12, 10:20, depth 1520.2m, heading 357.

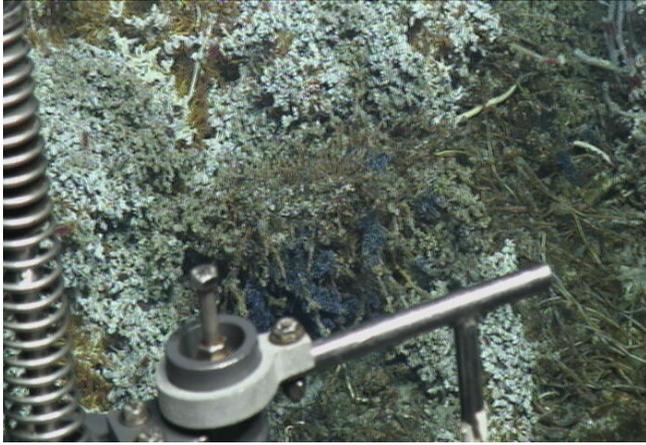


Figure 36 Small patch of blue mat on opposite (N end) of Spanish Steps. Depth 1519.5, heading 177.

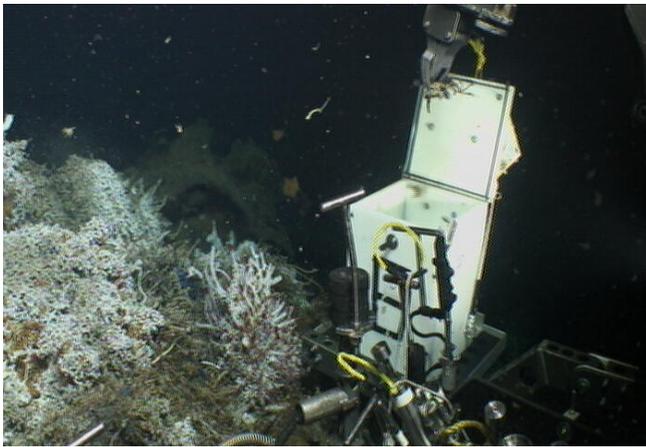


Figure 37 Tubeworm grabs with blue mat put into bio box.



Figure 38 Orange hydrothermal deposits between Spanish Steps and Trevi, bottom depth 1521, heading 3.

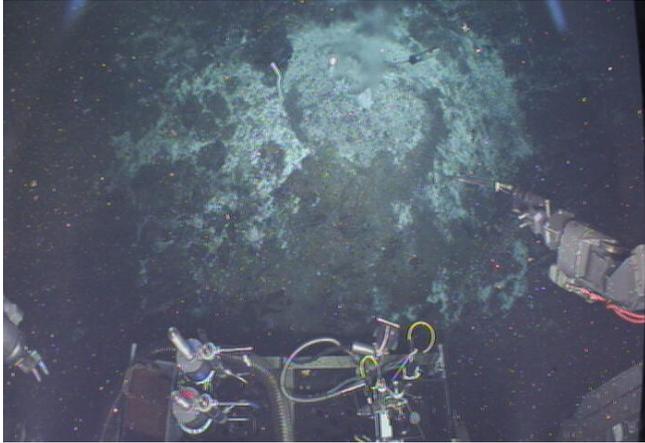


Figure 39 Downward view on Trevi vent with Hobo temperature recorder still in place. Heading 146, depth 1520.1.



Figure 40 Temperature measurement at Trevi, max 270C.



Figure 41 Sampling with HFS at Trevi vent.

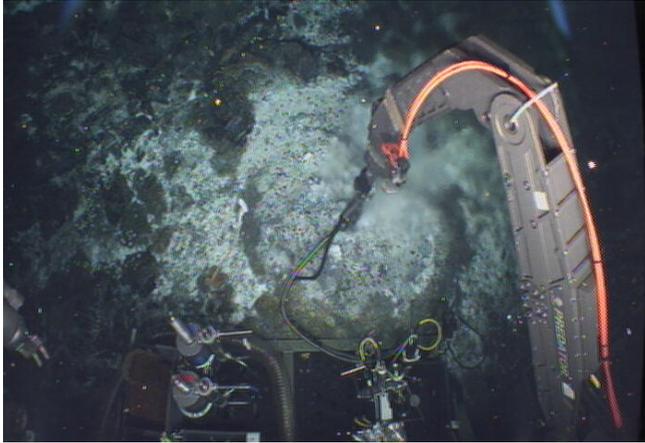


Figure 42 Downward view of sampling at Trevi. Piston 2 did not fill, piston 3 OK, GT12 on HFS fired.

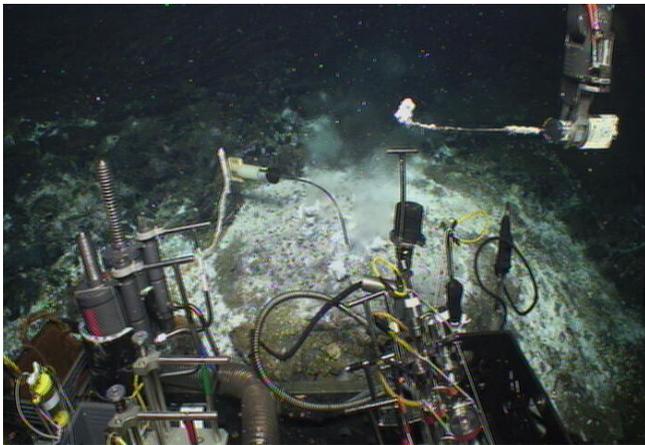


Figure 43 HOBO 135 is recovered and HOBO 104 is in place in Trevi.

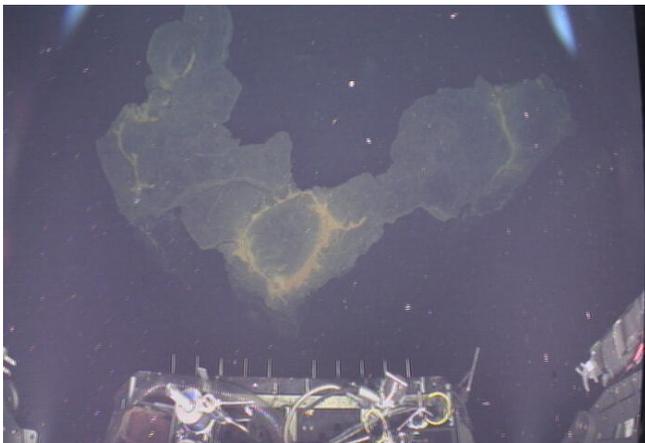


Figure 44 Lava pillars with iron-rich mat west of Trevi. Water is relatively clear in this area, unlike in 2011.

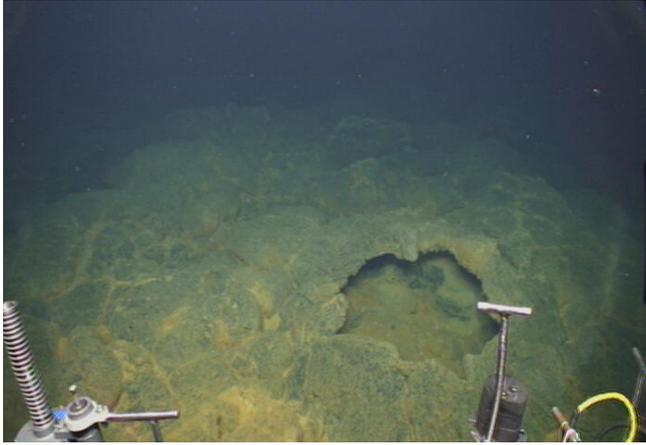


Figure 45 More iron-rich mat seen while looking for snow-blower activity.

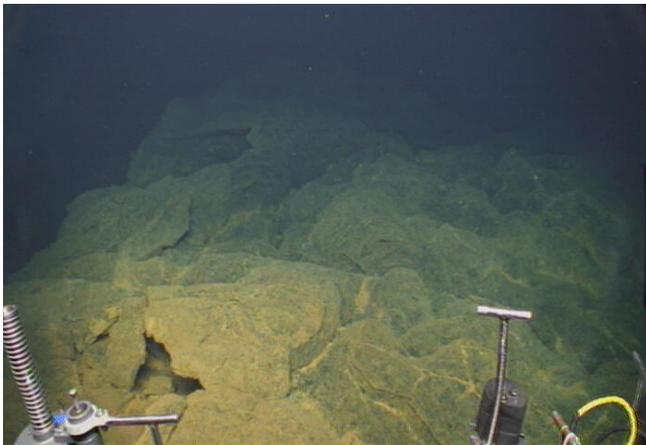


Figure 46 In the vicinity of Snow Globe. No venting.

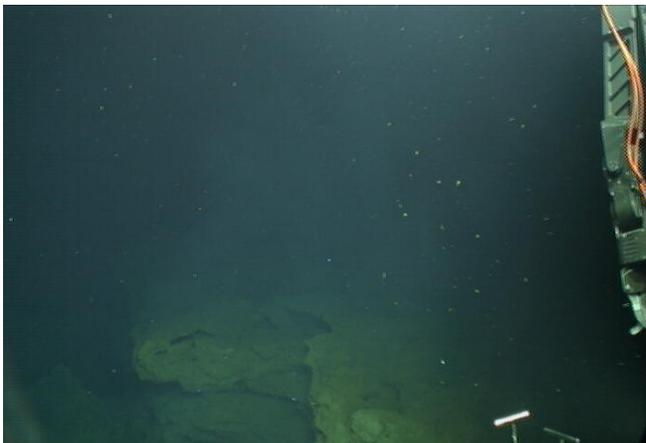


Figure 47. Snow Globe area. There is a faint shadow of cloudy water venting here, with a small but noticeable increase in temperature on the CTD (3.1C vs 2.5C background). Venting has nearly stopped.

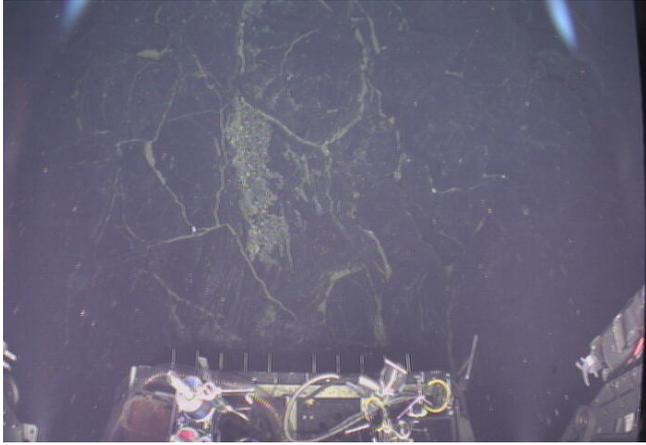


Figure 48 Light-colored debris and hydrothermal accumulation in cracks. 12:18UTC 8/20/12, 1524m bottom depth.



Figure 49 Arrived at marker N3 area (MTR#3312 seen here before being recovered). 12:38, depth 1522.4 (1523.1 bottom) heading 315.

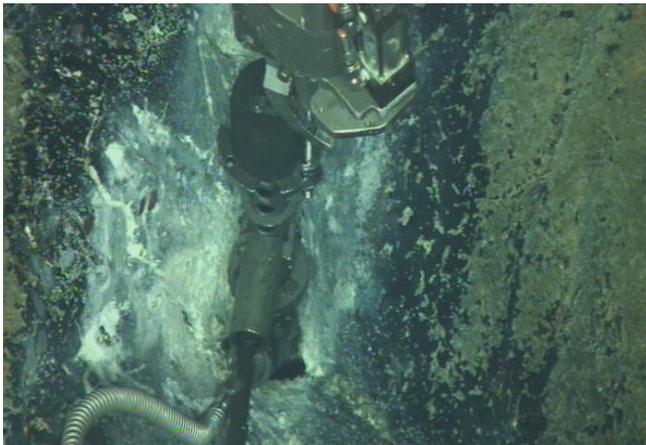


Figure 50 Sampling with HFS in crevice where MTR was deployed last year. Tmax 20.2deg C. Depth 1522.3, heading 312. Two bag samples taken, no gas-tights.

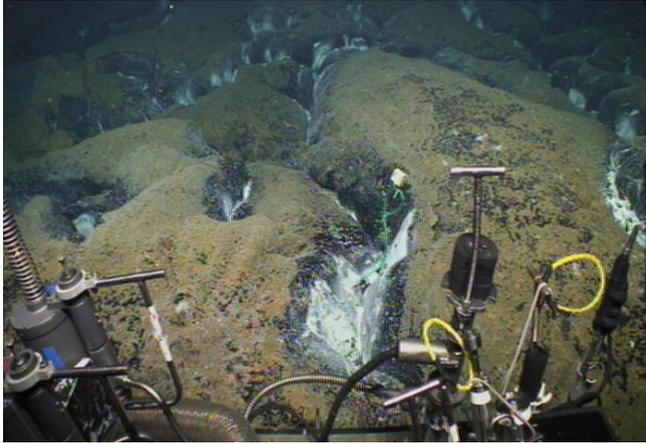


Figure 51 MTR deployed at sampled site, marker N3 area.



Figure 52 Leaving marker N3 area (13:26) see some minor floc venting and some white cloudy water.

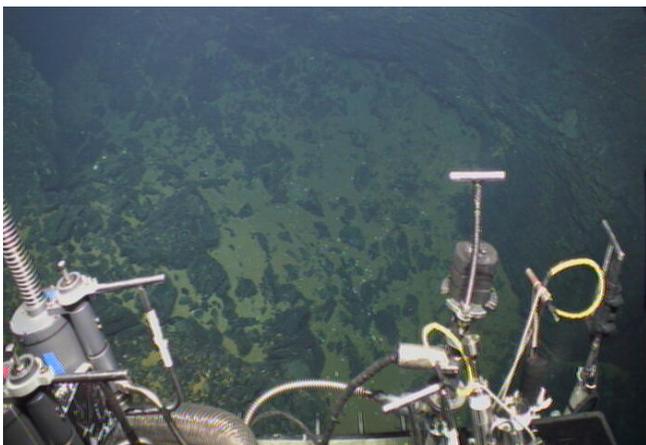


Figure 53 Driving south from N3 area, orange hydrothermal sediments/mat. 13:38, botom depth 1522, heading 170.



Figure 54 Crab seen en route to Mkr 33, 13:47. Abundant orange sediment/mat with some white material accumulated in cracks.



Figure 55 Glassy lava with hydrothermal staining. 14:24, 1513.3m depth at top of lava roof, floor is 4 m below.



Figure 56 Arrived marker 33 RAS, 15:49.



Figure 57 RAS floats (5) are 8.5m above bottom. A 5-m recovery line floats above them.

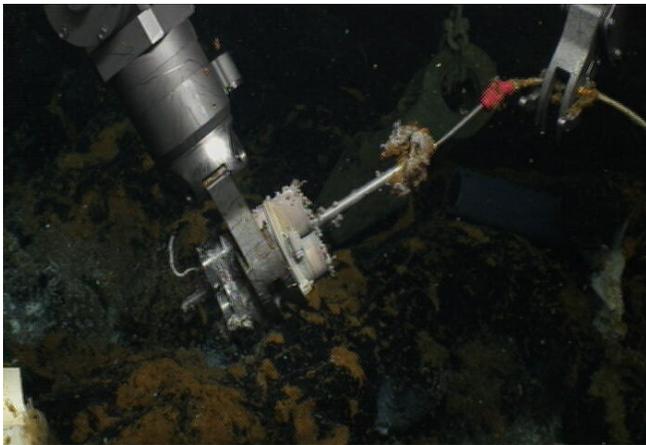


Figure 58 Pulling the intake tube for RAS out of the titanium tube with two MTRs attached. There is a clump of small tube worms around the end of the Ti tube. Depth 1515.5 (bottom 1516.2), heading 163.

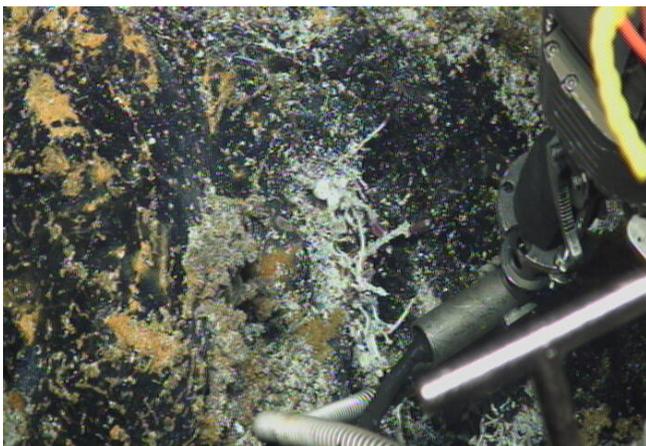


Figure 59 Closeup of vent sample site at marker 33 (new marker 166). Tube worms have grown to several inches length since last year. Temperature approximately 17C, low flow.

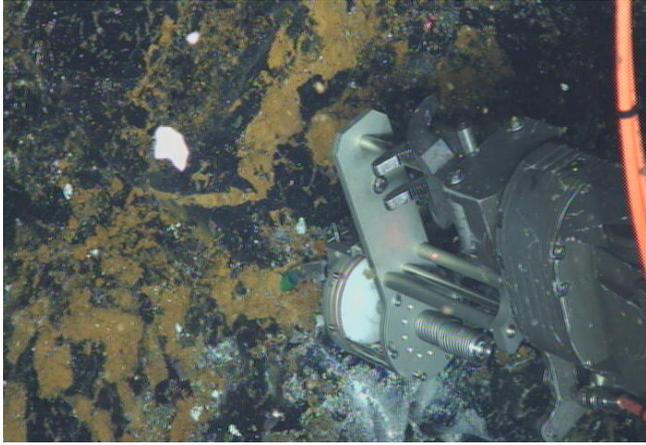


Figure 60 Taking green syringe sample for mat at marker 166/33.

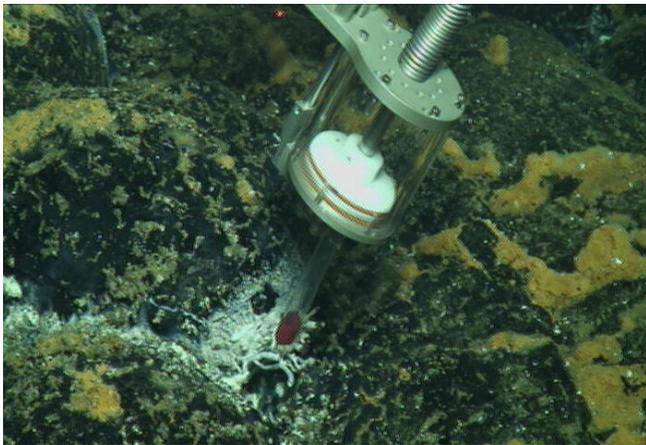


Figure 61 Taking red syringe sample for white mat at marker 166/33. Measured 18.4C at this spot.

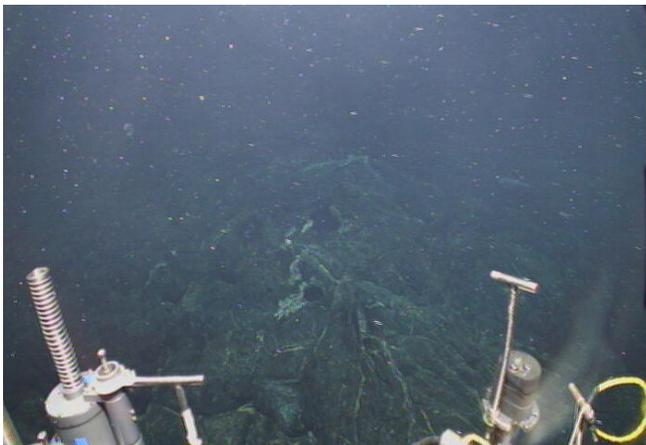


Figure 62 Cloudy and very slightly warm water (based on CTD readout) passed through while looking for snowblowers near Boca. J2-661, 23:19 on 8/20/2012.

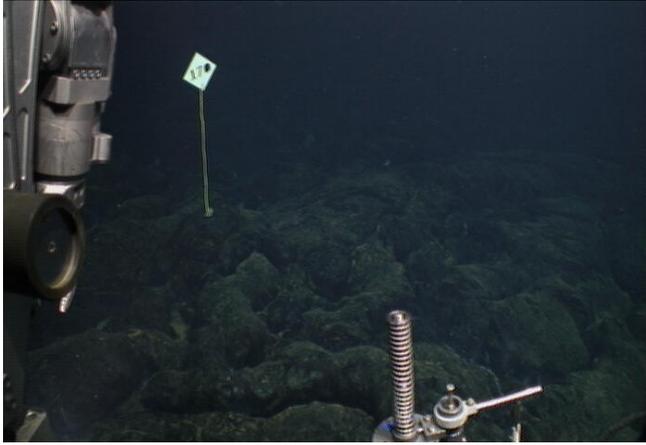


Figure 63 Marker 170 found, near Boca. 23:27. Boca is not right at this marker.

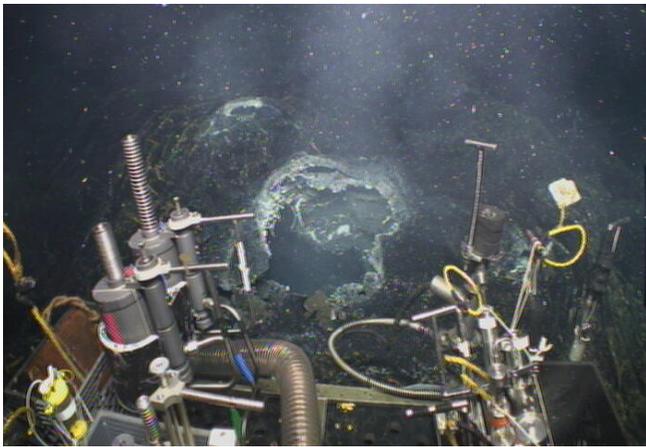


Figure 64 Boca vent area. Some snowblower activity still present, mostly very fine particles, milky water.



Figure 65. Boca vent. Disturbing the seafloor creates a snowstorm.

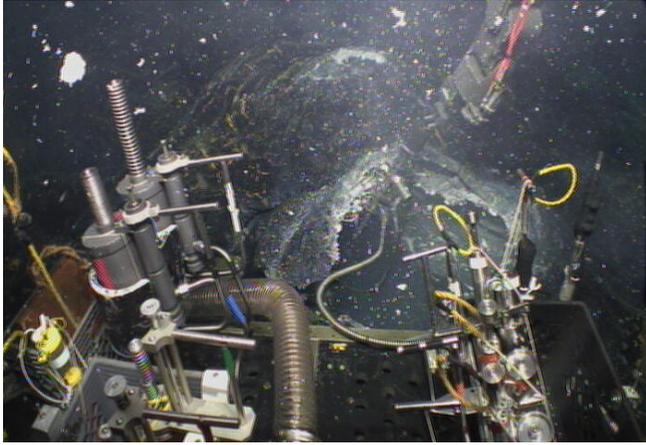


Figure 66 Boca vent. HFS nozzle in the opening, taking fluid samples. 23:49 8/20/2012.

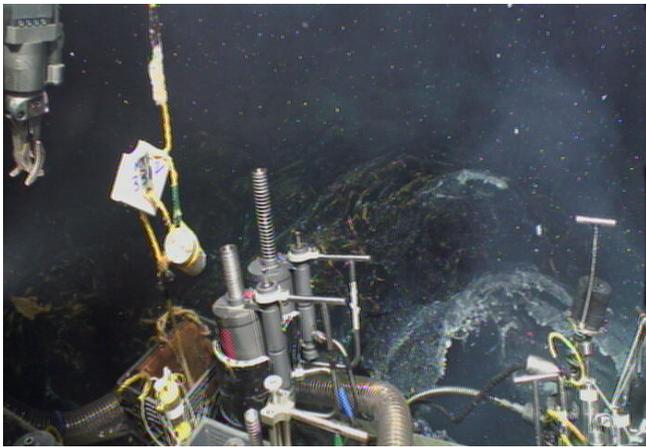


Figure 67 MTR #3043 recovered at Boca, into front milk crate.

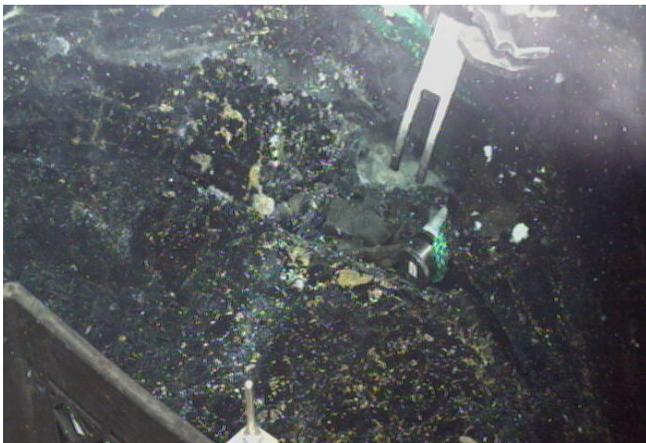


Figure 68 MTR #4001 deployed at Boca vent. Heading 130,depth 1518.2, alt 1.1m. Green line with one small syntactic cube.

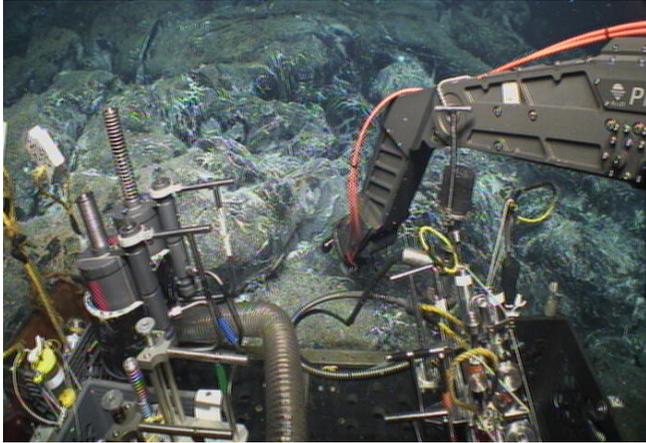


Figure 69. Area of hydrothermal staining near Boca. Temperature up to 15.7C.



Figure 70 Small syringe used to collect material from rock surface in altered area. Heading 115, depth 1518.4.



Figure 71. Rock sample 23 collected near Boca, depth 1518.8, heading 30, some warm water in this area.

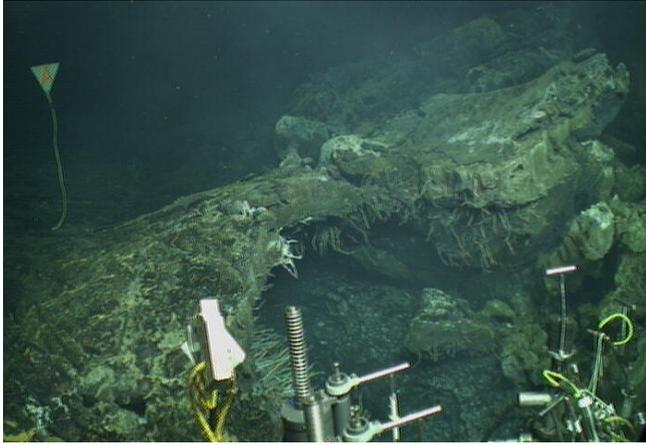


Figure 72 Triangle marker with orange A with slightly cloudy water venting, tubeworms on the undersides of lobate flow. 45deg 55.41395N 129deg 58.9656W, 1526m depth, heading 221. Near Skadi vents. Temperature measured 16C in tubeworms. Could not find warm spot with HFS and did not sample here.

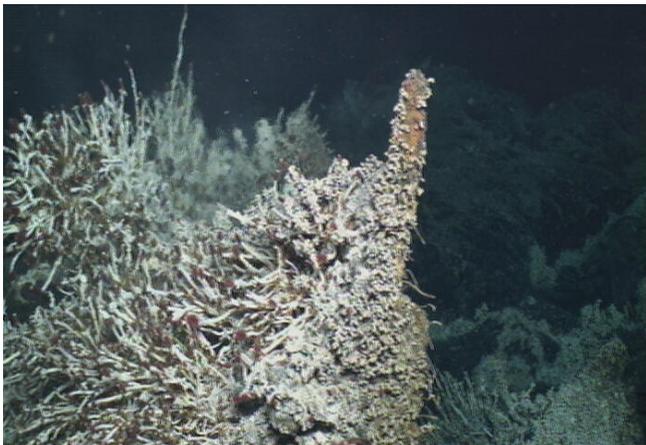


Figure 73 We are calling this the Skadi Tubeworm site. A sulfide structure covered with dense tubeworms and strong flow. Took one water sample (piston 6).



Figure 74 Sampling with HFS at "Skadi Tubeworm" site. HFS Temp up to 47C, depth 1519.6, heading 222, 8/21/2012 03:54. 45 55.40633 129 58.99175.



Figure 75 Field of clams seen just before arriving at marker 113. Seafloor depth 1523m. Heading 248.



Figure 76 Marker 113 vent from heading 258, depth 1521.6. We sampled the point on the far left of this image.

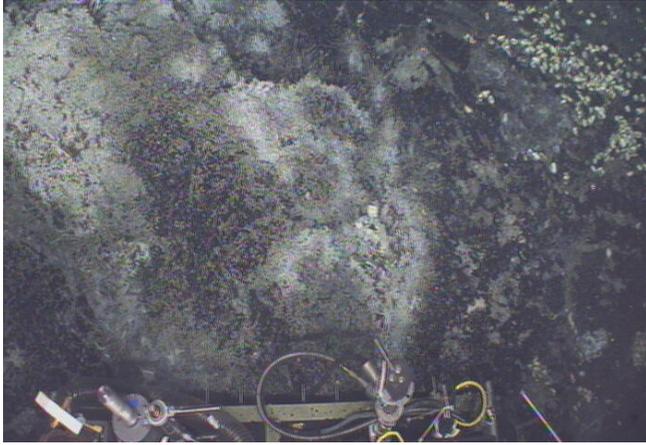


Figure 77 Marker 113 vent. 8/21/2012 04:56, depth 1520.7, heading 335. The MTR #4128 about to be recovered is visible in the crack in the middle of this downlooking image. We measured 19.5degC in this spot with the Jason T probe. Then we looked for a warmer spot to sample.

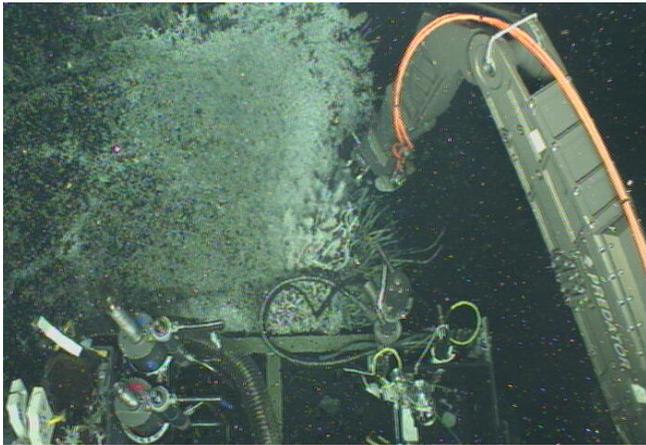


Figure 78 Rotated about 90deg to face 075 and using T probe on the southern point of the vent site.

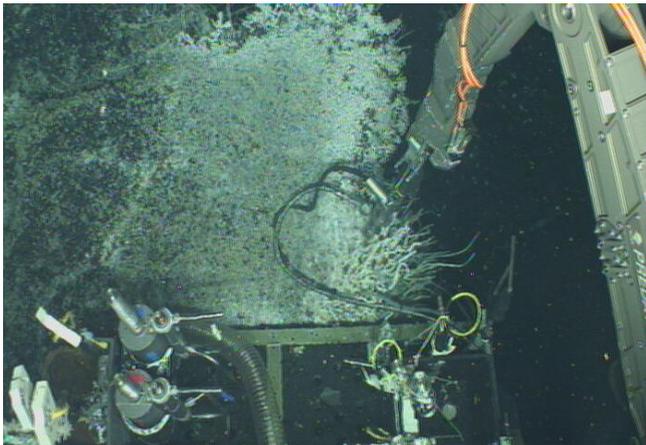


Figure 79 HFS sampling on the southern high point of marker 113 vent. Temp approx 28C. Heading 074, depth 1520.7. 05:32 8/21/2012.

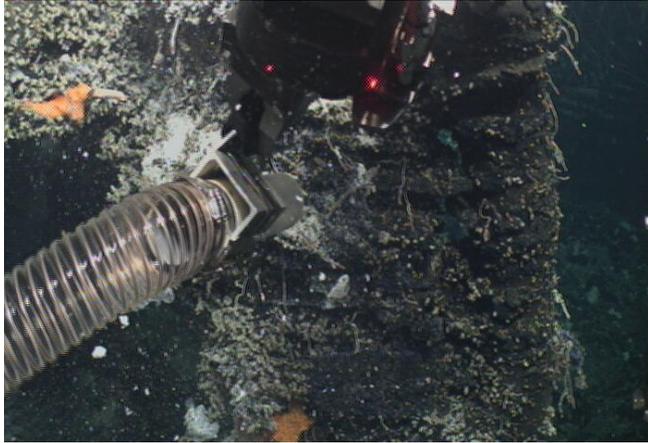


Figure 80 Slurp sample (32) of blue mat on vertical lava spire surface at marker 113. 07:03, 8/21/2012, depth 1522.4 heading 003.

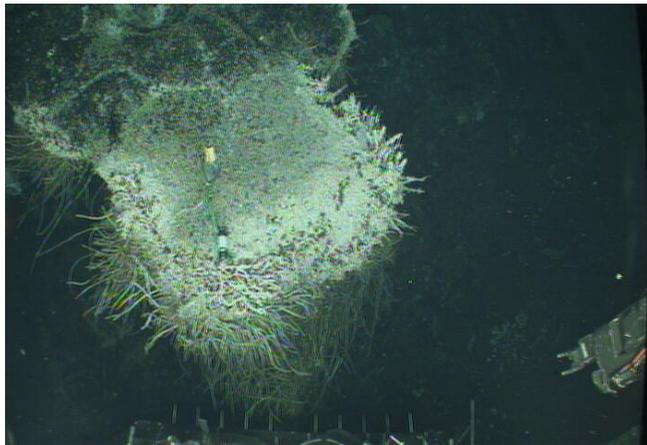


Figure 81 MTR #4127 deployed at mkr 113 site on edge of tubeworms, near the point of fluid sampling. Heading 24, depth 1520.3.



Figure 82 Octopus on glassy pillow lava between marker 113 and Vixen, 07:52.



Figure 83 First sign of tubeworms en route from mkr 113 to Vixen. 08:34. 1533 m depth.

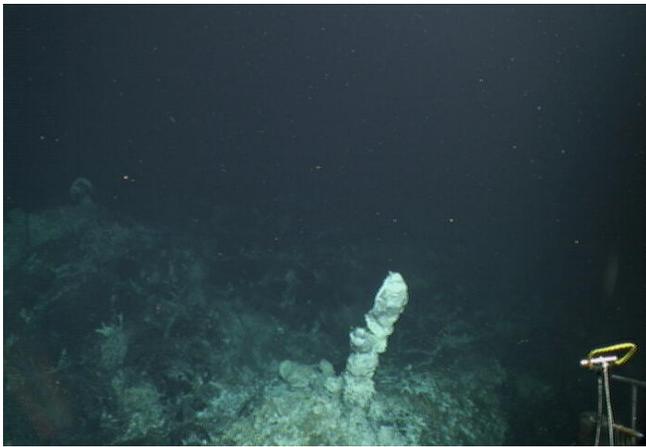


Figure 84 Casper vent in foreground with Vixen vent background left. Heading 193 (Casper is north and Vixen is south). Depth 1533.



Figure 85 HOBOT probe in Casper vent. The main vent is now behind where the Hobo probe is located.

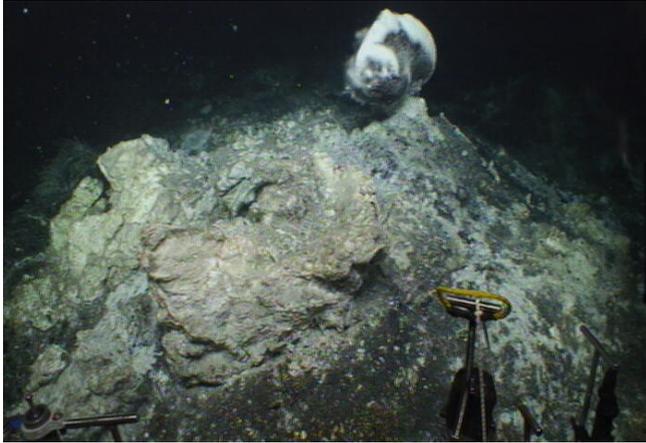


Figure 86 Vixen vent prior to sampling. The chunky, solid material in the foreground is new, as is the very distinctive black/white sulfide/anhydrite growth on top of the mound. 08:58 depth 1534.7m heading 185

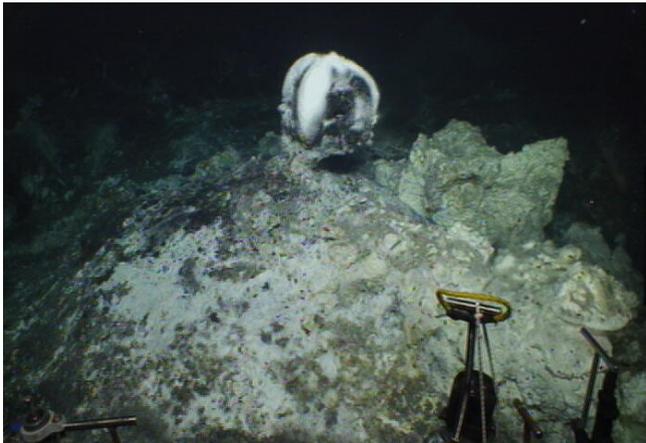


Figure 87 View of Vixen vent from heading 322, depth 1534.6



Figure 88 View of Vixen vent from heading 302, depth 1534.9

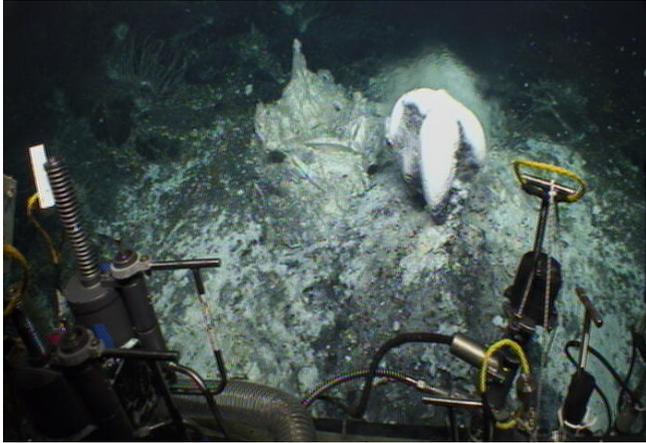


Figure 89 View of Vixen vent from heading 079, depth 1534.

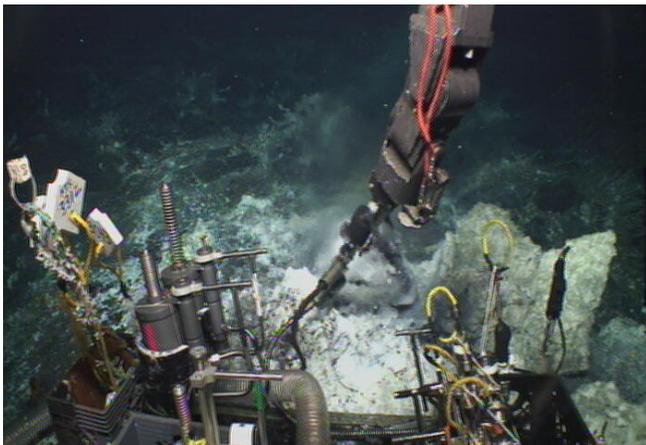


Figure 90 sampling hot fluid at Vixen vent, T by HFS 345.3, with Jason probe 352. Observed flashing/emulsion in fluid indicative of boiling. Heading 334, depth 1534. Took 2 piston samples here. The HOBO T recorder was not visible in this vent and may have been buried. HOBO recorder was still visible in nearby Casper.



Figure 91 A new Hobo T recorder installed at Vixen vent after sampling. 09:35 8/21/2012. depth 1534, heading 11.

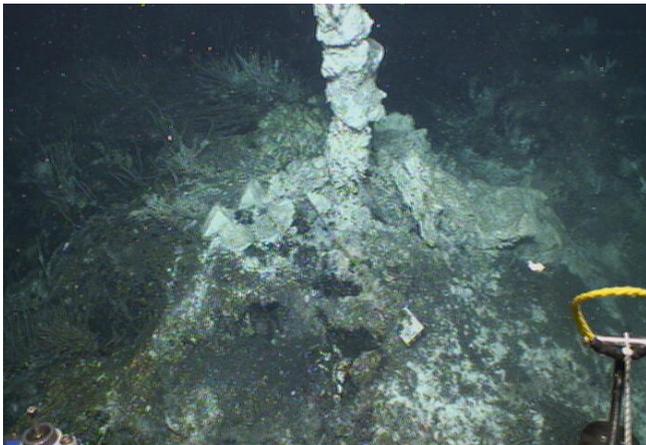


Figure 92 After starting to unbury this Hobo at Casper, it was decided to leave it in place for another year. Heading 103, depth 1534.5. This was the last operation at Axial before leaving the seafloor.

Appendix 1: High-definition video log

Dive Number	KiPro HD recorder name	Start time (log)	End time (log)	Notes
J2-660	3ATK394	8/19/2012 7:03	8/19/2012 7:14	thermal blanket K
J2-660	3ATK395	8/19/2012 7:48	2012-08-19 07:50	jelly fish
J2-660	3ATK396	8/19/2012 8:03	8/19/2012 8:04	virgin mound with MISO temp probe
J2-660	3ATK397	8/19/2012 8:14	8/19/12 8:16:11	Tube worms
J2-660	3ATK398	8/19/2012 8:17	8/19/2012 8:19	crack vents/tube worms
J2-660	3ATK399	8/19/2012 8:21	8/19/2012 8:26	chimney by the marker 68/92W foam block
J2-660	3ATK400	8/19/2012 8:28	8/19/2012 8:41	mtr4096
J2-660	3ATK401	8/19/2012 9:03	8/19/2012 9:19	water sample
J2-660	3ATK402	8/19/2012 9:36	8/19/2012 9:46	surveying anemone vents
J2-660	3ATK403	8/19/2012 11:19	8/19/2012 11:19	incubators at mushroom vent
J2-660	3ATK404	8/19/2012 13:16	8/19/2012 13:33	photomosaic of inferno chimney
J2-660	3ATK405	8/19/2012 13:40	8/19/2012 13:41	attempted sulfide chimney grab
J2-660	3ATK406	8/19/2012 14:51	8/19/2012 14:58	Anhydrite chimney MISO
J2-660	3ATK407	8/19/2012 15:02	8/19/2012 15:08	Virgin Temperature probe
J2-660	3ATK408	8/19/2012 15:38	8/19/2012 15:39	Gas tight sample
J2-660	3ATK409	8/19/2012 15:51	8/19/2012 15:53	MISO in Virgin vent
J2-660	3ATK410	8/19/2012 15:57	8/19/2012 15:59	Vent cap experiment Ferguson
J2-660	3ATK411	8/19/2012 15:59	8/19/2012 16:05	Transit from vent cap experiment to "Hell" past marker 68
J2-660	3ATK412	8/19/2012 16:06	8/19/2012 16:16	taking a little piece of Hell sample 21
J2-660	3ATK413	8/19/2012 16:21	8/19/2012 16:24	starfish and venting at Hell. Inserting temperature probe 1 meter from top on east side
J2-660	3ATK414	8/19/2012 16:31	8/19/2012 16:32	Using gas tight at Hell

Dive Number	Ki-Pro recorder#	Date time start	Date time stop	Notes
J2-660	3ATK415	8/19/2012 16:32	8/19/2012 16:34	Using gas tight at Hell
J2-660	3ATK416	8/19/2012 16:41	8/19/2012 16:45	Sampling
J2-660	3ATK417	8/19/2012 16:48	8/19/2012 16:49	Sampling
J2-660	3ATK418	8/19/2012 17:15	8/19/2012 17:16	neat view of the vent and marker
J2-660	3ATK419	8/19/2012 17:19	8/19/2012 17:25	Mat sampling for Oliver and Ed
J2-660	3ATK420	8/19/2012 17:29	8/19/2012 17:32	placing MTR at marker
J2-660	3ATK421	8/19/2012 17:52	8/19/2012 17:53	titanium tubing with chain
J2-660	3ATK422	8/19/2012 18:26	8/19/2012 18:30	SCPR gravity lab
J2-660	3ATK423	8/19/2012 18:30	8/19/2012 18:32	SCPR gravity lab
J2-660	3ATK424	8/19/2012 18:40	8/19/2012 18:41	swirly lava
J2-660	3ATK425	8/19/2012 2:49	8/19/2012 2:49	throwaway clip
J2-661	3ATK425	8/20/2012 9:40	8/20/2012 10:14	Marker 155/JASON T-probe/fluid sampling
J2-661	3ATK426	8/20/2012 10:29	8/20/2012 11:13	STB bio box/to Trevi/JASON T-Probe/fluid sample/
J2-661	3ATK427	8/20/2012 11:14	8/20/2012 11:18	Transit Trevi to Snowglobe
J2-661	3ATK428	8/20/2012 11:26	8/20/2012 11:45	Area around Snowglobe
J2-661	3ATK429	8/20/2012 12:39	8/20/2012 12:50	Survey of Mkr N3
J2-661	3ATK430	8/20/2012 13:57	8/20/2012 14:03	Collapsed lava tubes on way to Mkr33
J2-661	3ATK431	8/20/2012 15:05	8/20/2012 15:06	transit over old chimney
J2-661	3ATK432	8/20/2012 15:33	8/20/2012 15:34	Collapsed lava
J2-661	3ATK433	8/20/2012 15:50	8/20/2012 15:53	RAS mrkr 33
J2-661	3ATK434	8/20/2012 15:53	8/20/2012 15:57	RAS mrkr 33

Dive Number	Ki-Pro recorder#	Date time start	Date time stop	Notes
J2-661	3ATK435	8/20/2012 16:01	8/20/2012 16:54	RAS mrkr 33 biology MTR's new growth where there was none last year. Long clip for use at Hatfield Marine Science Center public education... etc
J2-661	3ATK436	8/20/2012 18:35	8/20/2012 18:41	testing green syringe Ed
J2-661	3ATK437	8/20/2012 19:34	8/20/2012 19:36	releasing RAS
J2-661	3ATK438	8/20/2012 21:09	?	collapsed pits, lava pillars
J2-661	3ATK439	8/20/2012 23:29	8/20/2012 23:32	Boca vent
J2-661	3ATK440	8/20/2012 23:37	8/20/2012 23:53	Boca vent sampling
J2-661				
J2-661				
J2-661	3ATK384	8/21/2012 1:01	8/21/2012 1:12	Diffuse venting near Boca, syringe sample of brown mat
J2-661	3ATK441	8/21/2012 1:27	8/21/2012 1:32	Breaking off a rock sample
J2-661	3ATK442	8/21/2012 2:29	8/21/2012 2:31	Skadi marker A
J2-661	3ATK443	8/21/2012 3:15	8/21/2012 3:20	accidentally fwd for half a sec
J2-661	3ATK444	8/21/2012 3:30	8/21/2012 3:38	interesting Geological features, headed into large growth of tubeworms on venting chimney
J2-661	3ATK445	8/21/2012 4:05	8/21/2012 4:09	Tubeworms not paved over last year, venting chimney
J2-661	3ATK446	8/21/2012 4:30	8/21/2012 4:32	Lava, collapses, holothurians... Bob Embley would love this clip
J2-661	3ATK447	8/21/2012 4:44	8/21/2012 4:53	Marker 113 healthy vent field
J2-661	3ATK448			
J2-661	3ATK449	8/21/2012 7:02	8/21/2012 7:14	vaccuming blue stuff
J2-661	3ATK450	8/21/2012 5:48	8/21/2012 9:27	Vixen/JASON T-Probe/water sample/
J2-661	3ATK451	8/21/2012 9:29	8/21/2012 9:31	at Vixen vent (sampling continued).
J2-661	3ATK452			throwaway clip
J2-662	3ATK453	8/24/2012 5:25	8/24/2012 5:29	CORK 857D

Dive Number	Ki-Pro recorder#	Date time start	Date time stop	Notes
J2-662	3ATK454	8/24/2012 5:32	8/24/2012 6:17	CORK 857D continued/Data downloading with plug-in
J2-662	3ATK455	8/24/2012 8:14	8/24/2012 8:50	CORK857D ODI disconnected/ODI on lander connected./sea-con connected
J2-662	3ATK456	8/24/2012 8:56	8/24/2012 9:08	sea-con disconnected./sea-com connection re-try./connected
J2-662	3ATK457	8/24/2012 9:25	8/24/2012 9:27	sea-con disconnected
J2-662	3ATK458			Throwaway clip
J2-663	3ATK460	8/25/2012 2:48	8/25/2012 3:16	CORK 1025C
J2-663	3ATK461	8/25/2012 3:21	8/25/2012 3:40	Found the pressure logger/cut the lines
J2-663	3ATK462	8/25/2012 3:43	8/25/2012 3:54	cutting lines on the logger contd./success!
J2-663	3ATK463	8/25/2012 4:15	8/25/2012	CORK 1025C logger installation/operation contd. But SC/HD camera has a problem.
	3ATK464	8/25/2012 5:15	8/25/2012 6:01	SC back on. CORK1025C logger installation contd.-finished.
	3ATK465	8/25/2012 8:13	8/25/2012 8:27	driving to release the floats/Jason off bottom
	3ATK466	8/25/2012 10:25		Engineering clip-Schilling cam at face of Jason

Appendix 2: ROV Dive Transcripts
Jason Dive 660, in and around ASHES vent field.

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 2:15	45.91665	-130.02505	217.3	2.46	JASON: Medea in water J2*660 02:16 Medea in the water
8/19/2012 2:16	45.91666	-130.02507	221.4	4.06	JASON: Jason in water late entry
8/19/2012 2:37	45.91672	-130.02503	200.2	432.68	VERSION 3.3
8/19/2012 2:43	45.91671	-130.02503	199.0	627.23	TXT: all stop on the winch
8/19/2012 2:51	45.91666	-130.02503	194.2	615.8	GenInst: Other we're considering doing the magnetometer thing at 616.6 meters
8/19/2012 3:00	45.93678	-130.01331	194.0	615.44	TXT: The winch will proceed with caution.
8/19/2012 3:04	45.93678	-130.01331	194.2	652.63	TXT: The winch was stopped.
8/19/2012 3:14	45.93680	-130.01331	95.4	685.4	GenInst: Other Magnetometer calibration begin
8/19/2012 3:14	45.93680	-130.01331	90.7	685.39	TXT: Counterclockwise first.
8/19/2012 3:18	45.93679	-130.01330	97.6	685.19	TXT: End of clockwise calibration
8/19/2012 3:18	45.93677	-130.01331	142.6	685.39	TXT: Correction end of counterclockwise calibration
8/19/2012 3:18	45.93676	-130.01332	152.9	685.37	TXT: Clockwise calibration begin.
8/19/2012 3:21	45.93679	-130.01330	28.4	684.87	TXT: Rotation rate is 2 degrees per second
8/19/2012 3:22	45.93676	-130.01330	109.3	685.04	TXT: Clockwise calibration end.
8/19/2012 3:24	45.93672	-130.01335	211.0	686.2	TXT: Ship changing heading to 155
8/19/2012 3:30	45.93666	-130.01341	209.2	668.6	TXT: All stop on winch until speed reading is fixed.
8/19/2012 3:31	45.93664	-130.01343	212.1	668.49	TXT: Winch underway. Speed reading is coming through.
8/19/2012 3:34	45.93663	-130.01344	214.4	725.85	TXT: All stop on winch. Leveler is not keeping up with the unwinding.
8/19/2012 3:35	45.93663	-130.01345	215.2	725.14	TXT: Winch paying out again.
8/19/2012 3:37	45.93663	-130.01346	238.6	793.23	TXT: All stop

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 3:38	45.93663	-130.01346	238.7	797.12	TXT: Winch stopped again.
8/19/2012 3:41	45.93662	-130.01348	241.0	788.89	TXT: Level wind issues persist. Engineer to take manual control of level winder in the mean time.
8/19/2012 3:42	45.93662	-130.01349	248.9	788.82	TXT: Hydraulic pressure assumed to be culprit but gauge readout appears to be within spec.
8/19/2012 3:43	45.93663	-130.01349	253.3	788.87	TXT: Payout of winch at 10 meters/min
8/19/2012 3:45	45.93663	-130.01349	261.6	789.19	TXT: Winch up to 15 meters/min
8/19/2012 3:50	45.93664	-130.01345	273.2	890.83	TXT: Winch payout rate to 30 meters/min
8/19/2012 3:55	45.93663	-130.01342	284.6	1034.05	TXT: passed 1k meters
8/19/2012 4:03	45.93661	-130.01336	289.5	1291.34	TXT: All stop on winch.
8/19/2012 4:04	45.93661	-130.01336	290.9	1297.18	TXT: Level wind issues again.
8/19/2012 4:04	45.93662	-130.01336	294.5	1303.51	TXT: Ship is transiting S/SW to locate SCPR
8/19/2012 4:05	45.93662	-130.01334	313.8	1321.14	TXT: Pulling in a few meters of cable to gain slack.
8/19/2012 4:06	45.93662	-130.01334	316.8	1313.07	TXT: Slack is for manual level wind movement.
8/19/2012 4:12	45.93661	-130.01332	314.1	1296.38	TXT: Comms established with SCPR on the bottom.
8/19/2012 4:12	45.93661	-130.01332	314.0	1296.28	TXT: Potential interference from Jason but it appears to be working.
8/19/2012 4:21	45.93659	-130.01328	330.1	1318.75	TXT: Positioning Jason under MEDEA to get visual on optical signal.
8/19/2012 4:22	45.93659	-130.01328	330.6	1322.93	TXT: Purple light visible on MEDEA down cam is the optical signal on JASON
8/19/2012 4:23	45.93658	-130.01327	330.6	1323.26	TXT: MEDEA down facing HIDs off optical signal should be more visible.
8/19/2012 4:29	45.93656	-130.01334	271.7	1299.07	TXT: Change of ships heading to 178

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 4:31	45.93656	-130.01334	270.7	1299.39	TXT: Winch payout to 10 meters/min
8/19/2012 4:35	45.93656	-130.01334	269.3	1349.66	TXT: Change of ships heading 15 degrees clockwise
8/19/2012 4:38	45.93657	-130.01335	270.9	1354.43	TXT: All stop on winch
8/19/2012 4:39	45.93657	-130.01335	271.1	1354.51	TXT: Payout again 10 meters/min
8/19/2012 4:39	45.93657	-130.01334	271.2	1354.47	TXT: Stop on winch again.
8/19/2012 4:40	45.93657	-130.01335	270.9	1368.54	TXT: Payout on winch
8/19/2012 4:44	45.93657	-130.01333	270.4	1422.97	TXT: Winch stopped again
8/19/2012 4:57	45.93552	-130.01122	181.7	1442.41	TXT: Winch payout to 20 meters/min gradually.
8/19/2012 4:57	45.93552	-130.01122	182.1	1442.46	TXT: Attempting to reach bottom.
8/19/2012 4:57	45.93548	-130.01123	181.6	1444.01	TXT: Once on bottom the deck will troubleshoot winder issues on winch
8/19/2012 4:57	45.93547	-130.01123	181.5	1444.92	TXT: while the van gets some work done
8/19/2012 4:59	45.93545	-130.01117	138.0	1482.81	TXT: Stop on winch. Level wind not keeping up.
8/19/2012 5:01	45.93544	-130.01118	138.9	1487.03	TXT: Winch payout again.
8/19/2012 5:04	45.93548	-130.01126	136.7	1527.13	TXT: Winch stop again to reset level wind.
8/19/2012 5:05	45.93542	-130.01113	125.8	1533.49	TXT: Winch payout again.
8/19/2012 5:05	45.93542	-130.01112	124.8	1533.39	TXT: 10 meters from bottom.
8/19/2012 5:06	45.93537	-130.01108	145.2	1541.27	JASON: Jason on bottom
8/19/2012 5:12	45.93535	-130.01107	145.0	1541.55	TXT: 16 pound weight dropped
8/19/2012 5:18	45.93528	-130.01105	228.5	1540.69	TXT: Moving 30 meters along 157
8/19/2012 5:20	45.93527	-130.01104	150.0	1540.63	TXT: Attempting to acoustic range to SCPR
8/19/2012 5:23	45.93525	-130.01105	149.9	1540.66	TXT: Range is 42 meters to SCPR
8/19/2012 5:24	45.93515	-130.01099	150.1	1540.92	Frame_Grab:
8/19/2012 5:24	45.93515	-130.01099	150.2	1540.85	Geological_Observations: Sheet Flow Lava whorl on sea floor.
8/19/2012 5:26	45.93517	-130.01102	167.3	1540.83	TXT: 30 meters from Jason to SCPR
8/19/2012 5:28	45.93506	-130.01101	167.5	1540.32	TXT: 23 meters from SCPR
8/19/2012 5:31	45.93503	-130.01097	148.9	1540.41	TXT: 20 meters from SCPR

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 5:37	45.93504	-130.01097	149.6	1540.53	TXT: Moving 20 meters down 140
8/19/2012 5:39	45.93506	-130.01100	148.9	1540.44	TXT: SCPR visible
8/19/2012 5:40	45.93510	-130.01105	159.3	1539.96	Image_Recording: HD start
8/19/2012 5:48	45.93502	-130.01086	167.4	1542.04	TXT: Grabbing SCPR for a reposition
8/19/2012 5:49	45.93502	-130.01086	168.0	1541.98	TXT: Goal is to place on flatter terrain
8/19/2012 5:52	45.93494	-130.01094	163.9	1543.45	TXT: Getting a level from SCPR to determine if this spot is OK
8/19/2012 5:56	45.93498	-130.01091	166.2	1540.28	Image_Recording: HD stop
8/19/2012 5:58	45.93498	-130.01095	165.9	1538.75	TXT: SCPR undergoing diagnostics to determine if systems OK
8/19/2012 5:58	45.93498	-130.01095	165.9	1538.9	TXT: Sitting on bottom until complete
8/19/2012 5:58	45.93498	-130.01097	165.9	1539.91	TXT: MEDEA lights off
8/19/2012 6:00	45.93498	-130.01097	166.2	1542.36	TXT: JASON butt light off.
8/19/2012 6:00	45.93499	-130.01096	166.1	1542.36	TXT: Attempting to minimize interference towards optical modem
8/19/2012 6:05	45.93499	-130.01092	166.0	1542.36	TXT: Shutting down lightbar lights
8/19/2012 6:06	45.93498	-130.01092	165.9	1542.38	TXT: Gauge cam off
8/19/2012 6:07	45.93498	-130.01091	165.9	1542.36	TXT: Only down facing lights are on to maximize optical signal
8/19/2012 6:10	45.93496	-130.01090	166.0	1542.37	TXT: All lights off
8/19/2012 6:12	45.93497	-130.01089	166.1	1542.36	TXT: Lights on
8/19/2012 6:31	45.93497	-130.01090	165.9	1542.37	TXT: SCPR data collection complete
8/19/2012 6:34	45.93496	-130.01089	165.9	1542.37	TXT: Heading S to determine if we are over 2011 flow
8/19/2012 6:37	45.93510	-130.01069	166.9	1536.67	TXT: Heat blanket will go down when we find new lava
8/19/2012 6:53	45.93435	-130.01033	166.1	1537.23	TXT: May be edge of new flow. Drop off in amount of sediment.
8/19/2012 7:02	45.93397	-130.00994	163.4	1536.33	TXT: New lobate flow
8/19/2012 7:02	45.93397	-130.00993	164.2	1535.97	TXT: Shrimp
8/19/2012 7:04	45.93398	-130.00990	164.3	1536.42	Image_Recording: HD start

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 7:09	45.93398	-130.00993	163.8	1536.91	TXT: Thermal blanket K deployed on flat lobate flow
8/19/2012 7:12	45.93401	-130.00992	164.0	1536.4	Image_Recording: DSC capture Pulling away to view thermal blanket
8/19/2012 7:12	45.93401	-130.00991	164.2	1536.46	Image_Recording: DSC capture
8/19/2012 7:13	45.93402	-130.00991	164.2	1536.46	Image_Recording: HD stop
8/19/2012 7:15	45.93402	-130.00990	164.1	1536.35	TXT: Heading 260m towards Virgin Mound
8/19/2012 7:21	45.93403	-130.00988	266.8	1535.87	TXT: Ship checking heading before travelling to Virgin Mound
8/19/2012 7:22	45.93405	-130.00989	266.4	1536.08	TXT: Will use Virgin Mound to check location before going to Anemone for sampling
8/19/2012 7:23	45.93405	-130.00994	267.9	1536.91	TXT: Moving toward Virgin
8/19/2012 7:27	45.93399	-130.01033	267.8	1537.66	TXT: Crossing pillow lava with light sediment
8/19/2012 7:27	45.93399	-130.01036	265.3	1537.93	Biological_Observations: shrimp (other)
8/19/2012 7:31	45.93393	-130.01072	267.2	1538.56	Biological_Observations: fish (other)
8/19/2012 7:32	45.93391	-130.01085	266.5	1540.39	Biological_Observations: shrimp (other)
8/19/2012 7:35	45.93389	-130.01109	266.3	1540.98	TXT: Edge of new lava flow (?)
8/19/2012 7:36	45.93388	-130.01113	258.7	1542.61	Biological_Observations: shrimp (other) Crab
8/19/2012 7:36	45.93389	-130.01114	259.5	1542.36	TXT: Majib (?) crab
8/19/2012 7:36	45.93388	-130.01116	259.8	1542.25	TXT: Starfish
8/19/2012 7:37	45.93389	-130.01125	270.2	1542.23	TXT: Jumbled lava sheet
8/19/2012 7:38	45.93391	-130.01129	269.7	1542.79	TXT: Starfish
8/19/2012 7:39	45.93391	-130.01136	269.2	1542.98	TXT: Holothurians
8/19/2012 7:40	45.93389	-130.01140	276.4	1542.59	TXT: Contact between sheet and jumbly lava flows
8/19/2012 7:41	45.93385	-130.01146	265.7	1543.68	TXT: Sheet flow lightly sedimented
8/19/2012 7:42	45.93384	-130.01165	263.7	1542.1	Biological_Observations: fish (other)
8/19/2012 7:43	45.93383	-130.01173	264.6	1542.53	TXT:
8/19/2012 7:43	45.93383	-130.01174	264.0	1542.6	TXT: More sheet flow

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 7:43	45.93383	-130.01175	264.5	1542.68	TXT: Starfish
8/19/2012 7:44	45.93382	-130.01179	264.1	1544.1	TXT: Mostly covered with light layer of sediment
8/19/2012 7:44	45.93382	-130.01179	265.3	1543.72	TXT: Hydrothermal deposit - orange sediment
8/19/2012 7:45	45.93380	-130.01187	264.0	1542.81	TXT: Contact with jumbly lava
8/19/2012 7:45	45.93380	-130.01191	263.6	1543.08	TXT: Holothurians starfish
8/19/2012 7:45	45.93380	-130.01192	262.0	1543.56	TXT: Crab
8/19/2012 7:46	45.93380	-130.01192	261.8	1543.72	TXT: Lots of crab pictures
8/19/2012 7:46	45.93379	-130.01193	262.1	1543.05	TXT: More holothurians
8/19/2012 7:47	45.93377	-130.01201	262.2	1542.28	TXT: Lots of holothurians
8/19/2012 7:47	45.93380	-130.01201	152.0	1541.81	TXT: Octopus?
8/19/2012 7:48	45.93379	-130.01202	155.9	1539.84	TXT: Weird thing
8/19/2012 7:48	45.93379	-130.01203	156.5	1540.08	Image_Recording: HD start
8/19/2012 7:48	45.93380	-130.01205	156.2	1540.88	TXT: Former jellyfish
8/19/2012 7:49	45.93380	-130.01205	156.1	1540.93	TXT: Mostly intact
8/19/2012 7:49	45.93381	-130.01205	155.8	1540.35	TXT: Current jellyfish (much smaller)
8/19/2012 7:50	45.93388	-130.01208	165.3	1540.14	Image_Recording: HD stop
8/19/2012 7:50	45.93390	-130.01215	184.2	1541.6	TXT: Starfish
8/19/2012 7:51	45.93390	-130.01221	218.5	1541.33	TXT: Asterid - multi-arm
8/19/2012 7:51	45.93390	-130.01225	232.7	1541.61	TXT: Holothurians
8/19/2012 7:51	45.93390	-130.01228	242.1	1541.78	TXT: Increase in macrofauna
8/19/2012 7:51	45.93390	-130.01230	252.4	1541.64	TXT: Still jumbly lava
8/19/2012 7:51	45.93391	-130.01232	259.3	1542.11	TXT: Correction - hackly
8/19/2012 7:52	45.93393	-130.01239	262.7	1542.68	TXT: Starfish
8/19/2012 7:52	45.93394	-130.01244	262.6	1542.11	TXT: And holothurians
8/19/2012 7:53	45.93395	-130.01254	264.7	1542.15	TXT: Jelly?
8/19/2012 7:53	45.93394	-130.01255	264.0	1542.16	TXT: UBO
8/19/2012 7:53	45.93393	-130.01256	266.3	1542.21	TXT: Fish
8/19/2012 7:54	45.93388	-130.01257	265.4	1542.57	TXT: Big fish
8/19/2012 7:54	45.93387	-130.01258	265.8	1542.52	TXT: Rat-tail
8/19/2012 7:55	45.93382	-130.01263	263.5	1542.04	TXT: Starfish
8/19/2012 7:56	45.93376	-130.01269	264.1	1542.05	TXT: More starfish
8/19/2012 7:57	45.93374	-130.01272	263.4	1542.06	TXT: Still hackly lava v light sediment some pockets
8/19/2012 7:57	45.93373	-130.01274	263.9	1541.97	TXT: Fish
8/19/2012 7:57	45.93372	-130.01279	263.5	1542.86	TXT: Hydrothermal sediment - orange

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 7:58	45.93371	-130.01285	263.2	1543	TXT: 29m to Virgin Mound
8/19/2012 7:58	45.93371	-130.01286	263.3	1542.91	TXT: More hydrothermal sediment
8/19/2012 7:58	45.93372	-130.01292	266.6	1542.74	TXT: Fish - rat-tail
8/19/2012 7:59	45.93373	-130.01293	270.5	1542.74	TXT: Hydrothermal sediment increasing
8/19/2012 8:00	45.93367	-130.01301	270.8	1541.68	TXT: Macrofauna quite evident - holothurians starfish etc
8/19/2012 8:01	45.93365	-130.01308	255.9	1542.28	TXT: At Virgin Mound
8/19/2012 8:01	45.93364	-130.01310	254.7	1542.28	TXT: Temperature recorder visible
8/19/2012 8:01	45.93365	-130.01310	255.2	1541.72	TXT: Old instrument frame visible too
8/19/2012 8:02	45.93365	-130.01312	227.3	1542.31	TXT: Bearing 230 range 70m to Anemone
8/19/2012 8:03	45.93364	-130.01312	227.6	1543.57	Image_Recording: HD start at Virgin
8/19/2012 8:04	45.93362	-130.01311	226.9	1542.14	Image_Recording: HD stop
8/19/2012 8:05	45.93362	-130.01311	226.6	1543.43	Biological_Observations: bacterial mat
8/19/2012 8:06	45.93361	-130.01311	226.7	1544.14	TXT: Hydrothermal sediment and white bacterial mat patches
8/19/2012 8:07	45.93361	-130.01312	226.7	1544.16	TXT: Marker in background
8/19/2012 8:07	45.93361	-130.01313	226.7	1544.16	TXT: Old sediment experiment
8/19/2012 8:08	45.93361	-130.01313	226.7	1544.16	TXT: Marker is Gollum
8/19/2012 8:08	45.93359	-130.01318	226.7	1542.9	TXT: Marker 121
8/19/2012 8:09	45.93357	-130.01320	227.5	1542.36	TXT: Worms
8/19/2012 8:09	45.93357	-130.01320	228.6	1542.07	TXT: Marker 64 adjacent
8/19/2012 8:09	45.93356	-130.01320	228.5	1542.43	TXT: White bacterial mat
8/19/2012 8:10	45.93356	-130.01321	228.1	1542.62	TXT: Fish
8/19/2012 8:10	45.93353	-130.01326	227.9	1541.23	TXT: Hackly lava surrounding
8/19/2012 8:10	45.93351	-130.01331	228.0	1542.39	TXT: Orange hydrothermal sediment and white bacterial mats
8/19/2012 8:12	45.93348	-130.01337	228.1	1543.57	TXT: Still around Gollum venting site
8/19/2012 8:12	45.93346	-130.01337	228.8	1543.16	TXT: Tubeworms
8/19/2012 8:12	45.93345	-130.01338	227.8	1543.37	Image_Recording: DSC capture
8/19/2012 8:13	45.93344	-130.01340	227.9	1544.27	TXT: Tubeworm bush closeup

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 8:13	45.93343	-130.01341	228.1	1544.31	TXT: Shimmering venting
8/19/2012 8:14	45.93343	-130.01342	228.0	1544.36	Image_Recording: HD start
8/19/2012 8:14	45.93343	-130.01342	228.0	1544.31	TXT: Palm worms
8/19/2012 8:15	45.93343	-130.01342	228.0	1544.32	TXT: Bush + white bacterial mat + palm worms
8/19/2012 8:15	45.93343	-130.01342	228.0	1544.36	TXT: Ridgia worms
8/19/2012 8:16	45.93343	-130.01342	228.0	1544.32	Image_Recording: HD stop
8/19/2012 8:16	45.93343	-130.01342	228.1	1544.32	TXT:
8/19/2012 8:16	45.93343	-130.01342	229.1	1544.12	TXT: Moseying on
8/19/2012 8:16	45.93343	-130.01345	235.0	1543.46	TXT: Starfish mats
8/19/2012 8:17	45.93343	-130.01349	233.4	1543.14	TXT: Old instrument anchor
8/19/2012 8:17	45.93343	-130.01350	233.0	1543.15	Image_Recording: HD start
8/19/2012 8:17	45.93344	-130.01351	233.1	1543.44	TXT: Tubeworms
8/19/2012 8:18	45.93344	-130.01355	236.9	1542.68	TXT: Crack venting
8/19/2012 8:18	45.93344	-130.01356	235.5	1542.37	TXT: Lots of tubeworms
8/19/2012 8:18	45.93344	-130.01357	235.7	1541.91	TXT: Marker 19
8/19/2012 8:18	45.93345	-130.01357	235.5	1541.7	Image_Recording: DSC capture
8/19/2012 8:18	45.93344	-130.01361	235.5	1542.99	TXT: Dave's 2003 - 19
8/19/2012 8:19	45.93340	-130.01371	234.7	1543.1	TXT: Pillow lava
8/19/2012 8:19	45.93339	-130.01373	235.3	1543.21	Image_Recording: HD stop
8/19/2012 8:20	45.93331	-130.01381	224.3	1543.5	TXT: Bare patch no venting
8/19/2012 8:21	45.93329	-130.01384	224.7	1543.58	TXT: Some mats
8/19/2012 8:21	45.93329	-130.01385	225.8	1544.08	Geological_Observations: Sulfide Chimney
8/19/2012 8:21	45.93328	-130.01386	226.2	1544.47	TXT: Hell chimney
8/19/2012 8:21	45.93328	-130.01386	225.9	1544.4	Image_Recording: HD start
8/19/2012 8:21	45.93328	-130.01386	226.2	1544.01	TXT: Tubeworms on chimney
8/19/2012 8:22	45.93326	-130.01385	225.5	1544.15	TXT: Marker 68
8/19/2012 8:22	45.93324	-130.01385	225.8	1544.29	TXT: Mats and tubeworms
8/19/2012 8:23	45.93323	-130.01385	225.7	1543.54	TXT: Lots of bact mat
8/19/2012 8:23	45.93322	-130.01387	232.1	1544.47	TXT: MTR
8/19/2012 8:23	45.93322	-130.01387	230.9	1544.49	TXT: Maybe
8/19/2012 8:24	45.93323	-130.01388	230.0	1544.79	TXT: Recovering poss MTR
8/19/2012 8:24	45.93323	-130.01388	230.0	1544.8	TXT: Definitely MTR
8/19/2012 8:25	45.93322	-130.01388	230.0	1544.82	TXT: Quite encrusted with stuff
8/19/2012 8:25	45.93322	-130.01388	229.9	1544.86	TXT: Number 92-W on MTR foam block by mkr 68
8/19/2012 8:25	45.93322	-130.01388	229.9	1544.82	TXT: Stowed in weight basket
8/19/2012 8:25	45.93322	-130.01388	229.9	1544.8	TXT: Port forward

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 8:25	45.93322	-130.01388	231.1	1544.21	TXT: Mats and tubeworms shimmering visible
8/19/2012 8:26	45.93321	-130.01387	229.7	1543.71	Image_Recording: HD stop
8/19/2012 8:26	45.93318	-130.01384	202.4	1543.48	TXT: Hackly lava with some mats worms
8/19/2012 8:27	45.93318	-130.01376	136.8	1543.38	TXT: Another old MTR? Completely encrusted
8/19/2012 8:28	45.93320	-130.01378	136.2	1542.87	Image_Recording: HD start
8/19/2012 8:28	45.93320	-130.01378	135.9	1543.06	TXT: MTR 4096
8/19/2012 8:29	45.93320	-130.01377	136.0	1543.65	TXT: Thick mat crusting and tubeworms around MTR
8/19/2012 8:29	45.93319	-130.01378	136.5	1543.98	TXT: Anenomes
8/19/2012 8:30	45.93319	-130.01378	135.9	1544.17	TXT: At Anemone vent
8/19/2012 8:30	45.93319	-130.01378	136.0	1544.27	TXT: (Mound with MTR)
8/19/2012 8:30	45.93319	-130.01378	136.2	1544.24	Image_Recording: DSC capture
8/19/2012 8:34	45.93315	-130.01380	52.1	1543.44	Image_Recording: DSC capture
8/19/2012 8:34	45.93315	-130.01378	46.1	1543.49	Image_Recording: DSC capture
8/19/2012 8:35	45.93314	-130.01377	36.8	1543.46	TXT: Taking pictures and video of Anemone site
8/19/2012 8:36	45.93315	-130.01372	303.8	1542.77	Image_Recording: DSC capture
8/19/2012 8:38	45.93321	-130.01374	170.2	1543.13	TXT: Anemone venting healthily
8/19/2012 8:38	45.93321	-130.01374	165.0	1543.25	Image_Recording: DSC capture
8/19/2012 8:39	45.93320	-130.01377	155.9	1542.92	TXT: Shimmering venting
8/19/2012 8:41	45.93320	-130.01380	219.2	1541.16	Image_Recording: HD stop
8/19/2012 8:41	45.93325	-130.01384	30.5	1542.59	TXT: Unwinding Jason tether
8/19/2012 8:45	45.93319	-130.01376	308.1	1543.19	TXT: Getting ready to sample at Anemone
8/19/2012 8:46	45.93319	-130.01375	308.2	1543.14	TXT: Filamentous bacteria on MTR foam
8/19/2012 8:47	45.93319	-130.01375	308.2	1543.06	TXT: Taking temperature reading using JASON temp probe
8/19/2012 8:57	45.93320	-130.01374	307.1	1543.65	TXT: Similar temps to last year
8/19/2012 8:57	45.93321	-130.01374	307.1	1543.65	TXT: Slightly warmer spot - 33
8/19/2012 8:59	45.93320	-130.01376	312.9	1543.54	TXT: 15C - trying again
8/19/2012 9:01	45.93319	-130.01376	313.8	1543.55	TXT: Ready to start fluid sampling
8/19/2012 9:03	45.93319	-130.01374	308.0	1543.53	Image_Recording: HD start

J2-660 Date- Time UTC	Latitude Dec deg	Longitude Dec. deg.	Head ing	ROV Depth	Log Entry
8/19/2012 9:13	45.93320	-130.01373	306.8	1543.54	TXT: Still waiting to sample - fussing with cables in van
8/19/2012 9:16	45.93320	-130.01374	306.6	1543.53	Sample: Vent Fluid
8/19/2012 9:18	45.93320	-130.01376	307.0	1543.53	TXT: Starting sample J2-660-1 HFS-B19 - unfiltered bag
8/19/2012 9:19	45.93320	-130.01377	307.0	1543.52	Image_Recording: HD stop
8/19/2012 9:23	45.93318	-130.01375	306.4	1543.53	TXT: Sample end - max temp 30.2 ave temp 28.8 volume 551ml Anemone vent
8/19/2012 9:24	45.93317	-130.01374	306.5	1543.51	TXT: Starting sample J2-660-2 HFS-BF20 - filtered bag
8/19/2012 9:28	45.93318	-130.01372	306.6	1543.51	TXT: Sample end - max temp 32.0C ave temp 28.1C volume 551ml
8/19/2012 9:28	45.93318	-130.01372	306.5	1543.51	TXT: Clock on fluid sampler laptop needs to be re-set - approx 1/2 hr fast for local time
8/19/2012 9:29	45.93318	-130.01373	306.7	1543.5	TXT: Starting sample J2-660-3 HFS-B21 - unfiltered bag
8/19/2012 9:32	45.93317	-130.01376	306.5	1543.49	TXT: Sample end - max temp 35.0C ave temp 32.5C volume 551ml
8/19/2012 9:34	45.93317	-130.01376	306.7	1543.49	TXT: Starting sample J2-660-4 HFS-1 LVB = unfiltered
8/19/2012 9:36	45.93317	-130.01374	306.8	1543.49	Image_Recording: HD start
8/19/2012 9:37	45.93317	-130.01373	306.6	1543.49	TXT: Closeups on palm worms - Alvinella - and Ridgeia tubeworms
8/19/2012 9:38	45.93317	-130.01373	306.7	1543.47	TXT: Dense limpet carpet
8/19/2012 9:40	45.93318	-130.01373	307.0	1543.47	TXT: More closeups - anemones Ridgeia at Anemone vent
8/19/2012 9:41	45.93318	-130.01373	307.1	1543.47	TXT: Bacterial mats and filaments
8/19/2012 9:41	45.93318	-130.01373	307.1	1543.47	TXT: Lots of diffuse venting
8/19/2012 9:41	45.93318	-130.01374	307.1	1543.47	TXT: *diffuse
8/19/2012 9:42	45.93318	-130.01374	307.2	1543.46	TXT: Crab
8/19/2012 9:42	45.93318	-130.01374	307.2	1543.47	TXT: Crabs
8/19/2012 9:43	45.93318	-130.01376	307.2	1543.47	TXT: Old marker floats
8/19/2012 9:45	45.93317	-130.01377	307.2	1543.46	Image_Recording: HD stop

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 9:53	45.93317	-130.01374	307.5	1543.42	TXT: Sample end - max temp 33.2C ave temp 29.3C volume 4007ml
8/19/2012 9:56	45.93317	-130.01376	307.5	1543.41	TXT: tube jump?
8/19/2012 10:00	45.93318	-130.01376	307.5	1543.38	TXT: Took gastight sample J2-660-5 Nude Gastight Starboard HFS
8/19/2012 10:01	45.93318	-130.01377	307.5	1543.4	TXT: Temp approx 30C
8/19/2012 10:02	45.93318	-130.01377	307.5	1543.4	TXT: Starting sample - J2-660-6 HFS-10 RNA filter
8/19/2012 10:25	45.93319	-130.01374	307.5	1543.27	TXT: Sample end - max temp 31.9C ave temp 29.5C volume passed through 3047ml
8/19/2012 10:25	45.93319	-130.01374	307.5	1543.27	TXT: Correction - ave temp 29.6C
8/19/2012 10:25	45.93319	-130.01374	307.5	1543.27	Sample: Vent Fluid at Anemone vent
8/19/2012 10:26	45.93319	-130.01374	307.5	1543.25	TXT: Starting sample - J2-660-7 HFS-11 RNA filter
8/19/2012 10:38	45.93321	-130.01377	307.2	1543.18	Biological_Observations: squat lobsters
8/19/2012 10:48	45.93320	-130.01380	307.5	1543.1	TXT: Sample end - max temp 31.6C ave temp 28.0C volume passed through 3004ml
8/19/2012 10:49	45.93320	-130.01380	307.5	1543.1	TXT: Finished fluid sampling at Anemone
8/19/2012 10:53	45.93320	-130.01380	308.3	1543.06	TXT: Retrieving MTR
8/19/2012 10:55	45.93321	-130.01381	308.2	1543.04	TXT: Recovered MTR 4096
8/19/2012 10:56	45.93321	-130.01381	308.2	1543.02	TXT: Deploying MTR 4099
8/19/2012 10:56	45.93322	-130.01381	308.4	1543	TXT: MTR deployed at Anemone vent
8/19/2012 10:58	45.93323	-130.01385	311.1	1541.98	TXT: Leaving Anemone
8/19/2012 11:02	45.93322	-130.01385	350.8	1543.28	TXT: Attempting to retrieve old markers of some sort (no numbers)

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 11:04	45.93322	-130.01386	351.3	1543.21	TXT: 1st appears to be weighted with shackle - not instrument
8/19/2012 11:04	45.93322	-130.01386	351.3	1543.19	TXT: Second same
8/19/2012 11:04	45.93322	-130.01386	351.0	1543.3	TXT: Leaving in place
8/19/2012 11:04	45.93322	-130.01386	351.2	1543.25	TXT: Next goal: Fuzzy Tubeworm Bush
8/19/2012 11:07	45.93325	-130.01382	21.9	1542	TXT: looking for fuzzy tubeworm bush
8/19/2012 11:09	45.93328	-130.01380	21.8	1541.94	Frame_Grab:
8/19/2012 11:18	45.93351	-130.01362	11.1	1543.91	TXT: looking at a small stump - Mushroom vent
8/19/2012 11:19	45.93351	-130.01364	11.1	1543.86	Image_Recording: HD start
8/19/2012 11:19	45.93350	-130.01364	10.5	1543.74	TXT: reset the cursor
8/19/2012 11:21	45.93357	-130.01371	335.8	1543.69	TXT: Mushroom imaging was for Girguis
8/19/2012 11:25	45.93360	-130.01369	344.3	1544.01	TXT: HD frame grab of tubeworm bush
8/19/2012 11:27	45.93360	-130.01369	344.5	1543.93	TXT: checking temperature at Fuzzy Tubeworm vent
8/19/2012 11:29	45.93361	-130.01369	344.4	1543.93	TXT: max temp 21.1 with Jason probe
8/19/2012 11:31	45.93361	-130.01369	344.4	1543.88	TXT: deploying Beast at Fuzzy Tubeworm vent
8/19/2012 11:33	45.93362	-130.01369	344.4	1543.85	TXT: got 16 with beast moving probe
8/19/2012 11:34	45.93362	-130.01369	344.4	1543.85	TXT: now have 27
8/19/2012 11:38	45.93362	-130.01368	344.4	1543.8	TXT: J660-9 starting
8/19/2012 11:38	45.93363	-130.01368	344.4	1543.8	TXT: That was really J660-8
8/19/2012 11:39	45.93363	-130.01368	344.4	1543.8	TXT: T1 is 28.0

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 11:42	45.93363	-130.01369	344.4	1543.78	TXT: sample pump says it has a sudden obstruction and has stopped
8/19/2012 11:53	45.93364	-130.01368	344.5	1543.67	TXT: still having problems with P1
8/19/2012 11:59	45.93366	-130.01369	344.5	1543.62	TXT: Dave came up and fixed it
8/19/2012 12:03	45.93367	-130.01369	344.5	1543.58	TXT: finished sample volume 550 Tmax 28.6 T avg 28.4 stopped at 12:02
8/19/2012 12:04	45.93366	-130.01367	344.5	1543.56	TXT: start J660-9 unfiltered bag 23 at Fuzzy Tubeworm
8/19/2012 12:08	45.93367	-130.01369	344.5	1543.53	TXT: done vol 552 T max 28.6. T avg 28.2
8/19/2012 12:11	45.93366	-130.01366	344.5	1543.5	TXT: start J660-10 filter 15
8/19/2012 12:25	45.93366	-130.01366	344.5	1543.36	TXT: finished J660-10 volume
8/19/2012 12:26	45.93366	-130.01367	344.5	1543.36	TXT: J550-10 not finished
8/19/2012 12:26	45.93366	-130.01367	344.5	1543.36	TXT: Hd frame grab
8/19/2012 12:32	45.93366	-130.01368	344.5	1543.29	TXT: J660=10 finished volume 3002 T max 29.3 T avg 28.6
8/19/2012 12:33	45.93365	-130.01368	344.5	1543.27	TXT: start J550-11 filter 16
8/19/2012 12:55	45.93365	-130.01368	344.5	1543.08	TXT: J2-660=11 29.3 max 28.8 average temp 3002 ml sample complete
8/19/2012 13:00	45.93365	-130.01366	344.6	1543.1	TXT: deploying mtr 3040 at Fuzzy Tubeworm
8/19/2012 13:01	45.93365	-130.01365	344.2	1543.04	Frame_Grab:
8/19/2012 13:04	45.93366	-130.01369	333.0	1543	Frame_Grab:
8/19/2012 13:05	45.93365	-130.01370	333.0	1542.96	TXT: 2m away from last mtr picked up has red tape on it unreadable number

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 13:06	45.93364	-130.01372	332.9	1542.68	TXT: mtr with red tape 3041? 3048? picked up 2m from recently deployed mtr
8/19/2012 13:06	45.93364	-130.01373	314.5	1542.7	TXT: heading for Inferno next
8/19/2012 13:07	45.93364	-130.01375	198.2	1542.3	TXT: 3041? mtr is the last one picked up with red tape on it
8/19/2012 13:08	45.93357	-130.01378	173.7	1540.39	Frame_Grab:
8/19/2012 13:09	45.93357	-130.01379	174.5	1538.86	Frame_Grab:
8/19/2012 13:09	45.93357	-130.01380	173.7	1538.79	TXT: took some HD frame grabs at Inferno
8/19/2012 13:24	45.93349	-130.01372	243.7	1539.64	TXT: completed digital still camera and HD camera photo mozaic north side
8/19/2012 13:27	45.93347	-130.01374	7.6	1542.79	TXT: starting photo mozaic south side of Inferno
8/19/2012 13:27	45.93347	-130.01374	7.5	1542.68	Frame_Grab:
8/19/2012 13:33	45.93348	-130.01376	359.5	1539.71	TXT: completed south side photo mozaic of Inferno
8/19/2012 13:38	45.93353	-130.01374	249.9	1539.18	Frame_Grab:
8/19/2012 13:41	45.93354	-130.01375	250.5	1539.12	TXT: first attempt at chimney sample got away
8/19/2012 13:43	45.93354	-130.01375	250.3	1539.14	TXT: trying another chimney sample
8/19/2012 13:44	45.93355	-130.01374	248.7	1539.01	TXT: second chimney too friable as was the first attempt
8/19/2012 13:46	45.93355	-130.01374	248.4	1539.28	TXT: HD grab of intended sampling hole
8/19/2012 13:49	45.93356	-130.01374	248.7	1539.27	TXT: We see the end of a hobo in frame
8/19/2012 13:50	45.93356	-130.01374	248.3	1539.25	TXT: We attempted to pick up a chimney piece but was too friable
8/19/2012 13:53	45.93356	-130.01374	248.4	1539.22	TXT: temperature probe 275 and rising

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 13:54	45.93356	-130.01374	248.2	1539.2	TXT: 318 degrees at Inferno
8/19/2012 13:56	45.93357	-130.01371	248.3	1539.21	TXT: 319.4 maximum temperature and we will try the hole above away from the hobo
8/19/2012 13:59	45.93356	-130.01373	248.2	1539.23	TXT: got up to about 280 degrees but it was hard to get into the hole--we will go back to the original site
8/19/2012 14:01	45.93356	-130.01373	248.4	1539.18	SAMPLE: gas-tight orange taken at 319.4 degrees
8/19/2012 14:05	45.93357	-130.01370	248.3	1539.16	SAMPLE: blue major triggered at Inferno
8/19/2012 14:07	45.93357	-130.01369	248.2	1539.13	TXT: blue major complete 1539 m heading 248 3.4 alt correction 1540 m depth
8/19/2012 14:10	45.93356	-130.01370	248.2	1539.12	TXT: filtered piston 4 started
8/19/2012 14:11	45.93356	-130.01371	248.1	1539.14	TXT: piston 4 didn't start
8/19/2012 14:11	45.93356	-130.01371	248.0	1539.14	TXT: piston started
8/19/2012 14:16	45.93355	-130.01370	248.2	1539.1	TXT: heading 248 alt 3.4 m titanium piston 4 finished 1540 m depth Tmax is 309.2 Tavg is 308.6
8/19/2012 14:16	45.93355	-130.01370	248.2	1539.1	TXT: 500 ml for piston 4
8/19/2012 14:17	45.93355	-130.01370	248.1	1539.11	TXT: starting p5
8/19/2012 14:23	45.93357	-130.01370	248.3	1539.08	Sample: Vent Fluid sample titanium piston 5 unfiltered hdg 248 alt 3.4 T max 309.8 average 309.3 500 ml J2-660-15
8/19/2012 14:24	45.93357	-130.01369	248.5	1539.14	TXT: sample piston 4 was J2-660-13
8/19/2012 14:25	45.93358	-130.01369	248.3	1539.11	TXT: sample gastight orange was J2-660-12
8/19/2012 14:25	45.93358	-130.01369	248.5	1539.12	TXT: correction piston 4 was J2-660-14

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 14:27	45.93358	-130.01370	248.9	1539.1	TXT: the major blue was J2-660-13
8/19/2012 14:29	45.93357	-130.01369	248.4	1539.09	TXT: All of this sampling was in the same hole as the hobo and it appears undisturbed
8/19/2012 14:29	45.93356	-130.01369	248.3	1539.09	Frame_Grab:
8/19/2012 14:35	45.93355	-130.01369	350.4	1539.72	Sample: BioSample sample worms with blue mat J2-660-16 in biobox
8/19/2012 14:35	45.93355	-130.01369	349.4	1539.71	TXT: second grab in biobox was live worms from Inferno
8/19/2012 14:36	45.93355	-130.01369	349.4	1539.79	TXT: heading to Virgin Mound
8/19/2012 14:51	45.93366	-130.01322	119.6	1541.64	TXT: watch change, at Virgin
8/19/2012 14:52	45.93366	-130.01324	119.7	1541.64	Image_Recording: HD start we are picking up the Miso (looks like a hobo) at Virgin
8/19/2012 14:59	45.93367	-130.01323	120.8	1541.55	Image_Recording: HD stop
8/19/2012 15:01	45.93368	-130.01323	120.8	1541.61	GenInst: Instrument off seafloor HOBO/MISO 103 recovered and placed in basket
8/19/2012 15:02	45.93367	-130.01323	119.8	1541.64	Image_Recording: HD start at Virgin
8/19/2012 15:03	45.93367	-130.01323	120.0	1541.61	TXT: High Temp probe to be inserted into Virgin vent
8/19/2012 15:05	45.93367	-130.01323	119.6	1541.59	GenInst: Other Expected temp about 300 degrees C
8/19/2012 15:08	45.93366	-130.01323	119.7	1541.58	GenInst: Other Virgin mound max temp was 277°C
8/19/2012 15:09	45.93366	-130.01323	119.7	1541.58	TXT: That is 3 degrees higher than 2011 Axial cruise
8/19/2012 15:12	45.93367	-130.01324	119.2	1541.61	Sample: Vent Fluid BEAST fluid sample from Virgin vent
8/19/2012 15:16	45.93366	-130.01324	119.3	1541.58	TXT: Still trying to find optimal probe position.
8/19/2012 15:21	45.93364	-130.01322	119.2	1541.6	Sample: Vent Fluid Begin BEAST vent fluid sample J2 600-17

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 15:21	45.93364	-130.01322	119.2	1541.58	Sample: Vent Fluid HFS filter piston 2
8/19/2012 15:22	45.93364	-130.01322	119.3	1541.59	TXT: This is a fluid sample of Virgin vent
8/19/2012 15:23	45.93364	-130.01322	119.3	1541.57	Sample: Vent Fluid Max Temp is 246 average temp is 227
8/19/2012 15:24	45.93364	-130.01323	119.4	1541.6	TXT: Vent Fluid sample J2 sample J2 660-18
8/19/2012 15:24	45.93363	-130.01323	119.3	1541.6	TXT: Unfiltered piston #3 at Virgin vent
8/19/2012 15:30	45.93363	-130.01324	119.1	1541.59	TXT: Firing port gastight blue on HFS at Virgin
8/19/2012 15:33	45.93363	-130.01326	119.1	1541.64	TXT: Temps on sample 18 Max 220.6 Avg 213
8/19/2012 15:36	45.93364	-130.01329	119.0	1541.58	TXT: Pulling white gastight for sample
8/19/2012 15:38	45.93363	-130.01324	119.5	1541.61	Sample: Vent Fluid This will be sample J2 660-20 white gastight
8/19/2012 15:46	45.93364	-130.01324	119.6	1541.7	TXT: Deploying HOBO 129 into Virgin vent.
8/19/2012 15:46	45.93364	-130.01324	120.3	1541.66	TXT: Should be last activity at Virgin for today.
8/19/2012 15:48	45.93366	-130.01325	119.9	1541.59	TXT: HOBO number 129
8/19/2012 15:51	45.93366	-130.01322	119.8	1541.82	Image_Recording: HD start
8/19/2012 15:51	45.93365	-130.01321	119.8	1541.81	Frame_Grab:
8/19/2012 15:53	45.93364	-130.01322	119.8	1541.83	Image_Recording: HD stop
8/19/2012 15:53	45.93364	-130.01322	119.8	1541.81	TXT: Activity at Virgin mound vent is complete
8/19/2012 15:57	45.93362	-130.01351	259.9	1541.71	TXT: Looking for Inferno vent
8/19/2012 15:58	45.93356	-130.01356	285.6	1540.68	Image_Recording: HD start
8/19/2012 15:58	45.93357	-130.01358	285.3	1541.31	TXT: Unknown instrument
8/19/2012 15:59	45.93356	-130.01358	285.4	1541.39	TXT: Looks like a vent cap experiment

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 15:59	45.93356	-130.01358	285.1	1541.41	TXT: Girguis lab experiment
8/19/2012 16:00	45.93356	-130.01357	285.3	1541.39	TXT: Mushroom vent
8/19/2012 16:01	45.93355	-130.01355	241.8	1541.11	TXT: Heading towards Hell vent
8/19/2012 16:04	45.93332	-130.01388	251.9	1541.52	TXT: Marker 68
8/19/2012 16:05	45.93333	-130.01390	251.9	1540.85	TXT: We have arrived at Hell
8/19/2012 16:12	45.93335	-130.01389	271.7	1540.04	TXT: Starboard swingarm out
8/19/2012 16:14	45.93335	-130.01388	271.0	1540	TXT: Grabbing sulfide sample
8/19/2012 16:16	45.93333	-130.01388	271.5	1539.98	Geological_Observations: Sulfide Chimney crumbled in Jasons hand.
8/19/2012 16:16	45.93332	-130.01388	271.6	1540.03	TXT: That was J2 660-21
8/19/2012 16:19	45.93336	-130.01385	272.5	1540.03	TXT: Taking temp of side vent on Hell
8/19/2012 16:22	45.93334	-130.01393	272.4	1540.05	TXT: Probe temp holding steady at 272 C
8/19/2012 16:23	45.93333	-130.01392	272.4	1540.04	TXT: Last years temp was approx 290 at Hell
8/19/2012 16:27	45.93333	-130.01392	272.4	1540.07	TXT: Max temp was 274
8/19/2012 16:27	45.93333	-130.01392	272.6	1540.11	TXT: This is about 1 meter down from the top of chimney on east side
8/19/2012 16:30	45.93335	-130.01393	272.3	1540.08	TXT: Taking titanium major red out for sample
8/19/2012 16:32	45.93333	-130.01393	272.6	1540.08	TXT: Firing titanium major at Hell
8/19/2012 16:33	45.93333	-130.01393	272.7	1540.08	Sample: Vent Fluid Sample J2 660-22
8/19/2012 16:33	45.93333	-130.01394	272.8	1540.09	TXT: Still at Hell vent
8/19/2012 16:38	45.93333	-130.01395	272.5	1540.16	TXT: Pulling red gastight Hell vent

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 16:47	45.93333	-130.01392	272.7	1540.18	Sample: Vent Fluid Firing red gastight into side vent on Hell
8/19/2012 16:49	45.93333	-130.01391	272.6	1540.27	Sample: Vent Fluid J2 660-23
8/19/2012 16:56	45.93331	-130.01394	272.4	1540.26	TXT: Preparing to take BEAST sample
8/19/2012 17:01	45.93330	-130.01391	272.5	1540.29	TXT: Sample will be J2 660-24 - HFS unfiltered bag 17
8/19/2012 17:01	45.93330	-130.01391	272.5	1540.29	Sample: Vent Fluid Sample started
8/19/2012 17:04	45.93331	-130.01394	272.6	1540.32	Sample: Vent Fluid Sample stopped
8/19/2012 17:04	45.93331	-130.01394	272.6	1540.32	TXT: Max was 239.5
8/19/2012 17:04	45.93331	-130.01394	272.5	1540.32	TXT: Avg 222
8/19/2012 17:04	45.93331	-130.01395	272.5	1540.32	TXT: Volume 478 mL
8/19/2012 17:07	45.93329	-130.01392	272.5	1540.37	Sample: Vent Fluid Sample started
8/19/2012 17:08	45.93329	-130.01392	272.4	1540.36	TXT: Filtered bag 18
8/19/2012 17:08	45.93329	-130.01392	272.4	1540.36	TXT: J2 660-25
8/19/2012 17:08	45.93329	-130.01392	272.4	1540.35	TXT: Hell east side
8/19/2012 17:11	45.93331	-130.01391	272.4	1540.39	Sample: Vent Fluid Sample stopped
8/19/2012 17:11	45.93331	-130.01391	272.3	1540.4	TXT: Max temp 268
8/19/2012 17:12	45.93331	-130.01391	272.4	1540.39	TXT: Average 260
8/19/2012 17:12	45.93331	-130.01391	272.3	1540.39	TXT: Volume 500 mL
8/19/2012 17:19	45.93330	-130.01387	262.8	1542.97	TXT: Marker for Hell
8/19/2012 17:19	45.93330	-130.01387	262.8	1542.91	TXT: Port swingarm out
8/19/2012 17:19	45.93330	-130.01387	262.8	1542.91	TXT: Planning to deploy MTR

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 17:20	45.93329	-130.01387	262.0	1542.94	TXT: Preparing syringe sampler first.
8/19/2012 17:22	45.93329	-130.01388	262.1	1542.86	Sample: BioSample Attempting to suction some bacterial mat
8/19/2012 17:24	45.93329	-130.01388	262.1	1542.89	Sample: BioSample Firing green large syringe
8/19/2012 17:26	45.93329	-130.01390	261.8	1542.99	Sample: BioSample J2 660-26
8/19/2012 17:30	45.93328	-130.01387	262.6	1542.93	TXT: Preparing to deploy MTR
8/19/2012 17:33	45.93326	-130.01389	262.6	1542.96	TXT: MTR 4098 deployed near HELL marker 68
8/19/2012 17:34	45.93325	-130.01389	262.8	1543.08	TXT: MTR #4098
8/19/2012 17:37	45.93333	-130.01391	262.2	1542.76	TXT: Attempting to grab some old iron plate weights
8/19/2012 17:39	45.93332	-130.01391	261.1	1542.56	TXT: MTR 4098 was deployed near where MTR 92W was picked up.
8/19/2012 17:40	45.93334	-130.01395	268.1	1541.21	TXT: Actual number of MTR 92W to be determined that was just ID on float
8/19/2012 17:59	45.93413	-130.01304	57.0	1542.57	TXT: Background seawater samples J2 660-27 and 28
8/19/2012 18:01	45.93433	-130.01291	57.3	1541.21	TXT: Starting filtered piston #6 for J2 660-27 background seawater
8/19/2012 18:06	45.93472	-130.01259	57.8	1542.87	TXT: First background complete
8/19/2012 18:06	45.93474	-130.01258	58.0	1542.88	TXT: 700 mL max and avg temps are 2.4 C
8/19/2012 18:06	45.93476	-130.01256	58.0	1542.95	TXT: Presently slowly transiting to Casius beacon
8/19/2012 18:08	45.93489	-130.01243	56.2	1542.87	TXT: Starting second background seawater collection. Unfiltered piston 7
8/19/2012 18:08	45.93490	-130.01243	57.5	1542.98	TXT: J2 660-28

J2-660 Date-Time UTC	Latitude Dec deg	Longitude Dec. deg.	Heading	ROV Depth	Log Entry
8/19/2012 18:17	45.93524	-130.01176	118.2	1542.48	TXT: Sample J2 660-28 finished. Temp max and average are 2.4 C 700 mL
8/19/2012 18:26	45.93490	-130.01091	52.9	1542.63	TXT: Found SCPR
8/19/2012 18:28	45.93491	-130.01087	56.8	1543.72	TXT: Release mechanism didn't work. Trying to shake it loose with Jason arm
8/19/2012 18:34	45.93492	-130.01085	59.6	1543.59	TXT: No luck can't knock weights off with manip
8/19/2012 18:57	45.93622	-130.01173	297.5	1543.55	TXT: At Cassius Beacon
8/19/2012 19:00	45.93621	-130.01171	297.7	1543.59	TXT: On hackly lava no sediment to speak of
8/19/2012 19:01	45.93621	-130.01172	297.7	1543.6	TXT: Occasional macrofauna - fish shrimp holothurians
8/19/2012 19:03	45.93621	-130.01172	297.5	1543.53	TXT: Releasing transponder buoy to surface for retrieval
8/19/2012 19:04	45.93616	-130.01164	297.8	1543.6	TXT: Moving SW to clear surface for buoy
8/19/2012 19:04	45.93618	-130.01165	304.6	1541.3	JASON: Jason off bottom
8/19/2012 19:05	45.93623	-130.01166	338.2	1541.89	TXT: Fish
8/19/2012 19:08	45.93654	-130.01128	31.7	1513.31	TXT: Ascending
8/19/2012 22:15	45.94016	-130.00987	252.2	0.93	JASON: Medea out of water
8/19/2012 22:15	45.94016	-130.00987	252.2	0.93	JASON: Jason out of water

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 7:11	45.93546	-130.01158	303	2.2	JASON: Jason in water
8/20/2012 7:11	45.93546	-130.01158	302	2.1	JASON: Medea in water
8/20/2012 7:12	45.93546	-130.01158	300	7.5	TXT: Jason heading down
8/20/2012 7:39	45.93561	-130.01174	334	484.5	TXT: holding at this depth because of winch problem
8/20/2012 7:42	45.93554	-130.01174	319	483.2	TXT: going down winch fixed
8/20/2012 7:51	45.93545	-130.01169	307	661.4	TXT: stop the winch again
8/20/2012 8:02	45.93546	-130.01154	216	680.4	TXT: descending
8/20/2012 8:03	45.93547	-130.01153	217	680.5	TXT: winch wtop
8/20/2012 8:03	45.93547	-130.01152	217	680.5	TXT: winch stop
8/20/2012 8:15	45.93564	-130.01137	208	686.7	TXT: winch test lowering
8/20/2012 8:20	45.93567	-130.01134	198	717.4	TXT: hold the winch
8/20/2012 8:21	45.93567	-130.01134	197	731.0	TXT: descending
8/20/2012 8:26	45.93569	-130.01135	208	760.0	TXT: tively twist (magnetometer calibration) start
8/20/2012 8:27	45.93570	-130.01135	205	752.0	TXT: tively twist aborted
8/20/2012 8:27	45.93571	-130.01138	266	754.2	TXT: tively twist re-start
8/20/2012 8:28	45.93573	-130.01139	304	753.7	TXT: tively twist aborted
8/20/2012 8:30	45.93575	-130.01138	347	753.7	TXT: tively twist restart
8/20/2012 8:30	45.93576	-130.01138	343	753.1	TXT: tively twist aborted
8/20/2012 8:35	45.93570	-130.01140	357	750.7	TXT: tively twist start
8/20/2012 8:38	45.93569	-130.01140	43	750.6	TXT: tively twist to stb
8/20/2012 8:41	45.93570	-130.01141	8	750.2	TXT: tively twist end
8/20/2012 8:41	45.93570	-130.01142	2	750.5	TXT: descending
8/20/2012 8:42	45.93571	-130.01142	0	756.1	TXT: winch stop
8/20/2012 8:44	45.93570	-130.01142	5	742.4	TXT: descending
8/20/2012 8:44	45.93571	-130.01141	14	747.9	TXT: winch stop
8/20/2012 8:54	45.93563	-130.01138	70	833.0	TXT: descending/holding -- winch problem
8/20/2012 9:04	45.93561	-130.01149	69	985.3	TXT: descending
8/20/2012 9:22	45.93561	-130.01152	68	1395.9	TXT: winch stopped again - rising
8/20/2012 9:22	45.93562	-130.01152	67	1401.8	TXT: descending
8/20/2012 9:23	45.93565	-130.01150	64	1441.9	TXT: fish
8/20/2012 9:23	45.93564	-130.01155	66	1445.2	TXT: DVD recording starting
8/20/2012 9:29	45.93512	-130.01180	161	1518.3	JASON: Jason on bottom
8/20/2012 9:30	45.93508	-130.01182	159	1517.9	TXT: doing ballast and tether checks

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 9:30	45.93510	-130.01188	161	1517.7	TXT: rough lava some sediment white bacterial mats
8/20/2012 9:30	45.93510	-130.01192	159	1521.3	TXT: On bottom near Trevi north of Spanish Steps
8/20/2012 9:30	45.93509	-130.01192	160	1522.5	TXT: Pillow lava
8/20/2012 9:31	45.93510	-130.01193	159	1522.0	TXT: In region where snowblowers were found in 2011
8/20/2012 9:32	45.94628	-129.98386	159	1522.5	TXT: Doppler reset
8/20/2012 9:32	45.94626	-129.98381	149	1521.6	TXT: Heading for Spanish Steps
8/20/2012 9:33	45.94625	-129.98378	152	1520.8	TXT: bearing 150 25m
8/20/2012 9:33	45.94624	-129.98377	151	1519.9	TXT: Fish
8/20/2012 9:33	45.94622	-129.98373	140	1520.8	TXT: Diffuse venting - mound with bacterial mats
8/20/2012 9:33	45.94622	-129.98374	121	1520.8	TXT: Trevi vent
8/20/2012 9:34	45.94617	-129.98376	165	1520.0	TXT: Hackly lava
8/20/2012 9:34	45.94616	-129.98376	165	1519.9	TXT: crab?
8/20/2012 9:34	45.94615	-129.98376	164	1519.7	TXT: clams and tubeworm bushes
8/20/2012 9:35	45.94612	-129.98370	162	1520.7	TXT: Majjib (sp?) crab
8/20/2012 9:36	45.94613	-129.98368	135	1519.8	TXT: Widespread tubeworms & clams
8/20/2012 9:37	45.94611	-129.98364	135	1519.5	TXT: Crossing through black smoke/debris
8/20/2012 9:37	45.94607	-129.98364	134	1518.8	TXT: At Spanish Steps - marker visible
8/20/2012 9:38	45.94603	-129.98366	131	1519.5	TXT: Marker 155
8/20/2012 9:38	45.94603	-129.98366	131	1519.3	Image_Recording: DSC capture
8/20/2012 9:39	45.94604	-129.98367	131	1519.0	TXT: Mound with mats tubeworms
8/20/2012 9:40	45.94605	-129.98368	131	1518.6	Image_Recording: HD start
8/20/2012 9:40	45.94606	-129.98369	131	1518.6	TXT: Using JASON temp probe to check diffuse venting
8/20/2012 9:40	45.94606	-129.98369	131	1518.6	Image_Recording: DSC capture
8/20/2012 9:41	45.94605	-129.98364	165	1519.5	TXT: Shimmering water
8/20/2012 9:43	45.94605	-129.98363	221	1519.7	TXT: Measuring shimmering temp at Spanish Steps
8/20/2012 9:46	45.94605	-129.98362	221	1519.7	TXT: Stirring up a lot of particles
8/20/2012 9:48	45.94605	-129.98361	221	1519.7	TXT: Low temp venting
8/20/2012 9:52	45.94603	-129.98361	357	1520.3	TXT: Much hotter venting - 140C

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 9:53	45.94603	-129.98361	357	1520.3	TXT: still rising
8/20/2012 9:55	45.94602	-129.98362	357	1520.3	TXT: 190C deeper in vent
8/20/2012 9:56	45.94603	-129.98362	357	1520.3	TXT: Max temp measured 195.4C
8/20/2012 9:56	45.94603	-129.98362	357	1520.3	TXT: Shrimp
8/20/2012 9:58	45.94604	-129.98362	357	1520.2	Sample: Vent Fluid
8/20/2012 9:58	45.94604	-129.98363	357	1520.2	TXT: Positioning fluid sampler arm
8/20/2012 10:02	45.94607	-129.98364	357	1520.3	TXT: Starting sample J2-661-1 HFS-04 - PF
8/20/2012 10:04	45.94606	-129.98364	357	1520.3	TXT: Actually going now
8/20/2012 10:07	45.94606	-129.98363	357	1520.3	TXT: Sample end - max temp 123.7C ave temp 123C volume collected 502ml Sp. Steps
8/20/2012 10:08	45.94606	-129.98364	357	1520.3	TXT: Starting sample J2-661-2 HFS-05 - unfiltered piston
8/20/2012 10:12	45.94604	-129.98364	357	1520.2	TXT: Sample end - max temp 126.6C ave temp 124.6C volume collected 502ml Sp. Steps
8/20/2012 10:13	45.94604	-129.98363	357	1520.2	Image_Recording: HD stop
8/20/2012 10:16	45.94606	-129.98360	357	1520.2	Sample 661-3 Taking handheld white gastight sample
8/20/2012 10:19	45.94604	-129.98361	357	1520.2	Sample 661-4 Blue titanium major sample
8/20/2012 10:19	45.94604	-129.98361	358	1520.2	TXT: Fluid sample
8/20/2012 10:25	45.94603	-129.98364	357	1520.2	Image_Recording: HD start
8/20/2012 10:25	45.94603	-129.98364	357	1520.2	Image_Recording: DSC capture
8/20/2012 10:30	45.94606	-129.98363	176	1519.9	TXT: Close-up on blue mat
8/20/2012 10:30	45.94606	-129.98363	176	1519.7	TXT: protozoa?
8/20/2012 10:31	45.94606	-129.98362	177	1520.0	Sample: BioSample
8/20/2012 10:31	45.94606	-129.98362	178	1520.0	Sample J2-661-5 - blue mat on tubeworms, into bio box
8/20/2012 10:31	45.94606	-129.98362	177	1520.0	TXT: Placing in biobox
8/20/2012 10:32	45.94606	-129.98362	178	1520.0	TXT: -3 and -4 were gastight and blue major at Spanish Steps
8/20/2012 10:34	45.94607	-129.98363	176	1520.0	TXT: tubeworm sample put in biobox
8/20/2012 10:35	45.94607	-129.98364	176	1519.9	TXT: Closing biobox
8/20/2012 10:36	45.94607	-129.98364	179	1518.9	TXT: Next – Trevi

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 10:37	45.94610	-129.98357	144	1519.1	TXT: Moving away from Spanish Steps
8/20/2012 10:37	45.94612	-129.98354	132	1518.9	TXT: Smooth lava flow
8/20/2012 10:39	45.94634	-129.98362	4	1518.6	TXT: Jumbly lava
8/20/2012 10:40	45.94627	-129.98368	124	1519.7	TXT: Lots of orange hydrothermal sediment in between lava
8/20/2012 10:41	45.94625	-129.98371	147	1520.0	TXT: Extensive white bacterial mats
8/20/2012 10:41	45.94624	-129.98372	146	1520.7	TXT: Arrived at Trevi mound
8/20/2012 10:42	45.94624	-129.98373	146	1520.1	TXT: Concentrated shimmering venting
8/20/2012 10:45	45.94624	-129.98372	145	1520.9	TXT: Deploying Jason temp probe at Trevi
8/20/2012 10:45	45.94624	-129.98372	145	1520.9	Image_Recording: DSC capture
8/20/2012 10:47	45.94623	-129.98373	144	1520.9	TXT: Venting max temp so far - 270C
8/20/2012 10:49	45.94622	-129.98374	144	1520.9	TXT: Preparing to take fluid sample at Trevi
8/20/2012 10:52	45.94622	-129.98373	144	1520.9	TXT: Starting sample J2-661-6 HFS-02 - filtered piston Trevi
8/20/2012 10:53	45.94623	-129.98374	144	1520.8	TXT: Sample ended - max temp 264.9C ave temp 264.8C volume collected 253ml
8/20/2012 10:55	45.94624	-129.98375	144	1520.8	TXT: Starting sample J2-661-7 HFS-03 - unfiltered piston Trevi
8/20/2012 10:56	45.94624	-129.98377	144	1520.8	TXT: Sample ended - max temp 264.8C ave temp 264.8C volume collected 252ml
8/20/2012 10:58	45.94625	-129.98378	144	1520.8	TXT: Sample J2-661-8 gastight blue
8/20/2012 11:00	45.94626	-129.98377	144	1520.8	TXT: Collecting hobo deploying replacement at Trevi
8/20/2012 11:03	45.94627	-129.98377	145	1520.6	TXT: hobo 104 in place
8/20/2012 11:04	45.94627	-129.98377	144	1520.8	TXT: hobo 135 recovered
8/20/2012 11:08	45.94627	-129.98375	145	1520.8	TXT: still stowing hobo
8/20/2012 11:10	45.94627	-129.98376	145	1520.9	TXT: heading for Snow Globe
8/20/2012 11:26	45.94601	-129.98429	240	1521.8	TXT: HD frame grab
8/20/2012 11:34	45.94585	-129.98483	164	1521.8	TXT: still looking for Snow Globe

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 11:41	45.94589	-129.98500	292	1521.5	TXT: Giving up on Snow Globe and heading for N3 looking for snow on the way
8/20/2012 12:00	45.94563	-129.98410	192	1521.8	TXT: frame grabs of lava contact
8/20/2012 12:06	45.94519	-129.98424	169	1522.4	TXT: no activity so far
8/20/2012 12:15	45.94465	-129.98411	223	1522.3	TXT: not seeing any hydrothermal/snowblower activity along our path south
8/20/2012 12:38	45.94371	-129.98515	312	1522.6	TXT: at Marker N3 site (note that the N3 marker is no longer here)
8/20/2012 12:47	45.94366	-129.98515	313	1522.6	TXT: setting up to work at Mkr N3 site
8/20/2012 12:50	45.94362	-129.98516	313	1522.5	Image_Recording: HD stop
8/20/2012 12:52	45.94363	-129.98517	312	1522.4	TXT: Recovered MTR 3312 from Marker N3
8/20/2012 13:05	45.94366	-129.98520	312	1522.3	Sample: Vent Fluid started sample J2-661-9 unfiltered bag marker N3
8/20/2012 13:06	45.94366	-129.98520	312	1522.3	Frame_Grab:
8/20/2012 13:08	45.94366	-129.98520	312	1522.3	TXT: 1307 502 ml 20.2 max 20.1 tavg hdg 31'2 1523 m
8/20/2012 13:09	45.94366	-129.98520	312	1522.3	Sample: Vent Fluid bag 18 started J2-661-10 filtered bag sample
8/20/2012 13:10	45.94366	-129.98520	312	1522.2	TXT: Same place mkr N3 1523 m depth hdg 312
8/20/2012 13:13	45.94366	-129.98519	312	1522.2	Sample: Vent Fluid 505 ml T max 20.2 max Tavg 20.1
8/20/2012 13:16	45.94366	-129.98519	314	1522.2	TXT: deploy MTR 3332/ 153
8/20/2012 13:24	45.94361	-129.98522	170	1521.7	TXT: leaving marker N3 hdg 170 to mkr 33 vent
8/20/2012 13:42	45.94258	-129.98485	168	1514.9	TXT: on the move, collapse pit
8/20/2012 13:45	45.94237	-129.98478	170	1515.2	TXT: nice picture of collapse pit in the digital still image
8/20/2012 13:45	45.94235	-129.98478	170	1515.3	TXT: lava pillar and drain back features
8/20/2012 13:48	45.94225	-129.98475	171	1515.2	TXT: crab dead ahead
8/20/2012 13:52	45.94208	-129.98476	175	1514.1	TXT: testing optical modem between Jason and Medea

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 13:58	45.94179	-129.98461	176	1513.3	Image_Recording: HD start hd recording of lava pillars
8/20/2012 13:59	45.94172	-129.98458	175	1512.6	TXT: recording started at 13:57
8/20/2012 14:03	45.94141	-129.98450	175	1512.0	Image_Recording: HD stop hd stopped recording
8/20/2012 14:14	45.94083	-129.98436	175	1512.2	TXT: lava pillar
8/20/2012 14:15	45.94069	-129.98443	175	1512.2	Biological_Observations: eelpout
8/20/2012 14:21	45.94046	-129.98447	175	1512.2	TXT: many lava pillars with drain back features
8/20/2012 14:34	45.93978	-129.98404	179	1512.7	TXT: crab
8/20/2012 14:36	45.93978	-129.98403	180	1513.1	Sample: BioSample crab dropped it
8/20/2012 14:38	45.93967	-129.98400	171	1512.3	TXT: shiny lava looks younger
8/20/2012 14:53	45.93868	-129.98368	170	1512.6	TXT: Crab
8/20/2012 15:16	45.93661	-129.98312	170	1512.4	TXT: Shrimp
8/20/2012 15:29	45.93527	-129.98298	171	1515.4	Geological_Observations: Sheet Flow
8/20/2012 15:29	45.93524	-129.98298	170	1515.6	TXT: Fish
8/20/2012 15:29	45.93519	-129.98297	172	1515.8	Image_Recording: DSC capture
8/20/2012 15:49	45.93315	-129.98244	109	1511.8	TXT: Marker 33 RAS sighted
8/20/2012 15:49	45.93315	-129.98243	109	1512.5	TXT: RAS sighted
8/20/2012 15:49	45.93314	-129.98239	109	1513.1	Image_Recording: HD start
8/20/2012 15:51	45.93312	-129.98235	110	1505.8	Frame_Grab:
8/20/2012 15:52	45.93312	-129.98235	110	1505.8	TXT: We are looking at the RAS floats for surface recovery
8/20/2012 15:59	45.93312	-129.98234	110	1505.7	TXT: Waiting for ship positioning to work itself out before continuing
8/20/2012 16:01	45.93315	-129.98230	106	1515.0	TXT: Signs of venting w/ white mats
8/20/2012 16:02	45.93315	-129.98230	106	1514.9	Biological_Observations: bacterial mat
8/20/2012 16:02	45.93315	-129.98230	106	1514.8	Biological_Observations: white filamentous bacteria
8/20/2012 16:02	45.93315	-129.98230	106	1514.9	Biological_Observations: sparse tubeworms
8/20/2012 16:07	45.93319	-129.98230	195	1514.0	TXT: 2 MTRs wrapped together on RAS intake
8/20/2012 16:14	45.93316	-129.98228	223	1515.3	TXT: Finding a good position to take a temp measurement

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 16:19	45.93317	-129.98227	220	1515.4	TXT: Temp survey w/ Jason probe around RAS water intake
8/20/2012 16:32	45.93313	-129.98228	163	1515.4	GenInst: Instrument off seafloor New MTR out of port biobox
8/20/2012 16:32	45.93313	-129.98228	163	1515.5	TXT: MTR 4095
8/20/2012 16:37	45.93315	-129.98229	162	1515.4	GenInst: Instrument off seafloor 2 old MTRs. 3197 and 4097
8/20/2012 16:39	45.93316	-129.98230	162	1515.5	TXT: Tube pulled out of MTR handle
8/20/2012 16:39	45.93316	-129.98230	163	1515.5	TXT: Old MTR into port biobox
8/20/2012 16:42	45.93317	-129.98229	163	1515.5	GenInst: Instrument off seafloor Pulling next MTR off seafloor. 4094
8/20/2012 16:42	45.93317	-129.98228	162	1515.5	TXT: 4094 going into port biobox
8/20/2012 16:45	45.93317	-129.98227	163	1515.5	GenInst: Instrument Orientation Repositioning new MTR 4095
8/20/2012 16:45	45.93317	-129.98227	163	1515.5	TXT: Float is mislabeled says 4096 but label on new MTR is 4095
8/20/2012 16:46	45.93317	-129.98227	163	1515.5	TXT: Tube worms have grown since last year.
8/20/2012 16:49	45.93316	-129.98229	155	1515.3	TXT: Taking BEAST sample before positioning MTR 4095
8/20/2012 16:56	45.93317	-129.98228	162	1515.4	TXT: About 17 degrees C on BEAST probe
8/20/2012 16:57	45.93317	-129.98228	162	1515.4	TXT: We will be taking 2 water samples and 2 RNA filters
8/20/2012 16:59	45.93317	-129.98228	162	1515.4	TXT: Still at Marker 33
8/20/2012 17:01	45.93317	-129.98229	162	1515.4	TXT: Starting sample RNA filter 15
8/20/2012 17:07	45.93317	-129.98230	162	1515.5	Sample: BioSample This is sample J2 661-11
8/20/2012 17:10	45.93317	-129.98230	162	1515.5	TXT: Clarification: RNA filter 15 is J2 661-11
8/20/2012 17:11	45.93317	-129.98230	162	1515.5	TXT: Still at Marker 33
8/20/2012 17:24	45.93316	-129.98230	162	1515.6	TXT: J2 661-11 complete. Max T 16.9 avg 14.9.
8/20/2012 17:24	45.93316	-129.98230	162	1515.6	TXT: Volume 3000 mL

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 17:25	45.93316	-129.98230	162	1515.6	TXT: Next we are going to take 2 water samples.
8/20/2012 17:28	45.93318	-129.98231	162	1515.6	TXT: Taking water sample in filtered bag 22 J2 661-12
8/20/2012 17:31	45.93319	-129.98230	162	1515.6	TXT: Sample complete
8/20/2012 17:31	45.93319	-129.98230	162	1515.6	TXT: Max Temp 13.5 avg 12.4
8/20/2012 17:31	45.93319	-129.98230	162	1515.6	TXT: Volume 530 mL
8/20/2012 17:32	45.93319	-129.98230	162	1515.6	TXT: Repositioning probe to find a better hotspot
8/20/2012 17:36	45.93317	-129.98230	163	1515.7	TXT: Taking water sample in unfiltered bag 23
8/20/2012 17:36	45.93317	-129.98230	163	1515.7	TXT: Sample ID J2 661-13
8/20/2012 17:37	45.93316	-129.98230	163	1515.7	TXT: Still at Marker 33
8/20/2012 17:44	45.93319	-129.98228	163	1515.7	TXT: Sample complete
8/20/2012 17:44	45.93319	-129.98228	162	1515.7	TXT: Max temp 14.5 avg 13.7
8/20/2012 17:44	45.93319	-129.98228	163	1515.7	TXT: Volume 500 mL
8/20/2012 17:45	45.93319	-129.98228	162	1515.7	TXT: Last sample is RNA filter 16
8/20/2012 17:45	45.93318	-129.98228	162	1515.7	TXT: Sample ID J2 661-14
8/20/2012 17:47	45.93318	-129.98228	162	1515.8	TXT: Sample starting now
8/20/2012 18:10	45.93319	-129.98232	162	1515.9	TXT: Sample 661-14 finished
8/20/2012 18:11	45.93319	-129.98231	163	1515.9	TXT: 14.2 is max temp 12.1 is the average
8/20/2012 18:11	45.93319	-129.98231	162	1515.9	TXT: 3000 mL pumped
8/20/2012 18:12	45.93319	-129.98230	162	1516.0	TXT: Stowing fluid sampler intake
8/20/2012 18:15	45.93317	-129.98231	163	1516.0	TXT: Placing MTR
8/20/2012 18:37	45.93315	-129.98231	203	1516.6	Sample: BioSample testing green syringe
8/20/2012 18:38	45.93317	-129.98232	203	1516.6	Sample: BioSample beginning suction
8/20/2012 18:38	45.93317	-129.98233	203	1516.6	Frame_Grab:
8/20/2012 18:38	45.93317	-129.98233	203	1516.6	Frame_Grab:
8/20/2012 18:39	45.93318	-129.98234	203	1516.6	Sample: BioSample stowing green suction
8/20/2012 18:40	45.93317	-129.98235	203	1516.6	Sample: BioSample sampled orange mat
8/20/2012 18:42	45.93319	-129.98227	172	1513.9	TXT: orange mat sample at marker 33 is J2 661-15
8/20/2012 18:43	45.93328	-129.98223	72	1515.0	Biological_Observations: bacterial mat

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 18:43	45.93328	-129.98230	348	1515.2	Geological_Observations: Pillow Basalts
8/20/2012 18:46	45.93327	-129.98232	313	1515.6	Biological_Observations: bacterial mat
8/20/2012 18:47	45.93326	-129.98234	314	1515.9	Biological_Observations: bacterial mat thick white bacteria
8/20/2012 18:55	45.93326	-129.98236	312	1516.2	Sample: BioSample Mat/sed whitish mat Red Syringe J2 661-16
8/20/2012 18:58	45.93326	-129.98235	312	1516.2	TXT: Sample stowed
8/20/2012 19:02	45.93326	-129.98235	313	1516.2	TXT: Using Jason temp probe on white bacterial mat
8/20/2012 19:04	45.93326	-129.98235	312	1516.2	TXT: Max temp 18.4C
8/20/2012 19:11	45.93321	-129.98214	317	1516.0	TXT: Moving over pillow lava
8/20/2012 19:13	45.93315	-129.98217	245	1516.4	TXT: Found anchor of some sort - marked 260
8/20/2012 19:17	45.93318	-129.98233	181	1516.4	TXT: RAS near marker
8/20/2012 19:18	45.93321	-129.98230	194	1514.7	TXT: marker 166 (deployed 2011, replaces mkr 55 which replaced original mkr 33)
8/20/2012 19:22	45.93314	-129.98228	328	1516.0	TXT: Waiting to release RAS
8/20/2012 19:24	45.93314	-129.98229	329	1516.5	Image_Recording: DSC capture
8/20/2012 19:35	45.93312	-129.98230	342	1516.9	TXT: RAS released
8/20/2012 19:38	45.93313	-129.98227	19	1513.2	JASON: Jason off bottom
8/20/2012 19:38	45.93318	-129.98223	22	1512.9	TXT: Leaving bottom temporarily to allow ship to recover RAS
8/20/2012 19:48	45.93285	-129.98182	319	1415.2	TXT: Holding at 106.5m above bottom
8/20/2012 19:48	45.93283	-129.98180	320	1415.1	TXT: Performing optical comms tests w/Medea
8/20/2012 19:58	45.93194	-129.98051	318	1412.2	TXT: RAS reached the surface
8/20/2012 20:00	45.93177	-129.98034	318	1411.6	TXT: Shrimp

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 20:03	45.93126	-129.98049	271	1411.5	TXT: Ship recovering RAS at surface; chief sci, expedition leader, captain and shoreside discuss if we can continue diving with winch level wind not working. Will continue but must stay at near const depth so can't go into Int Dist field.
8/20/2012 20:30	45.93231	-129.98439	102	1411.7	TXT: RAS on deck
8/20/2012 20:38	45.93229	-129.98548	62	1419.8	TXT: Deciding next vent target
8/20/2012 20:38	45.93227	-129.98554	40	1421.3	TXT: Fish
8/20/2012 20:39	45.93219	-129.98565	47	1429.1	TXT: Descending
8/20/2012 20:44	45.93174	-129.98669	228	1437.7	JASON: Jason Descent paused
8/20/2012 20:45	45.93170	-129.98670	183	1437.9	TXT: Still at 85m from bottom
8/20/2012 20:46	45.93159	-129.98678	185	1438.6	TXT: Video optical comms tests
8/20/2012 20:56	45.93157	-129.98691	125	1444.0	TXT: Descending
8/20/2012 21:02	45.93154	-129.98686	117	1516.9	JASON: Jason on bottom
8/20/2012 21:02	45.93154	-129.98683	119	1517.8	TXT: Lobate lava flow
8/20/2012 21:03	45.93151	-129.98676	117	1517.0	TXT: Collapsed lava zone
8/20/2012 21:04	45.93151	-129.98674	118	1519.7	TXT: Yellow deposits on pillar
8/20/2012 21:07	45.93152	-129.98660	119	1519.2	TXT: Lots of pillars and hackly collapsed lava below them
8/20/2012 21:08	45.93147	-129.98655	119	1520.3	TXT: Heading east to vent zone - drifted west during RAS retrieval
8/20/2012 21:09	45.93145	-129.98653	119	1519.4	Image_Recording: HD start
8/20/2012 21:12	45.93157	-129.98643	85	1518.6	TXT: Stirring up sediment w thrusters
8/20/2012 21:15	45.93143	-129.98646	90	1518.4	Image_Recording: HD stop
8/20/2012 21:15	45.93143	-129.98646	89	1518.5	TXT: Shrimp
8/20/2012 21:17	45.93145	-129.98630	89	1520.3	TXT: Shrimp
8/20/2012 21:28	45.93139	-129.98526	89	1517.2	TXT: Shrimp
8/20/2012 21:42	45.93133	-129.98379	90	1517.6	TXT: Pillow lava
8/20/2012 21:43	45.93134	-129.98361	90	1517.7	TXT: Still in collapsed zone
8/20/2012 21:50	45.93123	-129.98293	97	1520.7	TXT: Ropy sheet flow
8/20/2012 21:51	45.93124	-129.98280	94	1520.8	TXT: Hackly flow
8/20/2012 21:52	45.93126	-129.98273	134	1520.5	TXT: Collapsed pillow mound
8/20/2012 21:52	45.93129	-129.98266	85	1520.7	TXT: Sheet flow

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 21:53	45.93129	-129.98255	88	1521.8	TXT: Ropey flow
8/20/2012 21:54	45.93119	-129.98241	190	1521.0	TXT: More collapsed shells
8/20/2012 21:56	45.93118	-129.98243	191	1520.4	TXT: Heading south to Boca
8/20/2012 21:57	45.93115	-129.98234	182	1520.7	TXT: Jumbly collapsed lava stuff
8/20/2012 22:00	45.93098	-129.98230	182	1521.4	TXT: More jumbly broken stuff
8/20/2012 22:00	45.93097	-129.98230	182	1521.7	TXT: Sheet flow
8/20/2012 22:05	45.93067	-129.98226	190	1523.8	TXT: ropey sheet flow
8/20/2012 22:06	45.93061	-129.98228	162	1523.1	TXT: fish
8/20/2012 22:07	45.93060	-129.98232	174	1522.4	TXT: holothurian
8/20/2012 22:09	45.93044	-129.98238	182	1523.0	TXT: Holothurian
8/20/2012 22:09	45.93044	-129.98238	182	1523.1	TXT: Sheet flow
8/20/2012 22:11	45.93036	-129.98237	181	1523.4	TXT: Ropey/jumbly lava
8/20/2012 22:12	45.93029	-129.98235	207	1523.2	TXT: Pillars and hackly lava
8/20/2012 22:15	45.93013	-129.98234	178	1521.2	TXT: Sheet flows
8/20/2012 22:15	45.93011	-129.98234	179	1521.5	TXT: Quite sedimented
8/20/2012 22:16	45.92999	-129.98231	180	1521.9	TXT: Orange hydrothermal sediment
8/20/2012 22:16	45.92997	-129.98230	183	1520.6	TXT: Pillar jumbly lava
8/20/2012 22:17	45.92993	-129.98222	166	1520.9	TXT: More pillars etc
8/20/2012 22:17	45.92992	-129.98221	175	1520.6	TXT: Arch
8/20/2012 22:19	45.92985	-129.98214	159	1517.8	TXT: Driving south along the eruptive fissure
8/20/2012 22:21	45.92965	-129.98202	173	1521.0	TXT: Big fish
8/20/2012 22:21	45.92964	-129.98202	174	1521.1	TXT: At contact between new and old lava flow
8/20/2012 22:21	45.92964	-129.98202	174	1521.3	TXT: Crabs holothurians
8/20/2012 22:22	45.92962	-129.98202	174	1520.8	TXT: Pillow lava
8/20/2012 22:23	45.92940	-129.98209	177	1518.9	TXT: Arches and pillars
8/20/2012 22:24	45.92936	-129.98213	178	1518.5	TXT: Older than pillow lava
8/20/2012 22:24	45.92932	-129.98214	177	1517.9	TXT: Arches pillars jumbly flow sedimented
8/20/2012 22:24	45.92927	-129.98214	178	1518.7	TXT: New pillow lava flowing around the older feature
8/20/2012 22:26	45.92905	-129.98217	178	1519.7	TXT: Thick orange deposits
8/20/2012 22:26	45.92903	-129.98216	178	1519.7	TXT: Probably old diffuse vents from eruption last year
8/20/2012 22:26	45.92901	-129.98217	178	1519.7	TXT: Still on new pillow lava but v thick hydrothermal deposits
8/20/2012 22:27	45.92900	-129.98217	178	1519.3	TXT: Jellyfish? shrimp

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 22:28	45.92894	-129.98218	179	1518.1	TXT: Fish
8/20/2012 22:28	45.92893	-129.98218	179	1518.0	TXT: More shell regions
8/20/2012 22:32	45.92853	-129.98217	178	1519.0	TXT: Back to pillars + arches + broken lava
8/20/2012 22:33	45.92844	-129.98218	179	1518.8	TXT: More pillows but far less hydrothermal sediment
8/20/2012 22:33	45.92842	-129.98218	179	1518.9	TXT: Fish
8/20/2012 22:36	45.92813	-129.98218	179	1518.8	TXT: Sheet flows
8/20/2012 22:38	45.92806	-129.98227	261	1520.0	TXT: Pillows broken shells some hydrothermal deposits
8/20/2012 22:39	45.92807	-129.98228	262	1520.6	TXT: V small white bacterial mats in crack
8/20/2012 22:39	45.92807	-129.98228	262	1520.3	TXT: some diffuse flow
8/20/2012 22:41	45.92806	-129.98225	203	1520.0	TXT: Trying to break off fresh basalt sample
8/20/2012 22:41	45.92805	-129.98225	205	1519.3	Image_Recording: DSC capture
8/20/2012 22:42	45.92802	-129.98226	199	1517.9	TXT: More mat in cracks
8/20/2012 22:42	45.92799	-129.98224	176	1518.3	TXT: Sediment
8/20/2012 22:42	45.92793	-129.98224	179	1517.2	TXT: Fish
8/20/2012 22:57	45.92771	-129.98241	30	1517.9	TXT: There is some snowiness on the way to Boca
8/20/2012 22:58	45.92777	-129.98238	30	1518.8	GenInst: Other A vent has been sighted.
8/20/2012 23:00	45.92778	-129.98238	221	1518.6	GenInst: Other No markers seem to be evident.
8/20/2012 23:05	45.92779	-129.98230	137	1518.1	TXT: A request for a 180 degree turn around the hole was heard from the chair.
8/20/2012 23:15	45.92773	-129.98215	174	1517.9	TXT: A collapsed area has been sighted.
8/20/2012 23:20	45.92764	-129.98249	211	1518.8	TXT: Holes with creatures were sighted.
8/20/2012 23:25	45.92763	-129.98250	150	1518.7	Geological_Observations: Diffuse Vent Holy Mole
8/20/2012 23:28	45.92764	-129.98241	161	1518.8	Geological_Observations: Diffuse Vent Marker 170 has been found.
8/20/2012 23:29	45.92766	-129.98238	156	1518.4	Image_Recording: HD start HD on

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/20/2012 23:29	45.92766	-129.98238	156	1518.4	TXT: An accompanying MTR assures that this is Boca .
8/20/2012 23:32	45.92765	-129.98237	130	1518.8	Geological_Observations: Diffuse Vent The HFS wand was whipped out to take a temperature.
8/20/2012 23:32	45.92765	-129.98238	131	1518.8	Image_Recording: HD stop Stop HD
8/20/2012 23:37	45.92766	-129.98239	131	1518.8	Image_Recording: HD start
8/20/2012 23:37	45.92766	-129.98239	131	1518.8	TXT: HFS has recorded a rising trend about 9 deg C.
8/20/2012 23:46	45.92767	-129.98241	131	1518.7	Sample: Vent Fluid Unfiltered Piston #9 J661-17 start
8/20/2012 23:49	45.92767	-129.98242	131	1518.7	TXT: Done with Piston #9
8/20/2012 23:50	45.92767	-129.98242	131	1518.7	TXT: volume = 501 Tmax 9.9 = deg average T =9.8 deg
8/20/2012 23:51	45.92766	-129.98242	131	1518.7	TXT: J661-18 start filtered bag #24
8/20/2012 23:53	45.92766	-129.98242	131	1518.7	Image_Recording: HD stop
8/20/2012 23:55	45.92766	-129.98241	131	1518.6	TXT: Done with Bag #24 volume = 502 Tmax = 10.1 deg Tavg = 9.8 deg
8/20/2012 23:56	45.92767	-129.98241	131	1518.6	Sample: Vent Fluid J661-19 start filter #13
8/21/2012 0:15	45.92767	-129.98240	131	1518.5	TXT: done with filter #13 volume = 3002 Tmax = 10.0 deg Tavg = 9.8 deg
8/21/2012 0:16	45.92767	-129.98240	131	1518.5	Sample: Vent Fluid J661-20 start filter #14
8/21/2012 0:36	45.92767	-129.98239	131	1518.3	TXT: done with filter #14 volume = 3002 Tmax = 10.1 deg Tavg = 9.8 deg
8/21/2012 0:39	45.92767	-129.98239	131	1518.3	Sample: Vent Fluid Take red gastight bottle from basket J661-21 and sample the 10 deg fluid.
8/21/2012 0:41	45.92767	-129.98239	131	1518.3	TXT: That was GT9 for those who like the numbe permanently stamped into the titanum barrel.

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/21/2012 0:42	45.92766	-129.98239	130	1518.3	GenInst: Instrument off seafloor MTR 3043 was recovered to front milk crate
8/21/2012 0:52	45.92767	-129.98240	131	1518.2	GenInst: Instrument Orientation A new MTR 4001 was deployed to the same approximate location which 3043 came from.
8/21/2012 0:59	45.92750	-129.98245	116	1517.9	TXT: A curious area of discoloration suggests that there is a lot of venting here.
8/21/2012 1:01	45.92749	-129.98242	115	1518.5	Image_Recording: HD start
8/21/2012 1:01	45.92749	-129.98243	116	1518.6	TXT: Temperature measurements will scope out the area.
8/21/2012 1:04	45.92750	-129.98243	116	1518.4	Geological_Observations: Diffuse Vent Temperatures up to 15.7 deg C were found.
8/21/2012 1:05	45.92750	-129.98244	116	1518.5	TXT: Suspected sediment was poked for a perspective syringe sample.
8/21/2012 1:09	45.92749	-129.98244	116	1518.6	Sample: BioSample J661-22 the small OSU white taped syringe was used to suck brown sediment was stored in the starboard bio box.
8/21/2012 1:12	45.92749	-129.98245	116	1518.5	Image_Recording: HD stop
8/21/2012 1:21	45.92748	-129.98247	115	1518.6	Sample: GeoSample A chunk of rock from the same spot as the OSU syring sample was too crumbly to collect without a butterfly net.
8/21/2012 1:27	45.92746	-129.98243	28	1518.8	Image_Recording: HD start
8/21/2012 1:29	45.92746	-129.98243	30	1518.8	TXT: As was loads of foul language.
8/21/2012 1:29	45.92746	-129.98243	30	1518.9	TXT: Avalanche sampling was started.
8/21/2012 1:30	45.92745	-129.98242	30	1518.8	TXT: No not that one.

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/21/2012 1:32	45.92745	-129.98242	30	1518.8	Sample: GeoSample J661-23 a chunk of rock from someplace nearby was sent to the same milk crate as the large syringe samplers.
8/21/2012 1:34	45.92746	-129.98243	31	1516.0	TXT: Transit to Skadi.
8/21/2012 1:36	45.92759	-129.98238	149	1518.0	Image_Recording: HD stop stopped at 1:32
8/21/2012 1:39	45.92757	-129.98243	186	1516.9	TXT: We circled the area before moving on.
8/21/2012 1:42	45.92731	-129.98236	186	1516.2	TXT: In transit.
8/21/2012 1:47	45.92689	-129.98236	186	1517.1	TXT: crab and cavern
8/21/2012 1:48	45.92684	-129.98237	186	1517.8	TXT: Dirt!!!
8/21/2012 1:49	45.92676	-129.98239	186	1517.0	Biological_Observations: eelpout freestanding pillars
8/21/2012 1:52	45.92654	-129.98239	185	1516.7	TXT: Holes without signs of venting.
8/21/2012 1:53	45.92649	-129.98233	130	1516.7	TXT: Increased smokiness
8/21/2012 2:00	45.92588	-129.98236	186	1516.6	TXT: smokier
8/21/2012 2:02	45.92570	-129.98237	186	1519.0	TXT: less smoke
8/21/2012 2:14	45.92459	-129.98247	186	1521.0	TXT: lava pillars
8/21/2012 2:19	45.92413	-129.98249	188	1522.9	TXT: An increase of white chunks in the water.
8/21/2012 2:19	45.92421	-129.98257	186	1518.5	TXT: This dump is really overflowing with nothing.
8/21/2012 2:27	45.92361	-129.98268	243	1523.4	TXT: Marker sighting
8/21/2012 2:28	45.92358	-129.98269	272	1523.5	TXT: Marker A?
8/21/2012 2:30	45.92360	-129.98270	218	1525.8	Image_Recording: HD start
8/21/2012 2:31	45.92360	-129.98271	221	1526.1	Image_Recording: HD stop
8/21/2012 2:33	45.92361	-129.98271	221	1526.2	TXT: We think this is Skadi vent.
8/21/2012 2:48	45.92361	-129.98271	234	1525.9	TXT: The sub was set down near the lower cave area for a temperature measurement.
8/21/2012 2:49	45.92360	-129.98271	234	1525.9	TXT: Jason probe reads at several palces in the rubble.
8/21/2012 2:50	45.92360	-129.98271	192	1525.9	TXT: The worms to the left are more promising.
8/21/2012 2:53	45.92360	-129.98272	192	1525.9	TXT: Worms are about 16 deg C without much observation of flow.

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/21/2012 2:54	45.92360	-129.98273	192	1525.9	TXT: Whip out the HFS probe.
8/21/2012 3:00	45.92363	-129.98271	192	1525.8	TXT: HFS reads ~5 deg C
8/21/2012 3:06	45.92362	-129.98271	191	1525.8	TXT: Stowing the BEAST probe couldn't find the hotspot in the worm farm. No samples.
8/21/2012 3:08	45.92362	-129.98269	195	1524.7	TXT: Moving JASON and the ship 430 m to marker 113
8/21/2012 3:11	45.92362	-129.98286	258	1522.8	TXT: Shiny black sheet flow. Little if any microbial growth.
8/21/2012 3:12	45.92360	-129.98292	285	1518.4	TXT: Diffuse venting with a lot of worms and white mat
8/21/2012 3:19	45.92344	-129.98312	312	1518.8	TXT: Active venting. Slight smokey.
8/21/2012 3:19	45.92346	-129.98312	312	1518.9	TXT: Appears to be an old worm field. Some of them are quite long.
8/21/2012 3:22	45.92363	-129.98344	314	1520.0	TXT: Repositioning the ship to get back at that rich worm field.
8/21/2012 3:28	45.92343	-129.98331	112	1520.1	Image_Recording: HD start
8/21/2012 3:30	45.92344	-129.98320	142	1519.4	Biological_Observations: dense tubeworms
8/21/2012 3:30	45.92344	-129.98319	159	1519.2	Biological_Observations: white filamentous bacteria
8/21/2012 3:30	45.92344	-129.98318	171	1519.3	Geological_Observations: Diffuse Vent
8/21/2012 3:33	45.92344	-129.98316	223	1519.6	TXT: Jason probe to be used to find the hottest spots
8/21/2012 3:38	45.92343	-129.98320	222	1519.7	TXT: 35 degrees C at the first probe spot.
8/21/2012 3:41	45.92343	-129.98321	222	1519.7	TXT: New probe spot is about 21 degrees
8/21/2012 3:44	45.92344	-129.98320	222	1519.6	TXT: Armpit of the worm mound is about 22 degrees C
8/21/2012 3:45	45.92344	-129.98319	222	1519.6	TXT: Stowing JASON temp probe switching to BEAST fluid sampler.
8/21/2012 3:52	45.92343	-129.98318	222	1519.6	TXT: BEAST fluid probe found a hotter spot than before.
8/21/2012 3:54	45.92342	-129.98318	222	1519.6	TXT: Topped out at 47 C
8/21/2012 3:56	45.92342	-129.98318	222	1519.6	Sample: Vent Fluid

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/21/2012 3:56	45.92342	-129.98318	222	1519.6	TXT: J 661-24
8/21/2012 3:56	45.92342	-129.98318	222	1519.6	TXT: Water sample filtered piston #6 at Skadi worm site
8/21/2012 4:01	45.92343	-129.98316	222	1519.6	TXT: 652 mL pumped
8/21/2012 4:01	45.92343	-129.98316	222	1519.6	TXT: Average 45.0
8/21/2012 4:01	45.92343	-129.98316	222	1519.6	TXT: Sample complete.
8/21/2012 4:01	45.92343	-129.98316	222	1519.6	TXT: Temp max 47.4
8/21/2012 4:02	45.92343	-129.98316	222	1519.6	TXT: Correction Skadi
8/21/2012 4:02	45.92343	-129.98316	222	1519.6	TXT: Stowing BEAST probe
8/21/2012 4:03	45.92344	-129.98317	222	1519.6	TXT: Next stop Marker 113
8/21/2012 4:05	45.92344	-129.98314	224	1518.7	Image_Recording: HD start
8/21/2012 4:09	45.92343	-129.98313	224	1518.7	Image_Recording: HD stop
8/21/2012 4:21	45.92323	-129.98490	265	1519.5	Geological_Observations: Pillow Basalts Appears to be contact between new flow and old
8/21/2012 4:30	45.92309	-129.98638	265	1518.8	Image_Recording: HD start
8/21/2012 4:31	45.92309	-129.98650	265	1519.0	Image_Recording: HD stop
8/21/2012 4:40	45.92280	-129.98777	252	1522.0	Biological_Observations: fish (other) Rat
8/21/2012 4:42	45.92275	-129.98791	249	1520.1	TXT: Clams
8/21/2012 4:43	45.92271	-129.98799	248	1522.0	TXT: More clams
8/21/2012 4:44	45.92272	-129.98813	249	1521.7	Image_Recording: HD start
8/21/2012 4:45	45.92273	-129.98815	258	1521.5	TXT: Looks pretty healthy
8/21/2012 4:45	45.92274	-129.98816	258	1521.5	TXT: Unaffected by last eruption
8/21/2012 4:45	45.92273	-129.98815	258	1521.5	TXT: We have arrived at marker 113
8/21/2012 4:46	45.92275	-129.98820	266	1519.5	Biological_Observations: dense tubeworms
8/21/2012 4:46	45.92275	-129.98820	266	1519.6	Biological_Observations: sparse clams
8/21/2012 4:47	45.92275	-129.98820	266	1519.3	Geological_Observations: Diffuse Vent
8/21/2012 4:52	45.92272	-129.98819	340	1520.7	TXT: MTR sighted
8/21/2012 4:53	45.92273	-129.98819	335	1520.9	Image_Recording: HD stop
8/21/2012 4:56	45.92274	-129.98818	335	1520.7	TXT: Positioning to grab MTR
8/21/2012 4:58	45.92275	-129.98819	335	1520.5	TXT: MTR freed. #4128
8/21/2012 4:59	45.92275	-129.98819	335	1520.6	TXT: MTR into basket
8/21/2012 5:00	45.92275	-129.98819	335	1520.5	TXT: JASON temp probe goes first.

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/21/2012 5:06	45.92275	-129.98820	335	1520.5	TXT: Temp holding steady at 19.4 C
8/21/2012 5:08	45.92271	-129.98820	341	1519.3	TXT: Most likely sampling location
8/21/2012 5:08	45.92271	-129.98820	337	1519.0	TXT: Repositioning to the southern point of marker 113
8/21/2012 5:12	45.92271	-129.98823	74	1520.6	TXT: Probing the point with JASON temp probe
8/21/2012 5:13	45.92271	-129.98823	74	1520.6	TXT: Nearing 28 degrees C
8/21/2012 5:13	45.92271	-129.98823	74	1520.6	TXT: Over 29 and climbing.
8/21/2012 5:13	45.92271	-129.98823	75	1520.6	TXT: Switching to fluid sampling probe
8/21/2012 5:22	45.92273	-129.98823	74	1520.6	TXT: Still looking for that sweet spot
8/21/2012 5:29	45.92272	-129.98824	74	1520.6	Sample: Vent Fluid Unfiltered bag 19 at mkr 113
8/21/2012 5:29	45.92272	-129.98824	74	1520.6	TXT: Sample starting now
8/21/2012 5:32	45.92272	-129.98822	74	1520.7	TXT: Sample ID J 661-25
8/21/2012 5:33	45.92273	-129.98822	74	1520.7	TXT: Max T 28.0 avg 27.9
8/21/2012 5:33	45.92273	-129.98822	74	1520.7	TXT: Next sample is filtered bag 20
8/21/2012 5:33	45.92273	-129.98822	74	1520.7	TXT: Sample complete
8/21/2012 5:33	45.92273	-129.98822	74	1520.6	TXT: Vol 551 mL
8/21/2012 5:34	45.92273	-129.98822	74	1520.6	Sample: Vent Fluid Sample ID J 661-26
8/21/2012 5:34	45.92273	-129.98822	74	1520.6	TXT: Sample started now
8/21/2012 5:37	45.92272	-129.98822	74	1520.7	TXT: Sample complete
8/21/2012 5:38	45.92272	-129.98822	74	1520.7	TXT: Didn't see any hot fluid exhaust coming out of sample pump. Bad sign
8/21/2012 5:38	45.92272	-129.98822	74	1520.7	TXT: Max 28.4 avg 28.3
8/21/2012 5:38	45.92272	-129.98822	74	1520.7	TXT: Vol 552
8/21/2012 5:39	45.92273	-129.98821	74	1520.7	Sample: Vent Fluid Sample ID J 661-27
8/21/2012 5:39	45.92273	-129.98821	74	1520.7	TXT: Next sample is unfiltered bag 21
8/21/2012 5:43	45.92272	-129.98821	74	1520.7	TXT: Max T 28.5 avg 28.2
8/21/2012 5:43	45.92272	-129.98821	74	1520.7	TXT: Sample complete
8/21/2012 5:43	45.92271	-129.98821	74	1520.7	TXT: Up next is the port side gas tight

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/21/2012 5:43	45.92271	-129.98821	74	1520.7	TXT: Volume 553 mL
8/21/2012 5:49	45.92273	-129.98821	74	1520.7	TXT: The ram that moved is the inboard blue taped gas tight
8/21/2012 5:49	45.92273	-129.98821	74	1520.7	TXT: We triggered the button labeled "White" to trigger the gas tight
8/21/2012 5:50	45.92273	-129.98821	74	1520.8	Sample: Vent Fluid Sample ID J 661-28
8/21/2012 5:52	45.92273	-129.98821	75	1520.8	TXT: Next sample
8/21/2012 5:53	45.92274	-129.98821	75	1520.8	TXT: Large volume bag #1
8/21/2012 5:54	45.92274	-129.98821	75	1520.8	Sample: Vent Fluid Sample ID J661-29
8/21/2012 5:54	45.92274	-129.98821	75	1520.7	TXT: Still at marker 113
8/21/2012 6:11	45.92272	-129.98822	75	1520.9	TXT: Large fluid sample stopped
8/21/2012 6:11	45.92272	-129.98822	75	1520.9	TXT: T max 28.4 avg 28.1
8/21/2012 6:11	45.92272	-129.98822	75	1520.9	TXT: Vol 3872 mL
8/21/2012 6:13	45.92271	-129.98820	75	1520.9	TXT: Next sample
8/21/2012 6:13	45.92271	-129.98820	75	1520.8	TXT: RNA filter 10
8/21/2012 6:13	45.92271	-129.98820	75	1520.9	TXT: Started
8/21/2012 6:14	45.92271	-129.98820	75	1520.9	Sample: Vent Fluid Sample ID J 661-30
8/21/2012 6:32	45.92272	-129.98823	75	1521.0	TXT: Max T 28.5 avg 28.2
8/21/2012 6:32	45.92272	-129.98823	75	1521.0	TXT: Sample complete
8/21/2012 6:32	45.92272	-129.98823	75	1521.0	TXT: Volume 3000 mL
8/21/2012 6:33	45.92272	-129.98822	75	1521.0	TXT: Next sample
8/21/2012 6:33	45.92272	-129.98822	75	1521.0	TXT: RNA filter 11
8/21/2012 6:33	45.92272	-129.98822	75	1521.0	TXT: Started
8/21/2012 6:34	45.92273	-129.98822	75	1521.0	Sample: Vent Fluid Sample ID J 661-31
8/21/2012 6:53	45.92272	-129.98818	75	1521.2	TXT: Max T 28.3 avg 28.0
8/21/2012 6:53	45.92271	-129.98816	75	1521.2	TXT: Sample complete
8/21/2012 6:53	45.92271	-129.98818	75	1521.2	TXT: Volume 3002 mL
8/21/2012 6:58	45.92272	-129.98824	74	1521.2	TXT: Moving JASON into position to collect blue mat
8/21/2012 6:58	45.92272	-129.98824	74	1521.2	TXT: Slurp gun
8/21/2012 7:03	45.92273	-129.98817	4	1522.4	TXT: Sample J2-661-32 - white syringe
8/21/2012 7:12	45.92272	-129.98821	23	1520.3	TXT: Trying to persuade mat sample to go down tube

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/21/2012 7:14	45.92270	-129.98821	23	1520.3	Image_Recording: DSC capture
8/21/2012 7:15	45.92270	-129.98821	24	1520.3	TXT: Deploying MTR 4127
8/21/2012 7:15	45.92270	-129.98819	16	1520.5	TXT: Still at Marker 113
8/21/2012 7:19	45.92270	-129.98819	18	1521.8	TXT: MTR deployed successfully at edge of tubeworms
8/21/2012 7:21	45.92268	-129.98820	18	1520.7	TXT: Heading to Vixen high-temp vent now - bearing 211 range 723m
8/21/2012 7:27	45.92263	-129.98841	222	1521.4	TXT: Crab
8/21/2012 7:27	45.92262	-129.98843	221	1520.9	TXT: Moving over pillow lava - in old collapsed zone
8/21/2012 7:28	45.92260	-129.98850	221	1521.6	TXT: Orange hydrothermal staining
8/21/2012 7:29	45.92260	-129.98853	221	1521.4	TXT: Into jumbly area w pillars
8/21/2012 7:29	45.92259	-129.98856	221	1521.1	TXT: Tubeworm cluster on pillar
8/21/2012 7:30	45.92255	-129.98868	221	1521.2	TXT: Holothurian
8/21/2012 7:30	45.92258	-129.98862	221	1521.4	TXT: Hydrothermal staining
8/21/2012 7:30	45.92256	-129.98866	221	1521.1	TXT: Light sediment
8/21/2012 7:30	45.92256	-129.98865	221	1521.0	TXT: Ropy lava surface
8/21/2012 7:32	45.92248	-129.98873	220	1520.3	TXT: Pillow lava
8/21/2012 7:34	45.92232	-129.98885	221	1520.3	TXT: More pillowsw
8/21/2012 7:34	45.92235	-129.98883	221	1521.4	TXT: Pillars +jumbly collapsed lava
8/21/2012 7:37	45.92206	-129.98893	212	1521.8	TXT: 631m to Vixen
8/21/2012 7:42	45.92170	-129.98915	211	1524.6	TXT: 584m to Vixen
8/21/2012 7:42	45.92172	-129.98913	211	1524.5	TXT: Still pillow lava
8/21/2012 7:43	45.92163	-129.98920	213	1523.8	TXT: Hackly lava
8/21/2012 7:43	45.92159	-129.98924	211	1524.5	TXT: Pillows again
8/21/2012 7:45	45.92152	-129.98930	211	1525.2	TXT: Jumbly broken-up lava
8/21/2012 7:46	45.92146	-129.98934	212	1524.8	TXT: 543m to Vixen
8/21/2012 7:46	45.92146	-129.98934	212	1524.8	TXT: Pillow lava
8/21/2012 7:49	45.92120	-129.98960	212	1524.8	TXT: Holothurians
8/21/2012 7:50	45.92119	-129.98965	211	1525.1	TXT: Broken-up hackly lava
8/21/2012 7:50	45.92118	-129.98969	212	1525.1	TXT: Pillow lava
8/21/2012 7:50	45.92119	-129.98966	212	1525.2	TXT: Some collapsing
8/21/2012 7:51	45.92111	-129.98975	211	1524.9	TXT: Holothurian
8/21/2012 7:51	45.92112	-129.98976	212	1524.4	TXT: Octopus
8/21/2012 7:52	45.92109	-129.98976	212	1525.7	TXT: Asterids
8/21/2012 7:55	45.92081	-129.98995	211	1524.9	TXT: Still pillow lava

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/21/2012 7:56	45.92060	-129.99015	211	1524.7	TXT: Holothurians
8/21/2012 7:58	45.92051	-129.99025	212	1525.1	TXT: 441m to Vixen
8/21/2012 8:01	45.92034	-129.99040	314	1528.3	TXT: Pillars collapsed broken lava
8/21/2012 8:01	45.92034	-129.99040	334	1528.4	TXT: starfish and holothurians
8/21/2012 8:03	45.92024	-129.99050	233	1528.7	TXT: Fish
8/21/2012 8:04	45.92011	-129.99060	235	1529.4	TXT: Fish
8/21/2012 8:04	45.92012	-129.99059	236	1529.0	TXT: Hackly lava
8/21/2012 8:05	45.92007	-129.99067	235	1526.1	TXT: Pillow lava and holothurians
8/21/2012 8:10	45.91980	-129.99110	234	1527.6	TXT: 338m to Vixen
8/21/2012 8:10	45.91977	-129.99115	234	1528.0	TXT: Starfish
8/21/2012 8:12	45.91967	-129.99113	224	1528.6	TXT: Asterid
8/21/2012 8:15	45.91939	-129.99137	223	1529.6	TXT: Starfish and holothurians
8/21/2012 8:15	45.91938	-129.99138	224	1528.9	TXT: Still pillow lava
8/21/2012 8:18	45.91915	-129.99157	224	1532.1	TXT: 257m to Vixen
8/21/2012 8:19	45.91904	-129.99164	223	1531.8	TXT: Fish
8/21/2012 8:20	45.91899	-129.99168	224	1532.2	TXT: Still pillow lava
8/21/2012 8:25	45.91865	-129.99203	222	1533.2	TXT: Fish
8/21/2012 8:28	45.91844	-129.99220	222	1534.7	TXT: Fish
8/21/2012 8:30	45.91838	-129.99227	223	1533.7	TXT: 146m to Vixen
8/21/2012 8:33	45.91829	-129.99240	223	1534.0	TXT: Fish
8/21/2012 8:34	45.91825	-129.99244	223	1533.7	TXT: Holothurian
8/21/2012 8:34	45.91825	-129.99243	224	1533.8	TXT: Tubeworms
8/21/2012 8:34	45.91824	-129.99246	223	1533.6	TXT: White bacterial mats in cracks
8/21/2012 8:35	45.91815	-129.99256	223	1532.9	TXT: Some diffuse flow
8/21/2012 8:36	45.91815	-129.99255	223	1533.0	TXT: 97m to Vixen
8/21/2012 8:38	45.91808	-129.99267	225	1534.0	TXT: More tubeworms and mats
8/21/2012 8:38	45.91805	-129.99266	226	1533.6	TXT: Pillow lava still
8/21/2012 8:39	45.91782	-129.99252	192	1534.3	TXT: Some collapsed areas
8/21/2012 8:40	45.91768	-129.99248	194	1533.8	TXT: Hydrothermal staining
8/21/2012 8:40	45.91780	-129.99251	195	1533.5	TXT: Scattered diffuse venting
8/21/2012 8:41	45.91755	-129.99263	216	1533.5	TXT: Holothurians
8/21/2012 8:42	45.91745	-129.99280	223	1533.1	TXT: Tubeworms mats fish
8/21/2012 8:43	45.91743	-129.99283	223	1532.4	TXT: 15m to Vixen
8/21/2012 8:43	45.91741	-129.99288	222	1533.8	TXT: Diffuse venting
8/21/2012 8:43	45.91744	-129.99282	222	1532.5	TXT: Not venting
8/21/2012 8:43	45.91744	-129.99280	224	1532.5	TXT: Sulfide structure?

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/21/2012 8:44	45.91742	-129.99295	139	1533.5	TXT: At Casper/Vixen - Casper foreground Vixen background
8/21/2012 8:45	45.91741	-129.99296	141	1534.5	TXT: Looking for hobo
8/21/2012 8:46	45.91733	-129.99287	236	1533.3	TXT: Shimmering water at Vixen
8/21/2012 8:46	45.91736	-129.99286	193	1533.0	TXT: Tubeworms and mats around
8/21/2012 8:48	45.91733	-129.99292	76	1534.4	Image_Recording: HD start
8/21/2012 8:51	45.91732	-129.99289	302	1534.9	TXT: Can't find hobo. It must be buried by new material deposited here. Significant growth since last year.
8/21/2012 8:51	45.91732	-129.99289	302	1534.9	TXT: Lots of anhydrite
8/21/2012 9:01	45.91732	-129.99297	334	1534.4	TXT: Deploying Jason temp probe at Vixen
8/21/2012 9:02	45.91734	-129.99296	334	1534.4	TXT: 293.7C
8/21/2012 9:02	45.91734	-129.99296	334	1534.4	TXT: Max temp 293.andC
8/21/2012 9:03	45.91734	-129.99296	334	1534.4	TXT: Broke anhydrite piece off top of mound - flow rate increased
8/21/2012 9:06	45.91733	-129.99296	333	1534.4	TXT: Max temp 352.1C
8/21/2012 9:07	45.91733	-129.99296	333	1534.3	TXT: Getting ready for fluid sampling
8/21/2012 9:10	45.91732	-129.99298	334	1534.3	Sample: Vent Fluid Starting sample J2-661-33 HFS-7 unfiltered piston @ Vixen
8/21/2012 9:12	45.91732	-129.99297	334	1534.3	TXT: Sample end - max temp 345.3C ave temp 345.2C volume collected 251ml
8/21/2012 9:13	45.91733	-129.99296	334	1534.3	Sample: Vent Fluid
8/21/2012 9:13	45.91734	-129.99296	334	1534.3	TXT: Sample J2-661-34 HFS-8 filtered piston
8/21/2012 9:14	45.91734	-129.99296	334	1534.3	TXT: Sample end - max temp 345.3C ave temp 345.2C volume collected 251ml
8/21/2012 9:18	45.91733	-129.99295	334	1534.3	TXT: Sample J2-661-35 gastight orange loose
8/21/2012 9:26	45.91731	-129.99298	357	1534.6	TXT: Deploying hobo 101 at Vixen
8/21/2012 9:27	45.91731	-129.99297	9	1534.6	Image_Recording: HD stop
8/21/2012 9:28	45.91731	-129.99297	9	1534.5	TXT: Water appears to be boiling

Dive 661 Date/Time UTC	Latitude	Longitude	Hdg °	ROV Depth	Log Entry
8/21/2012 9:29	45.91731	-129.99297	9	1534.5	Image_Recording: HD start
8/21/2012 9:31	45.91732	-129.99299	12	1534.2	Image_Recording: HD stop
8/21/2012 9:36	45.91735	-129.99299	4	1533.4	TXT: Finished deploying hobo at Vixen
8/21/2012 9:38	45.91737	-129.99301	39	1534.6	TXT: now moving over to Casper
8/21/2012 9:39	45.91738	-129.99302	46	1534.3	TXT: hobo at Casper well buried
8/21/2012 9:40	45.91739	-129.99302	103	1534.8	TXT: Unburying Casper hobo. Stop. We have no replacement so will leave in place.
8/21/2012 9:41	45.91739	-129.99302	103	1534.9	TXT: Palm worms
8/21/2012 9:43	45.91737	-129.99305	103	1532.5	JASON: Jason off bottom Finished with dive work
8/21/2012 9:44	45.91734	-129.99298	85	1531.0	JASON: Jason off bottom
8/21/2012 9:44	45.91733	-129.99294	85	1529.6	TXT: Ascending
8/21/2012 11:40	45.91728	-129.99276	328	0.8	JASON: Jason out of water
8/21/2012 11:40	45.91728	-129.99276	328	0.8	JASON: Medea out of water

Appendix 3: Pre-Cruise Jason dive plans for NeMO-Axial Seamount

This section is included to compare what we planned to do with what we were able to accomplish with a shortened cruise.

Axial Dive 1: N to S sampling/observation transect on SE caldera. Trevi (AX202/mkr63) north end of 98 flow, working south past Marker 33. Objective: survey older vents and snowblowers, sample fluids/microbes/mats, recover RAS; scout new RAS deployment site.

Equipment: Sasagawa acoustic modem; HFS (100 lbs); 5 gas-tights (55 lbs); 2 majors (22 lbs); plastic syringe samplers (5 lbs); 2 HOBO temperature recorders (5 lbs); 5 MTRs (10 lbs)

Estimated dive time 20 hours

Start at Spanish Steps (45.9461, 129.98368, 1518/1520m, heading 48) 20 meters south of Trevi, take HFS sample set for low-T chemistry/microbiology, possible microbial mat sample. Short transit 20m to Trevi (45.9463,129.98374,1519/1521m, hdg 96), take gas-tight and HFS sample set for high-T chemistry; recover Trevi HOBO T probe (MISO 135), replace with new Hobo. Transit east on bottom to North snowblower site (Snow Globe 45.9458/129.98487, 1524m, hdg 282) if active, take HFS sample suite; or 45.9459/129.9851/1525m). Make transit along line of snowblower locations from 2011 running approximately N-S (see Table). Marker N3 area (45.943698, 129.98512, 1524/1528, hdg 100) is very close to this snowblower line. At N3, video survey, recover MTR3312. HFS sample set. Possible mat sample. Continue snowblower transit to end of this first line (45.94,129.9844)

Transit to marker 33 (45.9332, 129.98227,1518). Tasks at marker 33: wide view video/frame grabs looking east and west; close-up photo documentation of vent site, including estimates of faunal growth on new lava since 2011; take water samples at the point of the intake of the RAS using the HFS; take in-situ filter and other HFS samples; consider taking microbial mat sample in syringe; secure the temperature recorders and intake line and release the RAS mooring for recovery at the surface (requires aligning mooring-Jason-ship and waiting while RAS comes to surface, <30 minutes); when RAS is on deck, move Jason/ship south to Boca snowblower site (45.92769,129.98247,1519). Investigate/sample line of snowblowers trending roughly SSW (Boca/Skadi). Transit WSW to Marker 113 location to see if it is still active.

If we still have sampling capacity (due to lack of venting earlier) and/or time, proceed toward Bag City snowblower line.

Priority of large volume bag (LVB) and microbiology filters:

Background CTD 1520m

Dive 1

Snowblower LVB, 2 filters

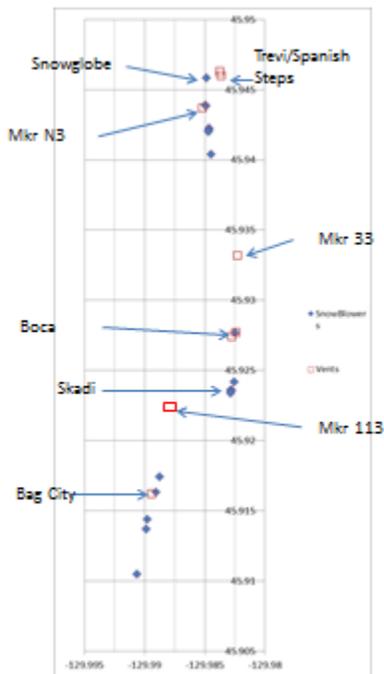
Marker 33 2 filters

Bag City 2 filters
 **if no snowblowers are found, we will do LVB at Marker 33

Dive 2
 Anemone LVB, 2 filters
 Fuzzy Tubeworm 2 filters
 Gollum 2 filters

Dive 3
 Marker 113 LVB, 2 filters
 9 m 2 filters
 Hermosa 2 filters
 **Bag City instead of 9m if we missed it on Dive 1

End of dive 1



Axial Dive 1: Trevi, N3, Mkr 33 and Snowblowers

- Sampling Targets:
1. Spanish Steps
 2. Trevi
 3. Snowglobe
 4. Mkr N3
 5. Snowblowers
 6. Mkr 33
 7. Boca
 8. Skadi
 9. Mkr 113

Figure 93 Axial dive 1 targets, SE caldera

Deck operations:

CTD cast over Castle vent (International District); CTD cast over marker 33.

Just prior to dive 2, lower Sasagawa/Zumberge instrument on CTD wire and drop at AX106 site (45.93448N,130.011599W, 1542m depth) or (45deg56.0669'N, 130deg00.6960'W).

Axial Dive 2: Pressure sensor and ASHES sampling

Estimated dive time 12 hours

Equipment: Sasagawa acoustic modem; HFS (100 lbs); 5 gas-tights (55 lbs); 2 majors (22 lbs); plastic syringe samplers; 2 HOBO temperature recorders (5 lbs); 3 MTRs (6 lbs)

Note: need to move pressure sensor mooring (approx. 45-50 lbs heavy) into position.

Begin dive at AX106 for pressure sensor installation/leveling and acoustic comms data collection (2-4 hours); transit 200 meters to ASHES field. Sample diffuse vents (Anemone, Fuzzy tubeworm, Golem, Marshmallow). Sample high-T vents (Inferno, Hell, Mushroom, Virgin). Collect HOBO T recorder from V.M. and replace with new HOBO. Return to pressure sensor and collect additional data before coming to the surface.

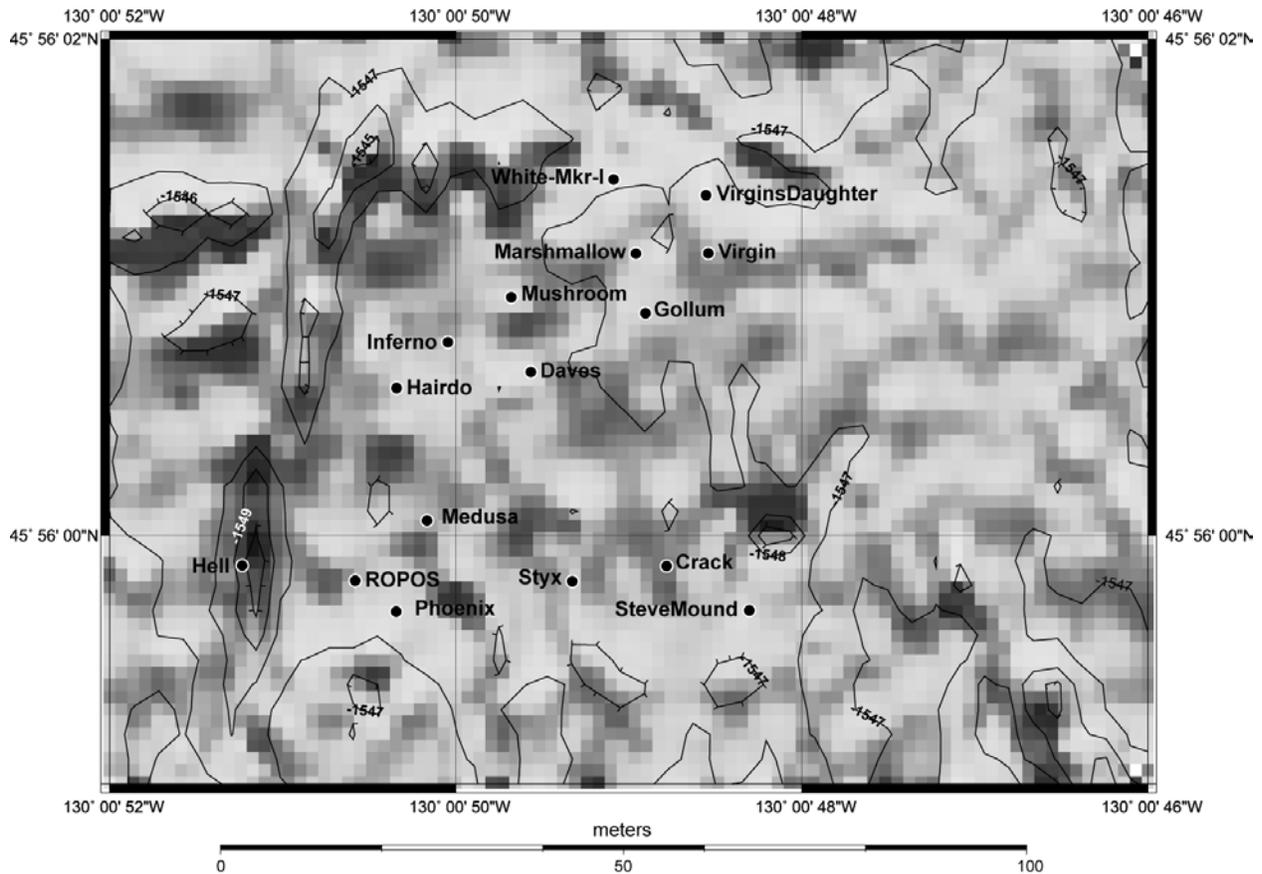


Figure 94 Imagenex sonar map of ASHES vent field (Chadwick, PMEL) with vent sites from previous NeMO cruises.

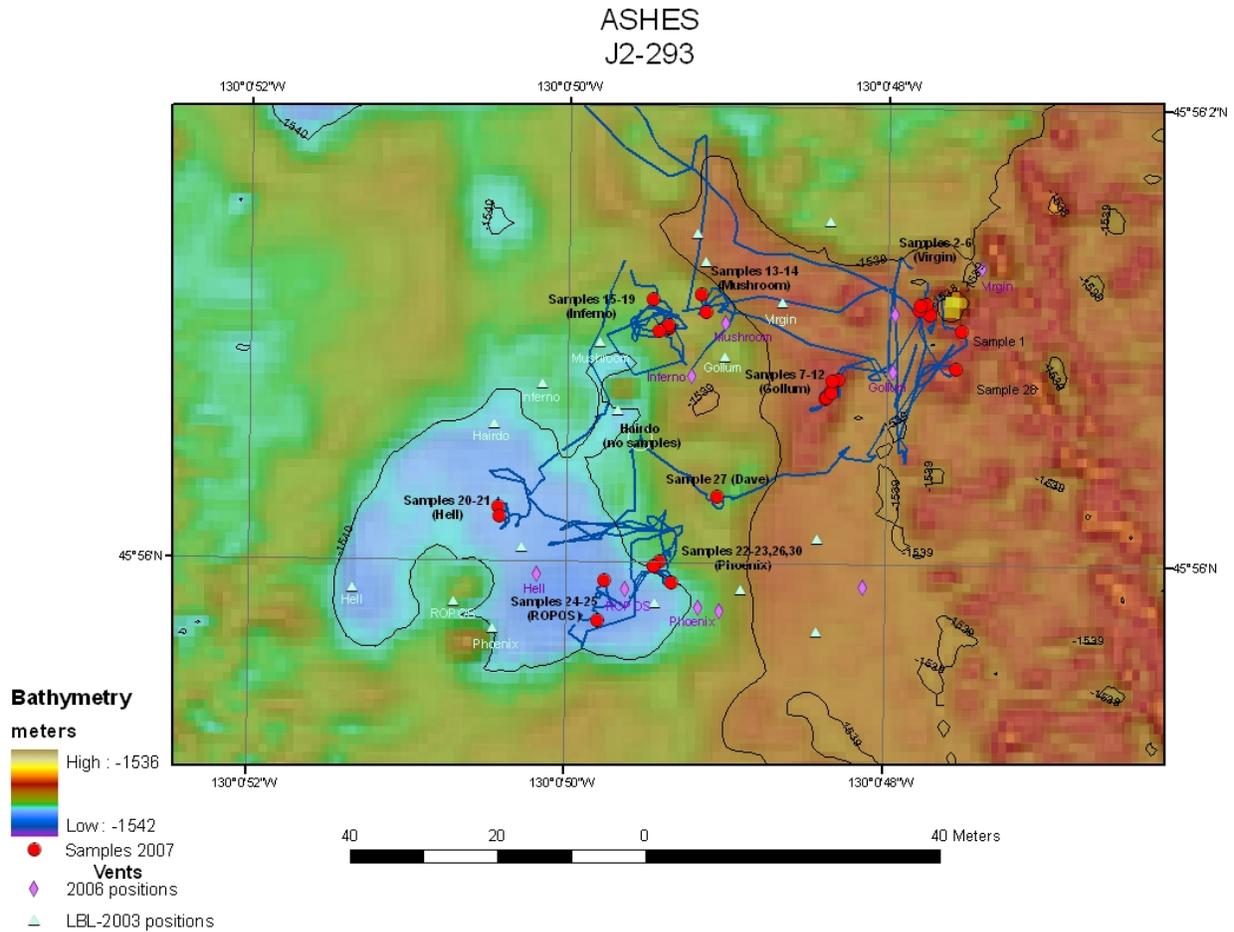


Figure 95 ASHES bathymetry map from 2006/7. MBARI AUV basemap? From the NeMO 2007 cruise report.

Diffuse vents to sample: Fuzzy, Anemone, Gollum, Marshmallow (see photo-mosaic map below).

High-T vents to sample: V.M., Mushroom, Inferno, Hell, Hilloid/Phoenix

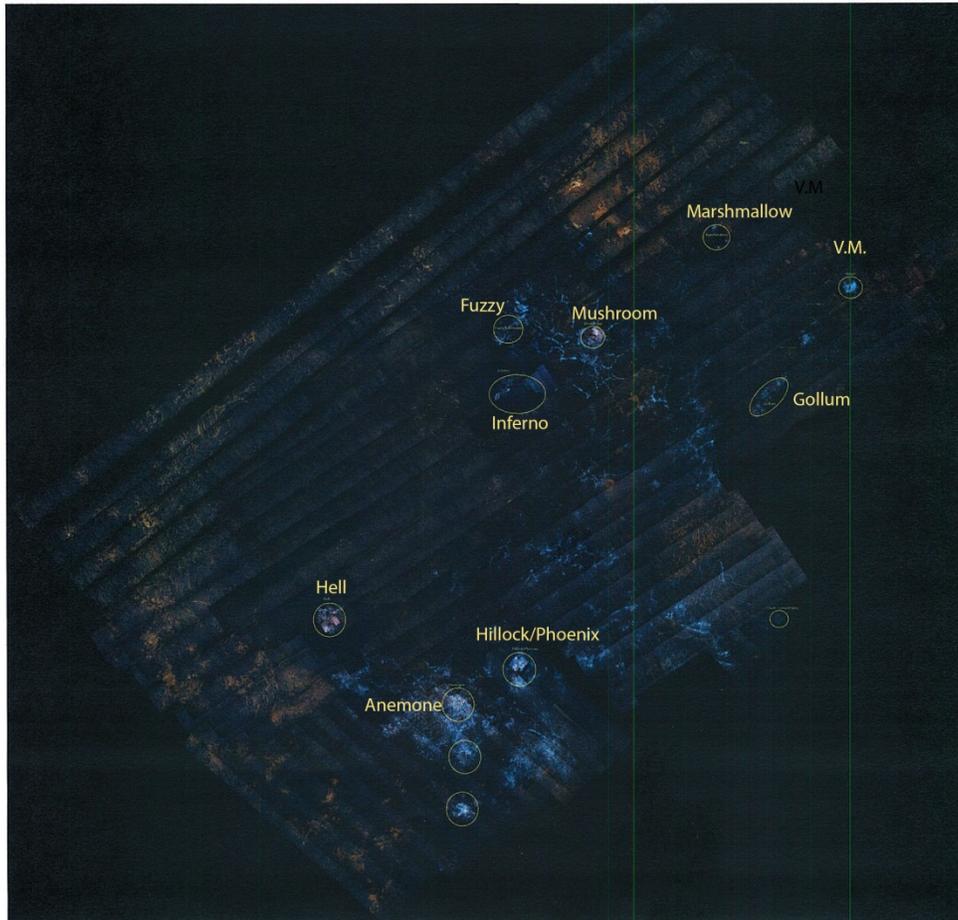


Figure 96 ASHES photo-mosaic base map by Mitch Elend (low-res version), courtesy of OOI/RSN. Vent target labels added by D.B.

End of plan for dive 2.

On deck operations: CTD casts (2) at ASHES and Vixen.

Drop RAS mooring at site to be determined following dive 1 review.

Axial Dive 3 plan

Approximate launch position: 45° 55.0448'N, 129° 59.579'W, 1538 m depth. Vixen-Bag City-Marker 113- International District. Deploy RAS. The order of dive targets depends on the site selected for the RAS deployment, to be determined following the first dive. The southern end of dive 1 will overlap with the northern end of dive 3.

Equipment: Sasagawa acoustic modem; HFS (100 lbs); 5 gas-tights (55 lbs); 2 majors (22 lbs); plastic syringe samplers; 2 HOBO temperature recorders (5 lbs); 5 MTRs (10 lbs)

Note: Need to move RAS mooring (~45 lbs heavy) into position.

Estimated dive time 24 hours.

End of sketch plan for dive 3.

On deck operations: CTD casts at CASM and background site outside caldera.

Axial Dive 4

Optical comms dive organized by Tivey/Farr

End of dive 4

Transit to Middle Valley

Appendix 4: CORK Operations Photos



Figure 96 8/24/2012 (RGB.20120824_083255_505) CORK 857D showing the optical modem (left) and the 'new' CORK logger to the right of the optical modem. An ODI UWMC connects the new logger with the optical modem. The 'old' CORK logger is seen to the rear of the CORK platform.



Figure 97 8/24/2012 (RGB.20120824_091245_445) connecting to the old logger using the SeaCon UWMC, CORK 857D.

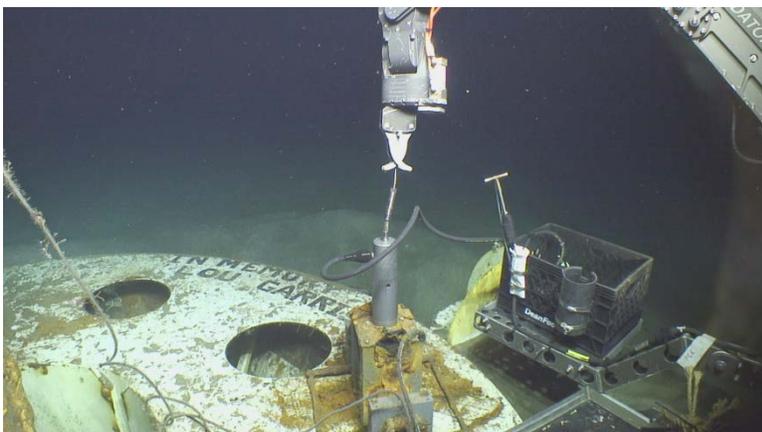


Figure 98 8/24/2012 (RGB.20120824_092305_428) connecting to the old logger using the SeaCon UWMC, CORK 857D.



Figure 99 8/24/2012 (RGB.20120824_111105_161) view of the CORK 857D from a distance with optical lander and new cork logger (left) in the foreground.



Figure 100 8/24/2012 (RGB.20120824_123934_904) CORK 857D with optical lander and new cork logger (left) and old cork logger (right).



Figure 101 8/25/2012 (RGB.20120825_042919_172) CORK 1025 with optical lander (left) and cork logger (right).



Figure 102 8/25/2012 (RGB.20120825_043159_864) CORK 1025 showing pressure connection prior to attempting to hook up.

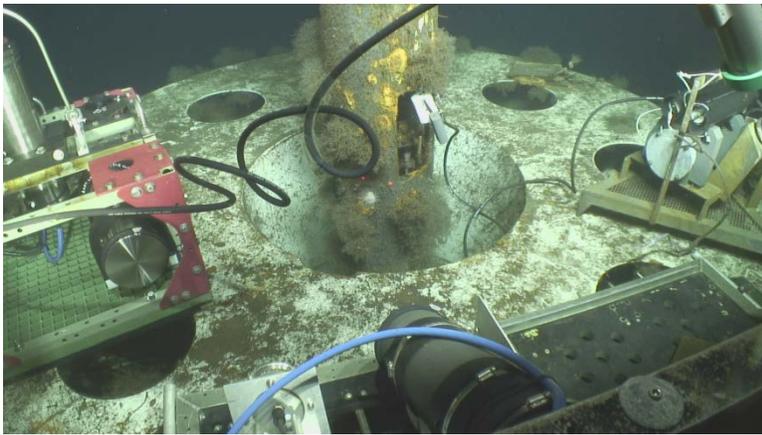


Figure 103 8/25/2012 (RGB.20120825_052942_810) CORK 1025 showing pressure connection hooked up to CORK logger and logger connected to the optical modem.

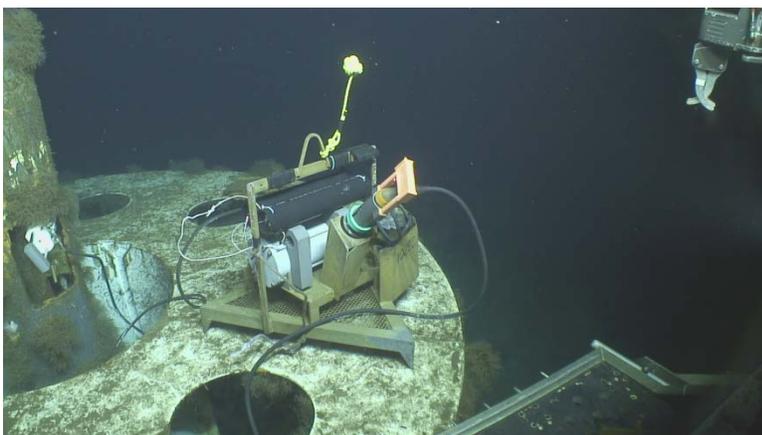


Figure 104 8/25/2012 (RGB.20120825_055712_733) CORK 1025 showing CORK logger being interrogated using an ODI connection to the ROV.



Figure 105 8/25/2012 (RGB.20120825_055842_722) CORK 1025 showing final configuration of CORK logger (right) and optical modem (left).