

# NeMO 2002 and 2003 Cruise Report

## *R/V Thomas G. Thompson*

NeMO 2002: TN149 Leg 2a 14 – 23 July, Leg 2b supplement 2 – 5 August  
Chief Scientist Robert W. Embley

NeMO 2003: TN160 27 August – 8 September  
Chief Scientist William W. Chadwick

NeMO Net 2003  
RAS at Virgin Vent



Report compiled by Susan Merle, Bob Embley, Bill Chadwick, and Shannon Ristau

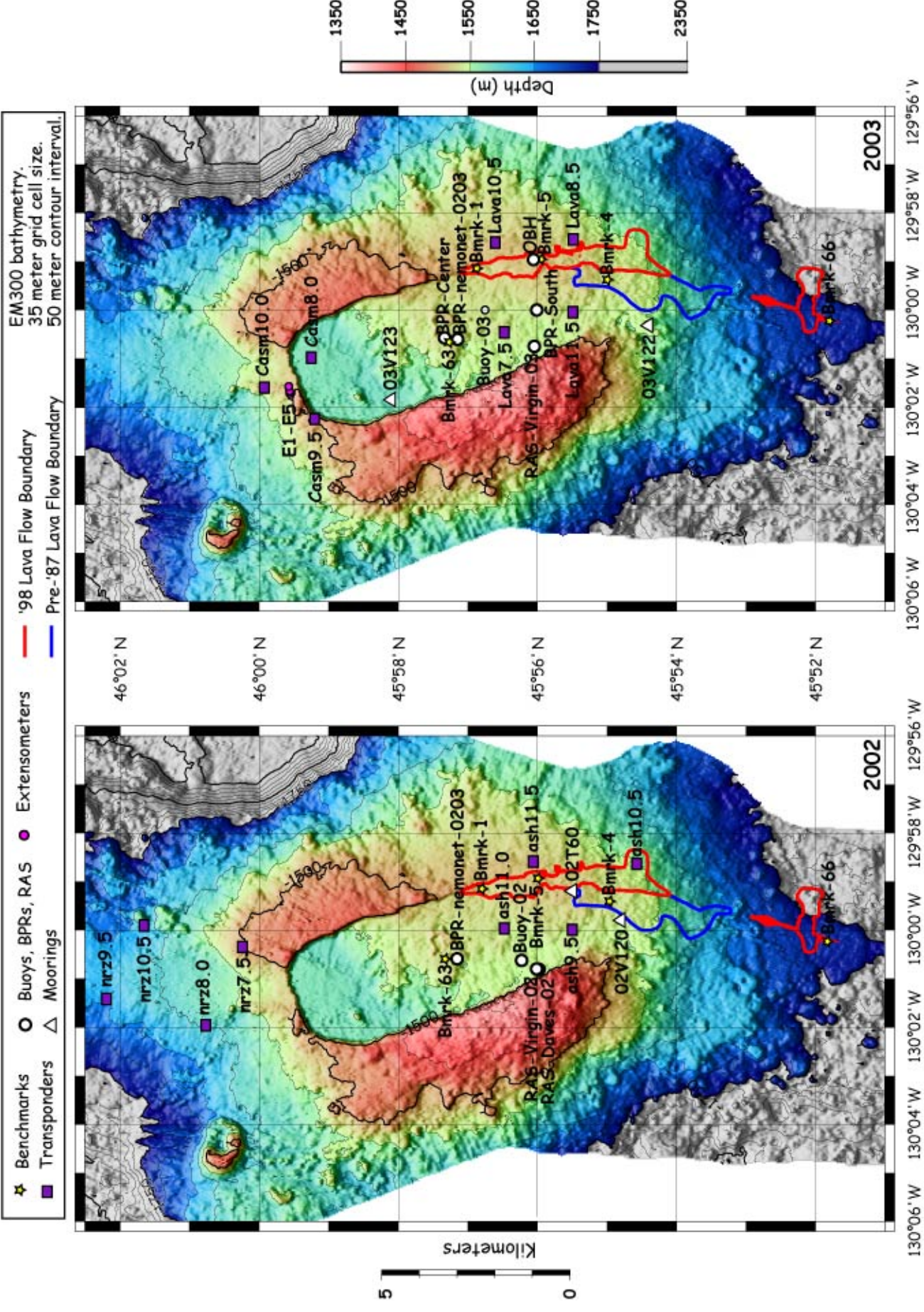
# NeMO 2002 and 2003 Cruise Report

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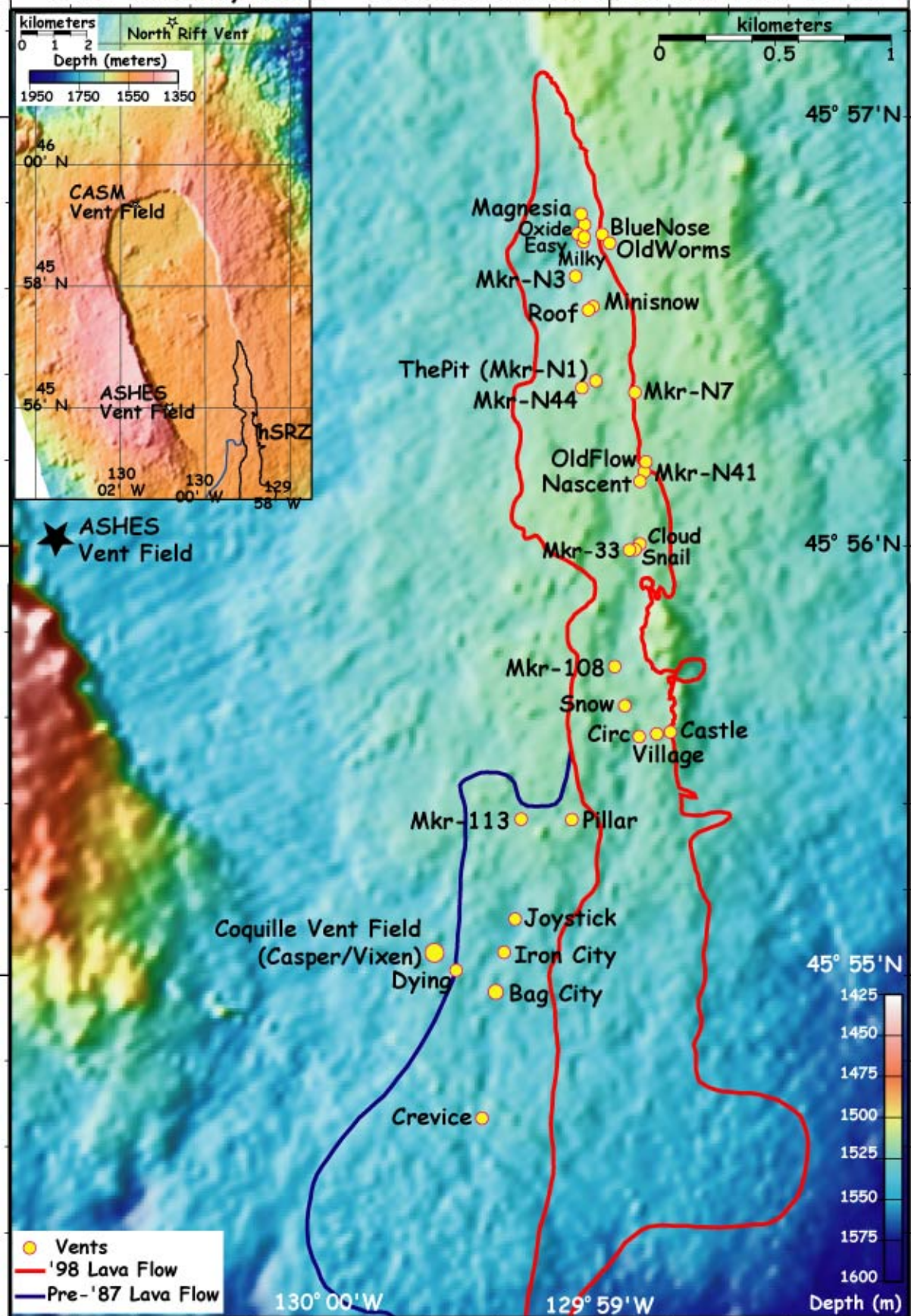
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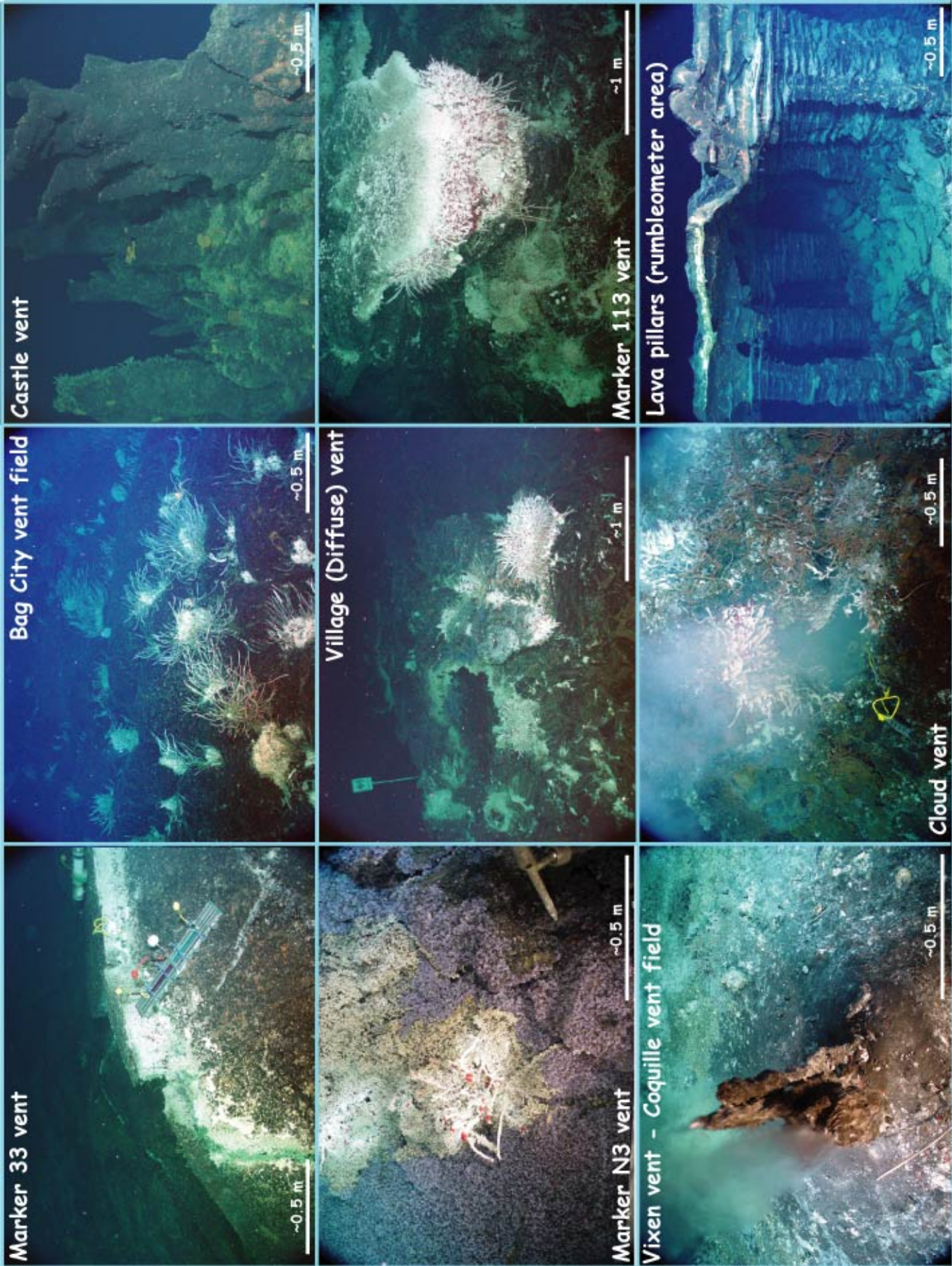
**NeMO 2002 and 2003 Instruments at Axial Volcano**

# Axial Volcano, nSRZ - 1998 Lava Flow Area and Vent Sites

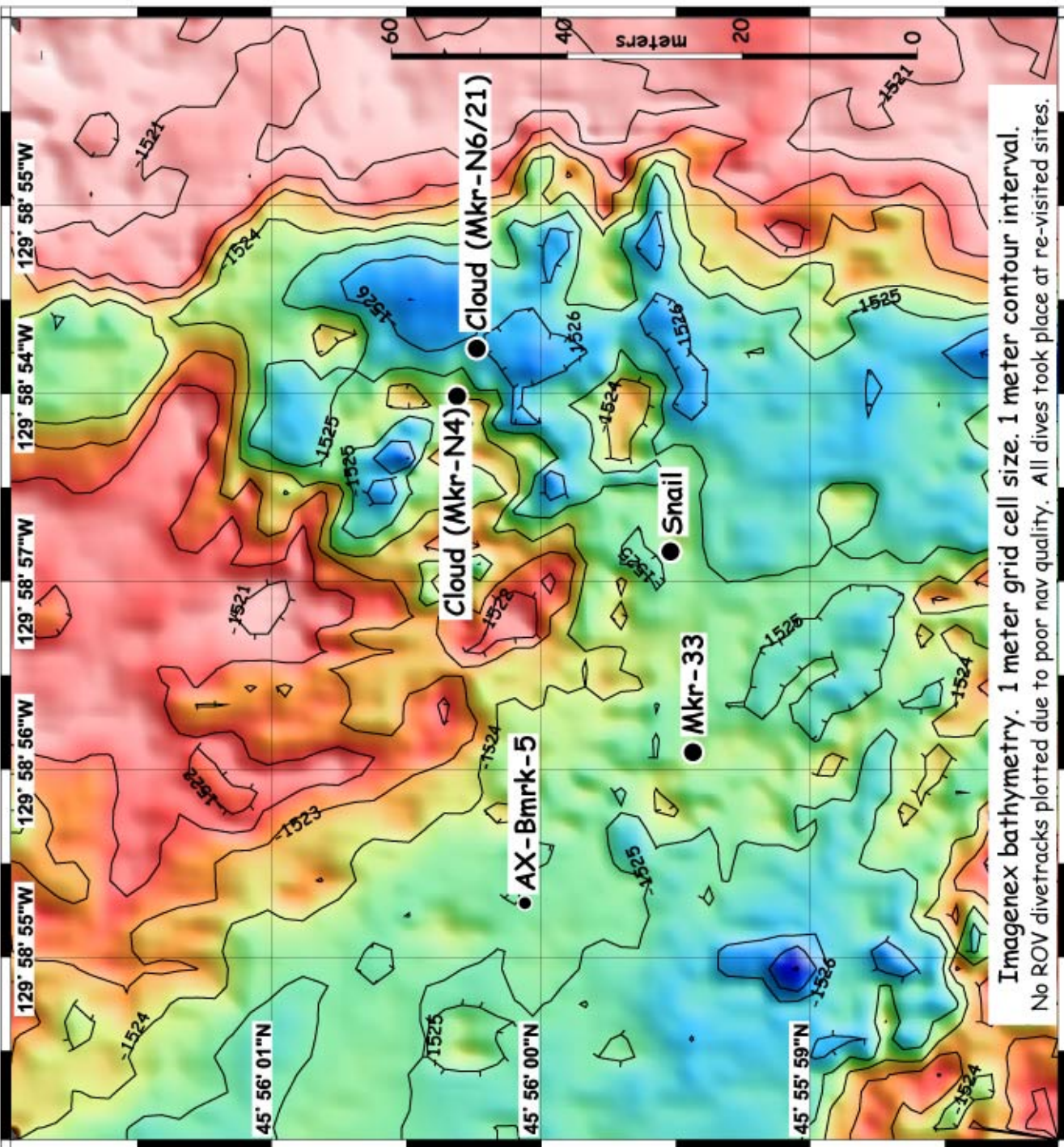


EM300 bathymetry. 35 meter grid cell size.

No ROV divetracks plotted due to poor nav quality. All dives took place at re-visited sites.



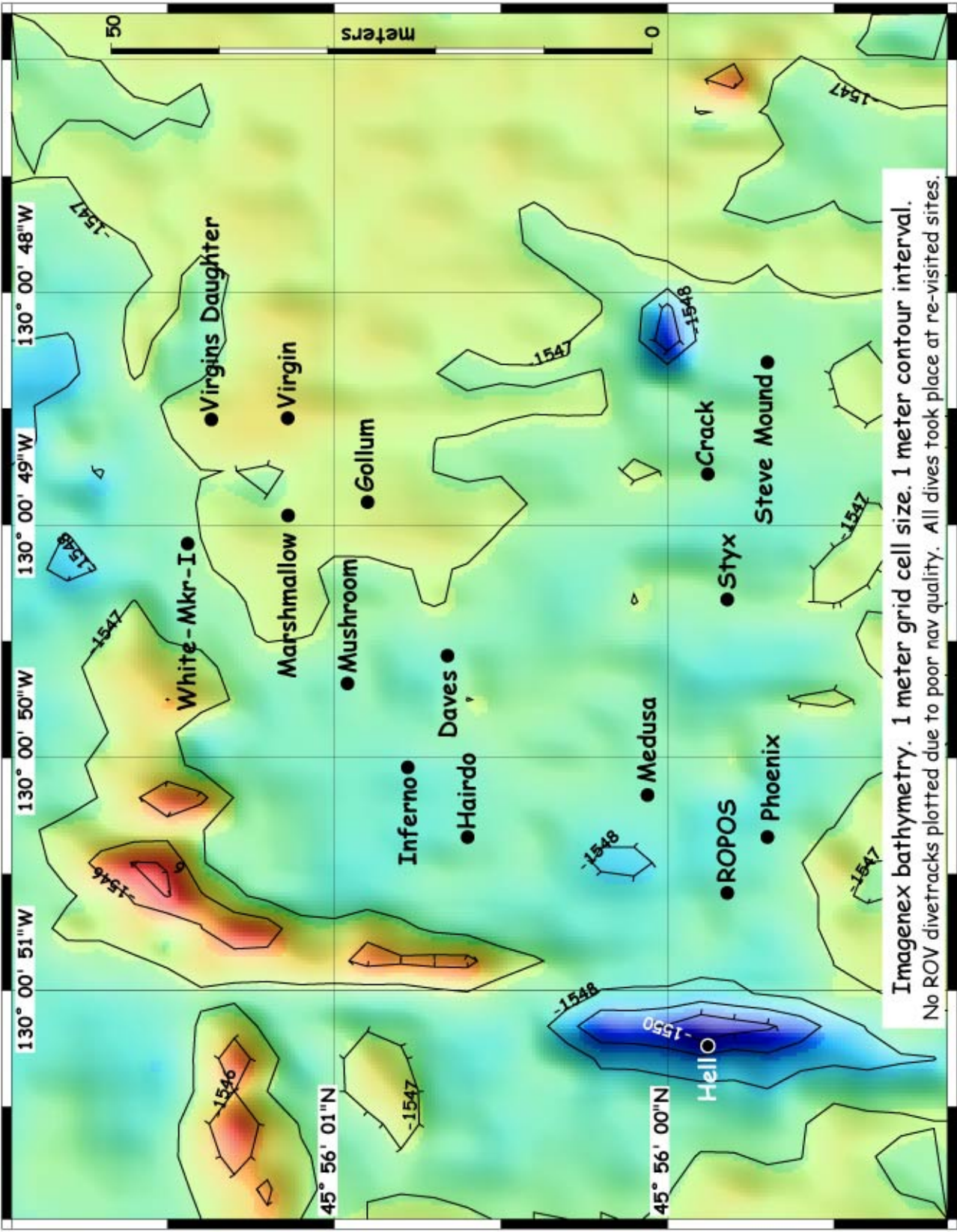
Northern South Rift Zone ('98 Lava Flow Area) Digital Still Camera Images



Imagenex bathymetry. 1 meter grid cell size. 1 meter contour interval.  
 No ROV divetracks plotted due to poor nav quality. All dives took place at re-visited sites.

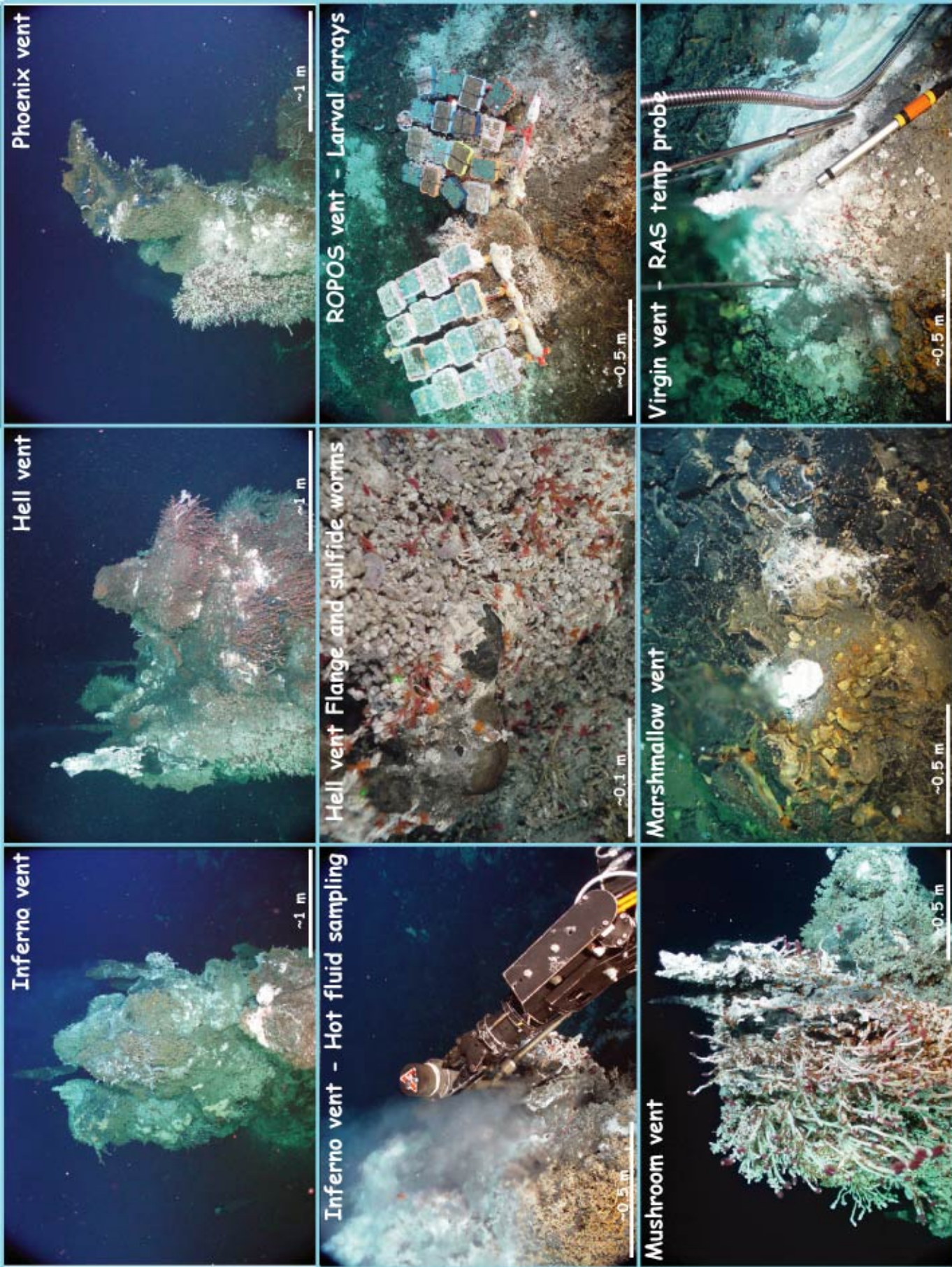
**Axial Volcano, nSRZ - Marker 33 and Cloud Vents**





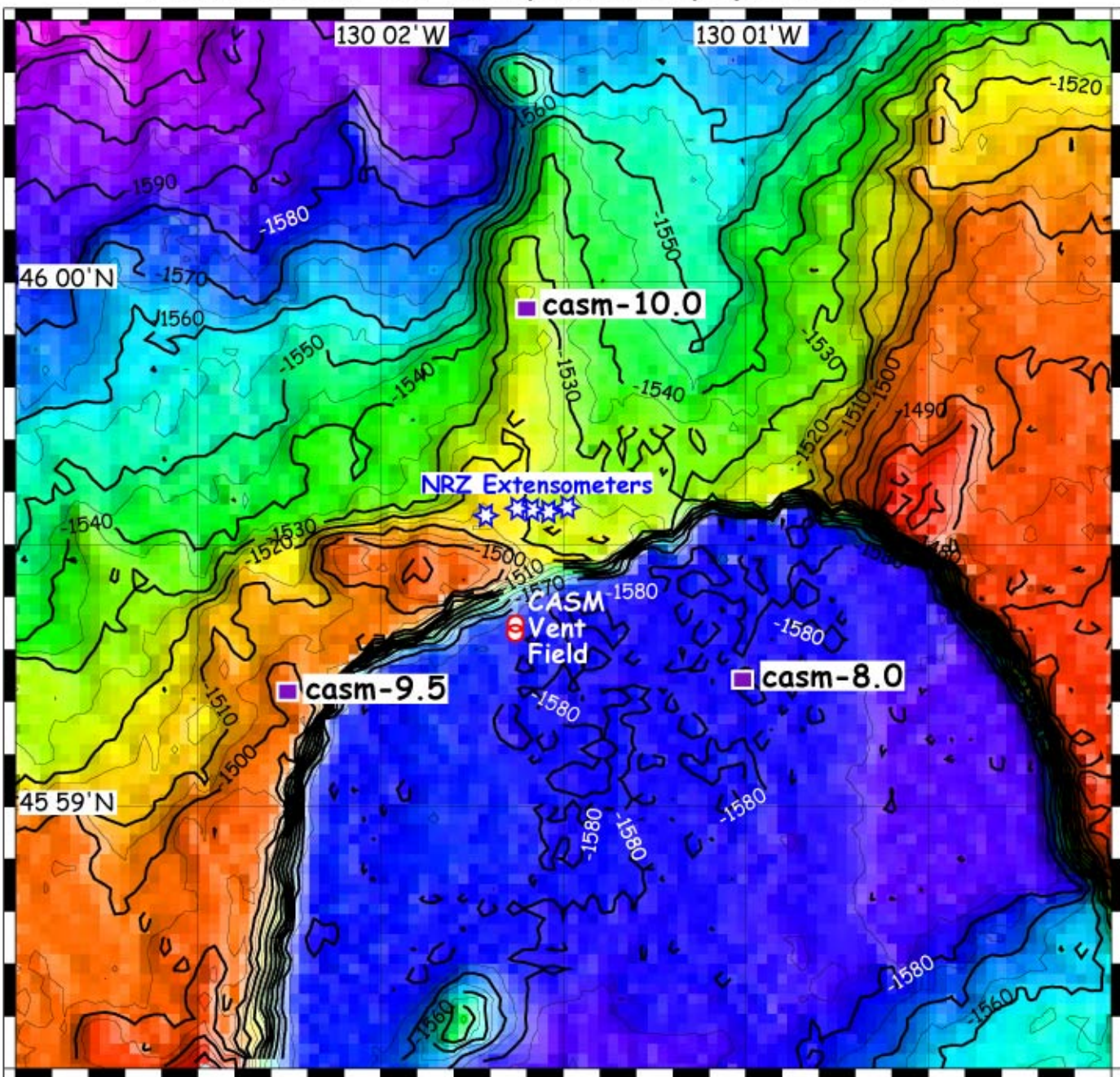
Imagenex bathymetry. 1 meter grid cell size. 1 meter contour interval. No ROV divetracks plotted due to poor nav quality. All dives took place at re-visited sites.

**Axial Volcano - ASHES Vent Field**



ASHES Vent Field Digital Still Camera Images

**Axial Volcano**  
**Northern Caldera and Southern North Rift Zone**  
**Extensometers and Transponders Deployed NeMO 2003**



EM300 bathymetry. 35 meter grid cell size.  
No ROV divetracks plotted due to poor nav quality. All dives took place at re-visited sites.

## NeMO 2002 and 2003 CRUISE DATES

### **Cruise TN149 - Summer 2002**

*Leg 1 Explorer Ridge 6/29 2342 UTC (6/29 1642 PST) - 7/11 0800 UTC (7/11 0100 PST)  
(CTD, ABE, EM300, rock coring)*

### **Leg 2a NeMO 2002: 7/14 – 7/23 2002**

(Victoria to Victoria)

Area of Operations: Axial Volcano, Juan de Fuca Ridge

**7/15 2300 UTC (7/15 1600 PST) - 7/20 2016 UTC (7/20 1316 PST)**

**ROPOS operations at Axial R657 – R662**

7/22 ~2300 UTC (~1600PST)

Left NeMO site

7/23 morning (PST)

Exchange scientific crew in Victoria

*Leg 2b Explorer Ridge 7/24 0100 UTC (7/23 1800 PST) - 8/1 2100 UTC (1400 PST)*

*ROPOS Operations*

### **Leg 2b NeMO 2002 supplement: 8/2 – 8/5 2002**

(Explorer Ridge to Axial Volcano to Victoria)

Area of Operations: Axial Volcano, Juan de Fuca Ridge

8/2 0000 UTC (8/1 1700 PST) – 8/2 1100 UTC (0400 PST)

Collecting EM300 data on transit from Explorer to Axial

**8/2 1800 UTC (1100 PST) – 8/4 0930 UTC (0230 PST)**

**ROPOS operations at Axial dives R672 – R674**

8/5 Arrive in Victoria

### **Cruise TN160 Summer 2003**

#### **NeMO 2003: 8/27 – 9/8 2003**

(Astoria to Victoria)

Area of Operations: Axial Volcano, Juan de Fuca Ridge

8/27 1615 UTC (8/27 1615 PST) – 8/28 1700 UTC (1100 PST)

Transit Astoria to Axial Volcano and mapping of CoAxial Segment

**8/28 1700 UTC (1100 PST) – 9/7 1330 UTC (0630 PST)**

**ROPOS operations at Axial dives R672 – R674**

**NeMO Net equipment deployment and recoveries**

9/7 1500 UTC (0800 PST) Depart Axial

9/8 1900 UTC (1200 PST) Arrive Victoria

9/9 0700 UTC (0000 PST) Depart Victoria

9/9 1600 UTC (0900 PST) Arrive Seattle fuel pier

## 1.0 NeMO 2002 SCIENCE SUMMARY

**Bob Embley, Chief Scientist**

The NeMO 2002 expedition was shorter than in previous years, and so it was particularly intensive with as much science as possible packed into each day on site. We made 9 ROPOS dives, with a total of 93 hours of bottom time, and 84 samples collected. Between ROPOS dives we deployed or recovered 6 oceanographic moorings, deployed or recovered 4 seafloor instrument packages, and conducted 5 CTD casts.

One of the main goals at Axial Volcano in 2002 was to install an upgraded NeMO Net system. NeMO Net is a state-of-the-art communication system that links desktop computers on land to instruments on the seafloor. A surface buoy is the heart of the system, which communicates with shore by satellite and to the seafloor via an acoustic link. We have been incrementally developing the capabilities of NeMO Net over the last 3 years, starting with one-way communication from a single camera, to this year's system which has two-way communication with three independent instruments on the seafloor. The 3 instruments include two interactive fluid samplers (called RAS's) and one bottom pressure recorder (BPR). The whole idea of NeMO Net is to be able to get information from the seafloor in order to be able to know when a volcanic event is occurring at Axial Volcano and then be able to respond to such an event immediately, without having to wait until a ship can get out to the site.

During our dives with ROPOS we were also able to recover many instruments and experiments that had been left last summer. These included a RAS sampler at Cloud vent that successfully took 1 fluid sample per week for the year, many probes that had been continuously monitoring temperature at various vent sites, and bacteria traps at some of the same vent sites. Particularly successful was an experiment (P.I. A. Metaxas) which offered a variety of artificial and natural substrates in order to see which the larvae of vent animals might prefer. Vent animals were found to colonize in some areas where none are observed on the seafloor, probably due to a lack of appropriate substrate.

Another experiment new to NeMO 2002 uses special "chambers" that can simulate the high pressure that the animals live under at the vents. The chambers provide a means to test hypothesis related to the extreme environmental conditions the animals can tolerate. For example, some observations suggest that worms living on the smoker chimneys can tolerate temperatures up to 176° F (80° C)! The "chamber" experiments with their animals are designed to test this hypothesis.

Pressure measurements were made in two different ways for two different purposes. Bottom pressure recorders (BPRs) record continuously over a year and look for sudden deflation events that signal the onset of a volcanic eruption or intrusion. But these instruments have a long-term drift rate so they are not good at measuring volcanic inflation, which occurs at a gradual rate over long periods of time. To try to measure the inflation signal we are using another pressure sensor that ROPOS can carry to seafloor benchmarks. With this instrument we can determine the relative depths of the benchmarks and determine if the ones inside the caldera are being uplifted relative to the one located outside the caldera. We repeat these measurements annually to look for changes.

We know relatively little about how submarine volcanoes work, as compared to more accessible volcanoes on land, but with long-term seafloor observatories like NeMO we are making dramatic progress in our understanding.

## 1.1 NeMO 2002 PARTICIPATING ORGANIZATIONS

NOAA Pacific Marine Environmental Lab (PMEL)  
Oregon State University (OSU)  
University of Washington (UW)  
Western Washington University (WWU)  
Washington State University (WSU)  
University of Victoria (UVic)  
University of Quebec at Montreal (UQAM)  
University of Toronto (UT)  
Dalhousie University (DU)  
University of Manitoba (UM)  
Canadian Scientific Submersible Facility (CSSF)

## 1.2 NeMO 2002 SCIENTIFIC PERSONNEL

<b>Scientist</b>	<b>Affiliation</b>	<b>Participation</b>
Robert Embley	NOAA PMEL Vents Program	Geologist/Chief Scientist
Bill Chadwick	OSU / NOAA Vents Program	Geologist
Dave Butterfield	UW / NOAA Vents Program	Chemistry
Anna Metaxas	Dalhousie University	Biology
Richard Leveille	University of Quebec	Geochemistry
Craig Moyer	Western Washington University	Microbiology
Joe Resing	UW / NOAA Vents Program	Chemistry
Ray Lee	Washington State University	Biology
Susan Merle	OSU / NOAA Vents Program	Data Manager/Outreach/Navigation
Leigh Evans	OSU / NOAA Vents Program	Gas Chemistry
Bill Martin	UW / NOAA Vents Program	Chemistry
Kevin Roe	UW / NOAA Vents Program	Chemistry
Sheryl Bolton	University of Washington	Microbiology
Kimberly Williams	NOAA Teacher At Sea	Education/Outreach
Amanda Bates	University of Victoria	Biology GS
Noreen Kelly	Dalhousie University	Biology GS
Catherine Lalonde	University of Quebec	Biology GS
Leslie Cho	Western Washington University	Microbiology GS
Julius Csotonyi	University of Manitoba	Microbiology GS
Chris Kennedy	University of Toronto	Biogeochemistry GS
Susan Kulp	University of Florida	Geology GS
Kevin Lilley	University of Washington	Gas Chemistry Student
Chris Meinig	PMEL Engineering	Engineer
Scott Stalin	PMEL Engineering	Engineer
John Shanley	PMEL Engineering	Engineer
Jon Bumgardner	PMEL Engineering	Engineer
Keith Shepherd	CSSF	ROPOS Team Leader
Bob Holland	CSSF	ROPOS Engineer
Keith Tamburri	CSSF	ROPOS Engineer

Kim Wallace	CSSF	ROPOS Engineer
Craig Elder	CSSF	ROPOS Engineer
Sebastian Durand	CSSF	ROPOS Navigator
Ian Murdock	CSSF	ROPOS Engineer
Shane Lovelace	CSSF	ROPOS Engineer
James Illman	Contractor	Navigation

**Additional Scientific Personnel for NeMO Supplement (8/2– 8/4 2002)**

Kathy Gillis	University of Victoria	Geologist
Anthony Williams-Jones	McGill University	Geochemist
Brian Cousens	Carlton University	Geologist
Jeff Streich		Videographer
Michael Kelly	NOAA Office of Ocean Exploration	Biologist
Cathrine Channing	University of Victoria	Geologist GS

(GS = Graduate Student)

**1.3 2002 R/V THOMAS G. THOMPSON PERSONNEL**

Glenn Gomes	Captain
Gray Drewry	Chief Mate
Jake Sowers	2nd Mate
Tom Drake	3rd Mate
Joe Heise	Chief Engineer
Lew Skelton	1st Engineer
Rich O'Connell	2nd Engineer
Debby Ramsey-Bell	3rd Engineer
Andy Bartell	Oiler
Russell Rowley	Oiler
Rich Leonard	Oiler
Frank Spetla	Able Bodied Seaman
Dan McBriar	Chief Steward
Mike Realander	Marine Technician
Robert Hagg	Marine Technician

## 2.0 NeMO 2002 DISCIPLINE SUMMARIES

### 2.1 GEOLOGY

#### 2.1.1 NeMO 2002 PMEL Geology Summary

**Bill Chadwick and Bob Embley**

The NeMO 2002 cruise spent only about a week at Axial, since most of the 2002 dives were made at Explorer Ridge. The NeMO fieldwork was actually divided up into 2 parts, at the beginning and end of the ROPOS leg on the Thompson (with dives at Explorer Ridge in between). We continued our monitoring efforts to measure inflation and deflation of the volcano using bottom pressure recorders (BPRs) and repeat pressure measurements made at seafloor benchmarks with ROPOS. We recovered a BPR that had been deployed at Axial since 2000, and we deployed a new one, equipped with an acoustic modem so that it can transmit data back to shore through the NeMO Net buoy. Having realtime BPR data allows us to make more informed decisions about event responses, since they can detect sudden deflations of the caldera due to volcanic eruptions or intrusions. We used a precision pressure sensor on the ROPOS vehicle for a second year to make pressure measurements at 5 benchmarks inside and outside the caldera. The benchmarks are located at: the caldera center, Magnesia vent, Marker 33 vent, Bag City vent, and the Southern Pillow Mound (10 km from the caldera center). The pressure sensor can measure the relative depths between benchmarks, so by making annual measurements at these benchmarks and assuming that the outer-most benchmark is stable, we will be able to see if caldera is moving up or down relative to the outermost one. The third prong of our instrumental monitoring effort is our prototype extensometer array deployed on Axial's north rift zone. At the end of the ROPOS leg, we recovered 5 extensometer instruments from Axial's north rift zone that had been deployed for the last 2-3 years (one of the five instruments was deployed in 1999, and the other 4 were deployed in 2000), but found that only two of the five had worked properly during the deployment, so this was very disappointing. All five instruments were brought back to PMEL for evaluation. Internally recording temperature probes were recovered and deployed at several high temperature and diffuse vents in our continuing effort to monitor the thermal output of Axial volcano. (See section 4.0 for details)

### 2.2 CHEMISTRY

#### 2.2.1 NeMO 2002 PMEL Fluid Chemistry Program

**David Butterfield**

##### Summary

- recovered RAS deployed in 2001 at Cloud vent.
- **successfully installed two interactive samplers!**
- took one suction water sample each at Cloud, marker 33, Vixen, and Village
- deployed hot interactive sampler at Virgin Mound vent
- deployed warm interactive sampler at Dave's vent
- deployed NeMO Net buoy

In the final analysis, this leg was a great success for the chemistry/NeMONet project. The interactive sampler deployed last year had a cable failure that prevented any acoustic communication after the first 6 days. However, the RAS continued to function and collected nearly a full set of samples (only two bottles out of 45



failed to fill). Unfortunately, there was an undetermined problem (probably blockage or misalignment in the valve) that resulted in addition of rinse acid to the samples. The sampler had to be disassembled quickly on deck after recovery in order to get at the samples, so we could not fully diagnose the problem. Addition of acid will complicate the interpretation of the time series results, and we can't determine the extent of the problem until we analyze the samples fully on shore. There were no apparent problems with the sample containers (no failed bags or valves) or plumbing (no loose connectors or broken lines). The pH sensor used on the 2001-2002 deployment (s/n 10) still showed a response after one year in the water. The pH response was stable, but not linear. Prospects are good for a pH record for most of the year if the valve problem did not affect the sensor channel.

The osmosampler at Cloud was recovered at the very last hour of the cruise on August 3<sup>rd</sup>. This will be an important addition to the time series data provided by the NemoNet sampler from July 2001 to July 2002.

The temperature at Cloud vent dropped by slightly more than one degree over the year, from 9.5C (PMEL MTR) in July 2001 to 8.4C (Moyer MTR) in July 2002. Flow appeared to be less than the previous year, but the temperature within the hole at N6 was still uniform as before. Long strands of probable sulfide-oxidizing bacteria cover most surfaces at the vent. Tube worms had colonized the titanium intake nozzle to the RAS over the one year deployment, and the worms reached an estimated size of 2-4 cm in length.

Because of the large number of tasks that had to be completed during the time available at Axial Volcano, we did not use the fluid sampler on ROPOS. Water sampling during the Nemo leg 2a was limited to one suction sample at Cloud and one suction sample at marker 33. The temperature probe on the suction sampler was working, and we measured 5.6 to 5.8 degrees on the intake and 5.2-5.4 on the outlet at Cloud (these have to be adjusted by adding the ambient temperature since the probes are thermocouples referenced to ambient water at about 2.3C). The maximum temperature registered on the suction sampler probe at marker 33 was approximately 21C (adjust to 23C). Excess seawater was entrained during the water sampling, so our intake temperature was 10-19C (adjust to 12-21C) while the outlet temperature was 7.5C (adjust to 9.8C). The adjusted outlet temperature should be used for calculating ratios to heat based on the water sample analysis. On the final dive of leg 2b, we collected a suction sample for water 1 meter from Vixen hot vent (30C inlet, 20C outlet) and one 20 m from Castle vent, where the maximum temperature registered by the suction sampler was 21C. This is the first year since 1998 that we have not completed a thorough time series sampling for chemistry of the vent sites in ASHES and the SE caldera, but we are collecting year-long time series at selected vents.

The decision to deploy the 2002-2003 NeMO-Net interactive samplers at ASHES was reached after a careful look at both Cloud and Castle vents. The terrain around the single vent at Castle was too steep to allow placement of the sampler package within the 20-foot reach of the temperature probe and intake lines. It was estimated that we would need 35 feet on these lines to reach the vent from the probable resting place of the bottom package. Although the scientific aspects of monitoring this part of the caldera were attractive (unique flow stability at Cloud and location on the eruptive line), the logistical complications were strongly against it.

We had one long dive at ASHES, with 26 tasks listed. Placing the interactive samplers in the vent field was put near the end of the list in order keep the samplers out of the way and safe while other instruments and samples were recovered. The hot sampler was installed at Virgin Mound vent, which required moving the package near the vent, removing the tripod with temperature probe and intake nozzle, adjusting the placement of the package several times, and finally adjusting the tripod and the second temperature probe, which was placed with the tip in the flow of hot fluid near the base of the anhydrite mound. The hot fluid effluent mixed with seawater was filling the titanium fluid collector. The installation of the hot sampler went well, but the tripod setup was vulnerable to fall over during collapse of the anhydrite chimney or during an exceptionally strong current event.

While moving the low-temperature sampler toward the vent field from its drop site, the starboard arm malfunctioned and knocked the color camera out of alignment, with the result that the camera could only see down over the edge of the biobox. After this incident, it was determined that the dive could proceed with limited functionality. Ballast was removed from the low-T sampler package and it was moved into the vent field. The starboard arm/manipulator continued to malfunction with sudden rapid swings left and right. With the limited visibility from the camera (down only) and the unreliable arm, it was too dangerous to try to remove the intake lines from the sampler frame and impracticable to try to install in the selected vent. The last operation of the dive was to recover Paul Johnson's temperature monitor off of the cement box at Crack vent. The flow meter could not be installed with the arm malfunction. It was decided to terminate the dive, repair the arm and camera, and dive again to finish the job.

The repairs on the sub took about 12 hours, and were finished at 3:30 am, but the wind was up to nearly 25 knots. The dive was postponed, and the weather got progressively worse and did not improve over the last two days of our time at Axial Volcano. With no prospects of weather good enough to dive, we had to install the NeMO-Net buoy and leave the site to make the personnel transfer at Victoria.

The Nemonet buoy system was fully functional, with the BPR and both sampler systems working. At 6pm local time on 7/22/02, we sent the command to the hot sampler to take a water sample. It went through the entire procedure (rinse, sample and sensor, pH 4 and 7, reverse sw and acid backflush). The temperature T1 in the fluid collector registered 61.6 (which is reasonable for the height above the vent). T2 was reading 03.2, which is probably 203.2, but there is no way to be certain since the hundreds digit does not get processed. It will be important to get a ground truth temperature measurement in the fluid collector and in the vent orifice before the sampler is recovered.

Fortunately for the NemoNet project, we were able to return to Axial after working at Explorer ridge, and complete one remarkable dive in close proximity to the NemoNet buoy/mooring. With the buoy less than 200 m away from the ship, ROPOS dove in the ASHES field and successfully installed a stabilizing weight around the tripod (which had tipped over about one week after we left it) at Virgin Mound, move the second sampler into position at a diffuse vent and successfully install it, then install Paul Johnson's flow meter/temperature probe on top of the cemented box at Crack vent. The dive was then curtailed because of the difficulty and danger of continuing to work in the vent field. Keith Shepherd and the entire ROPOS group truly saved the day with their technical excellence and confidence to dive under very complicated circumstances.

We now have the first multi-node, deep-sea, interactive network of experiments in place for the 2002 version of NemoNet.

The chemistry team consisted of Kevin Roe, working primarily on keeping the Beast under control and analyzing H<sub>2</sub>S, NH<sub>3</sub>, dissolved oxygen; Bill Martin, working primarily on RAS setup and analyzing pH, alkalinity and dissolved silica; Brooke Silver, analyzing methane and hydrogen by gas chromatography; Leigh Evans, taking care of gas-tight samplers, gas pistons, and extraction of gases for helium and other analysis. Sheryl Bolton of the Univ. of Washington handled all of the microbiology work on fluid and particle samples from the Beast, as well as working on solid samples.

We had an excellent team of PMEL engineers, who dealt with many things including the NemoNet interactive samplers. Thanks to Chris Meinig (co-P.I. on WCNURC-funded NemoNet project), Scott Stalin, Jon Bumgardner, and John Shanley for their contributions before and during the cruise.

The support of Ray Highsmith and the West Coast and Polar Regions Undersea Research Center has kept the

NemoNet project going.

### NeMO 2002 Hydrothermal Fluid and Particle Sampler Log July 14-Aug. 5 2002

Dive	sampler	vent site	note	Tmax	Tavg	T1 stdev	T2 Avg	pH shipboard
R659	suction (s3)	Cloud-N6	Temp. constant inside hole, add 2.3 to suction thermocouple. Suction sample for temperature at the hole (Mkr-N6). Temperature was 5.6 degrees in the hole and steady (temperature is from the alien). Start 1807 End 1811.	8.1	7.7	0.1	Note Moyer MTR 8.48C	6.89
R661	suction (s1)	Marker 33	Turning pump on to initiate suction sample on lowest speed. Water sample at highest temp spot (T=7.5 on T2). Start 0415 End 0420.	see Alien log				6.18
R662	gastights	Virgin	GTB 6 port and GTB 12 stbd. Samples were not good (see Leigh Evans write-up).	no data				

### 2.2.2 NeMO 2002 PMEL Helium Group Leigh Evans

The lack of a fluid sampler dive at Axial limited the sampling capabilities to one dive with the least favorable sampling method, i.e. titanium tubes hanging precariously from the shirtsleeve of ROPOS' 7-function arm. The quality of each of the 2 samples is questionable at best. On the last dive, R674 two gastight bottles were attempted at Vixen vent. The gases will be extracted as soon as they are delivered to Newport.

Dive	sampler	vent	[gas] ccSTP/g	P (CM1)	P (cm2)	cal Vol	T lab	weight	cm2/cm1	300 cc front end	cal volume	sum	% front end	
R662	gt6 port	Virgin Mound	0.118	6.52	134.4	110	22.1	172.6	20.6	0.014	0.104	0.118	11.7%	bad sampling technique; off the 7 function sleeve.
R662	gt12 stbd	Virgin Mound	1.523	6.1	124.8	1024	22.4	103.5	20.5	0.022	1.502	1.523	1.4%	shipboard GC says that this is mostly air

### 2.2.3 NeMO 2002 Analysis of Methane and Hydrogen Concentration Brooke Silvers, for Dr. Marv Lilley

Samples from the NOAA/PMEL RAS sampler were analyzed for methane and hydrogen concentration using gas chromatography. Averages of about 33 micromolar in hydrogen and 250 nanomolar in methane were obtained. Microbial activity during the storage of the samples at the sea floor may have changed these numbers from their values when collected. There is an upward trend to the methane concentration as age of the sample decreases. A suction sample gave values of 56 and 431 nM respectively for H<sub>2</sub> and CH<sub>4</sub>.

## 2.3 MICROBIOLOGY

### 2.3.1 Microbial Sampling for Molecular Microbial Ecology Analyses

Craig L. Moyer and Leslie S. Chao

We primarily used our dual approach of suction sampling and microbial growth chambers (aka bact-traps) for our microbial sampling effort. A “slurp-gun” suction device was used in combination with a rotating rosette of sample bottles to vacuum and capture free-living microbial mats from the surface of various hydrothermal vent habitats. Slurp-gun samples were successfully obtained from the (1) Marker #33 Vent, (2) Fe-HydeVent, (3) Fe-City Vent, and (4) the Village Vent area approx 20 meters west of Castle Vent. The sample acquired from the Fe-City Vent was extremely rich in neutrophilic iron-oxidizers and was used further for enrichment culture in an attempt to isolate a pure culture of these iron-oxidizers from the Axial Volcano region (Emerson and Moyer, 2002). In general, once microbial “slurp samples” were collected, each was independently processed and preserved using a variety of protocols. The majority of these samples were preserved for molecular biological analyses by placing in 50ml centrifuge tubes and quick-freezing in liquid nitrogen and storing in either an ultrafreezer or on dry ice until return to the laboratory. These samples will be used for the direct extraction of nucleic acids and/or phospholipids. A series of sub-samples were also either cryo-preserved (again using liquid nitrogen quick-freezing) with 40% glycerol, or stored briefly at 4°C then inoculated directly into enrichment media. Another series of sub-samples were fixed with 2.5% EM grade glutaraldehyde for examination with SEM and epifluorescence microscopy. We also fortuitously collected sub-samples recovered from larval array L that was deployed at ROPOS Vent, these sub-samples included bag creatures and white filamentous sulfur oxidizers, and were processed similar to the other slurp samples.

We also continued with our time-series sampling strategy with the deployment and recovery of “bact-traps” using a network of 8-micron glass wool strands as a substrate for microbial growth. Our traps were constructed using a cluster of three 3"-high cylinders (aka cells) of 4"o.d. plexiglass tubing, surrounded top and bottom by a 202-micron nylon mesh (Nytex) to exclude macrofauna and meiofauna grazing. These have been heat-tested to withstand boiling water (at 1 atm., i.e., 100°C) and we estimate that there is approximately 3 to 5 square meters of surface area available for microbial colonization in each trap. Upon recovery, inside a biobox to prevent winnowing and cross-contamination, individual bact-trap cells were aseptically opened and biomass-laden glass wool was transferred to sterile zip-lock bags. These bags were then fast frozen at -80°C in an ultrafreezer, transferred back to the laboratory on dry ice, then stored again in an ultrafreezer until further processing. Traps were once again successfully recovered from Cloud, Marker N6 after a short-term 18 day deployment and from Ashes, Gollum Vent and Marker #33 Vent after long-term (~1 year) deployments this year. Unfortunately our primary goal of a short-term deployment in the Ashes area, was once more elusive due to logistical constraints. The current method of choice for assessing the community structure and diversity has been coined terminal-restriction fragment length polymorphism or T-RFLP. Please see the progress report section for a recent abstract submitted to AGU (Moyer and Engebretson, 2002) on the current state of our growth chamber analyses using the T-RFLP method.

Finally, we have also attempting to ask an additional question this year concerning the nature the microbial endosymbiont(s) found inside *Ridgeia piscesae*. Basically, we are using a modified version of the T-RFLP method to attempt to detect other possible inhabitants of the trophosome structure in addition to the previously described endosymbiont (Feldman et al., 1997). So far, we have successfully detected the previously described endosymbiont and further experimentation is currently underway to attempt to detect other putative co-occurring microbial populations from these trophosome extractions.

## Progress Report, AGU abstract, 2002:

### Colonization by pioneer populations of $\epsilon$ -*Proteobacteria* and community succession at mid-ocean ridge hydrothermal vents as determined by T-RFLP analysis

Terminal-restriction fragment length polymorphism (T-RFLP) patterns were used to track populations of bacteria occurring within multiple bacterial growth chambers (BGCs) deployed at eight diffuse-flow ( $T_{max}=78^{\circ}\text{C}$ ) hydrothermal vent orifices located within the caldera of Axial Volcano, Juan de Fuca Ridge. For comparison, two distal diffuse vents located at the Magic Mountain area on the Explorer Ridge were also examined. Over a five-year sampling period in conjunction with the NeMO (New Millennium Observatory) program, 52 BGCs were recovered after either a short-term (days) or long-term (annual) deployment. Upon recovery, genomic DNA was extracted and amplified using bacterial-specific PCR primers to generate 5' fluorescently-labeled amplicons of small subunit rRNA genes (i.e., SSU rDNAs). These PCR amplicons were digested with multiple tetrameric restriction endonucleases and the respective community diversity and succession patterns were characterized. The average number of populations (a measure of species richness) within the community that developed in short-term deployed BGCs was significantly lower than those detected in long-term deployed BGCs. All short-term BGC communities were dominated by primary colonizers or pioneer populations indicative of  $\epsilon$ -*Proteobacteria*, of which, specific phylogenetic groups were recognized at vent sites throughout the five-year sampling period. The long-term BGCs showed evidence of successional events by an increased occurrence of numerous other populations accompanying the pioneer populations of  $\epsilon$ -*Proteobacteria*. The discovery that all primary colonizing populations were most similar to known lineages of  $\epsilon$ -*Proteobacteria* detected from hydrothermal vents located worldwide provides further evidence that a few cosmopolitan populations are capable of acting as the primary microbial successors of newly-formed hydrothermal vent systems.

#### References:

Emerson, D. and C. L. Moyer. 2002. Neutrophilic Fe-oxidizing bacteria are abundant at the Loihi Seamount hydrothermal vents and play a major role in Fe-oxide deposition. *Appl. Environ. Microbiol.* 68:3085-3093.

Feldman, R. A., Black, M. B., Cary, C. S., Lutz, R. A. and R. C. Vrijenhoek. 1997. Molecular phylogenetics of bacterial endosymbionts and their vestimentiferan hosts. *Mol. Marine Biol. Biotechnol.* 6:268-277.

Moyer, C. L., and J. J. Engebretson. 2002. Colonization by pioneer populations of  $\epsilon$ -*Proteobacteria* and community succession at mid-ocean ridge hydrothermal vents as determined by T-RFLP analysis. *Abstr. Fall Mtg. Eos. Trans. AGU* 83:F1472.

#### Moyer Lab Microbiology Sample List – NeMO 2002

##### Slurp-Gun Samples

Sample#	Dive#	Bottle(s)#	Site	Notes
1.	R661	Btl 5 & 6	Mkr33	Near Bac-traps
2.	R622	Btl 6 & 7	Fe-Hyde	
3.	R674	Btl J2 & J3	Fe-City	Lots of Fe-oxidizers here!
4.	R674	Btl J4	Village Vent	~20m west of Castle vent

##### Bacteria Traps

Sample#	Dive#	Trap(s)#	Site	Notes
1.	R659	Deploy 65 & 66	Cloud: N6	Weighted, ~1m tag lines
2.	R661	Recover 61 & 62	Mkr33	Long-term from last year
3.	R662	Recover 63 & 64	Ashes: Gollum	Long-term from last year
4.	R662	Deploy 67 & 68	Ashes: Gollum	(Intended for short-term)
5.	R674	Recover 65 & 66	Cloud: N6	Short-term @ 18 days

##### WaDaRs and Hobos

Item#	Dive#	Action	Site	Notes
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1.	R659	Deploy	Cloud: N6	WaDaRs #340 & #1051
2.	R659	Recover	Cloud: N6	Three hour, high-rate record!
3.	R659	Recover	Castle	Hobo #128
4.	R661	Recover	Vixen	Hobos #152 & #153
5.	R662	Recover	Virgin	Hobos #126 & #130

#### Osmo-Samplers

Sample#	Dive#	Action	Site	Notes
1.	R674	Recover	Cloud: N6	“Red” Osmo-sampler

#### Flange/Chimney Chunks

Sample#	Dive#	Type	Site	Notes
1.	R674	chimney	Castle	Two pieces fast-frozen with three 50ml tubes F.F.

#### Microbial Samples Taken from Larval Arrays

Sample#	Dive#	Array	Site	Notes
1.	R662	Larval Array L	Ashes: ROPOS	Bag Creatures and white filamentous sulfur-oxidizers

#### Microbial Samples collected from Macrofauna

Sample#	Dive#	Type	Site	Notes
1.	R661	Tubeworms	Casper	Trophosomes, n=3

### 2.3.2 Hydrothermal Fluid Microbiology

#### Sheryl Bolton

Diffuse fluids can be used as a window into the subsurface biosphere and information gained from their study allows inferences to be made about the nature of the subsurface habitat and the associated microbial community. The study of hydrothermal fluid microbiology at Axial over the last four years has been focused on examining the spatial and temporal changes in the microbial community associated with diffuse fluids using molecular, culture and microscopic techniques.

The primary objectives of the 2002 NeMO cruise were to continue the time-series studies of vents that have been sampled over the last four years using semi-quantitative culture enrichments (MPNs, Most-Probable Number technique) to monitor the presence of hyperthermophiles and thermophiles, microscopic techniques, and DNA/RNA extractions to look at microbial diversity and gene expression. Additional objectives included the recovery and collection of samples from the RAS sampler that was deployed at Cloud N6 last year, inoculation of diffuse fluids into growth media selecting for nitrogen fixers (media devoid of any nitrogen other than N<sub>2</sub> gas) and high and low salt tolerant microbes.

Fluid and filtered samples have been acquired for the last four years using the hot fluid sampler. The constraints of time and amount of work to be done this year did not allow for a hot fluid sampler dive so the objective of continuing the time-series experiments was not fulfilled. Fluid samples were taken from two of the six time-series vents (Marshmallow, Marker 33, Bag City, Nascent, Gollum and Cloud N6) using the suction sampler, but because this is a different quality of sample some of the results are not comparable to those of previous years. Because of possible dilution by entrainment of seawater during suction sampling the Most-Probable Number results as well as those of microscopic techniques may not be reliable. DNA and RNA extractions from these samples are still useful as the microbial seawater component can be subtracted out and because this is a purely qualitative analysis.

Due to a valve problem with the RAS sampler at Cloud N6 during the last year all but the first five samples

were acidified. Culturing was done from a non-acidified and an acidified bag, neither of which produced any growth suggesting that, even without the addition of the acid, there may be an issue of decreased survivability over long periods of time in the enclosed sample bag. Filters intended for FISH (Fluorescence In-Situ Hybridization) studies from this long-term deployment may also be useless as the strong concentration of acid likely damaged any microbes captured on their surfaces. A communication problem with the RAS also did not allow the addition of the cell preservatives that would permit the filters to be used for DNA studies. Filters for DNA extraction as well as cell preservatives were again placed on the low temperature RAS sampler deployed for the next year at “Dave’s vent”.

Some potential positive enrichments in thermophilic nitrogen fixer and high/low salt media were obtained from the two suction samples at Marker 33 and Cloud N6 as well as from two additional sites that were not part of the time series study. Microscopic confirmation of growth will be done after the cruise and those cultures that grew can then be isolated and their DNA partially sequenced to determine if there are any new organisms. While not all of the objectives of this cruise were accomplished the samples that were successfully obtained may still provide us with new insights into the microbial populations in the subsurface biosphere at Axial Seamount.

### NeMO 2002 Hydrothermal Fluid Microbiology Samples

date	dive #	log sample #	description	culture	DNA	RNA	FISH	counts
10:22 am	R659	R659-SS-J3-0002	Cloud N6 suction sample (5.6 deg)	*	*		*	*
10:22 am	N/A	N/A	RAS year-long deployment at Cloud N6	*			*	*
10:22 am	R661	R661-SS-J1-0011	Marker 33 suction sample (24.3 deg)	*	*		*	*
10:22 am	R661	R661-MTR-4128-??	Tubeworms and limpets off MTR 4128 at Casper	*				
10:22 am	R674	R674-SS-J4-0004	Diffuse at Vixen about 1m from smoker (Tmax=30)	*	*	*	*	*
10:22 am	R674	R674-SS-J5-0010	Suction sample at Village (Tmax=21)	*	*	*	*	*

### 2.3.3 Geothermally Driven Photosynthesis and Bacterial Heavy Metal Resistance at Hydrothermal Vents Julius Csotonyi

My research at Axial Volcano on the Vents 2002 cruise covers two areas of microbiology: geothermally driven photosynthesis and bacterial heavy metal resistance at hydrothermal vents, a subset of my PhD program that investigates microbiology of extreme environments. This research also represents a continuation of similar studies performed by the lab of Dr. V. Yurkov (University of Manitoba) at hydrothermal vents. When it was realized that hot hydrothermal fluids emit near infrared blackbody radiation at wavelengths commonly utilized by anoxygenic phototrophic bacteria, a search was mounted for microbes that photosynthesize by geothermal radiation alone, the only source of radiation available at deep-sea hydrothermal vents. Because of the remarkable overlap between the wavelength range of available energy and energy used by phototrophic bacteria (between 700 and 1100 nm), it has even been suggested that photosynthesis first evolved at hydrothermal vents. Therefore the search for deep-sea phototrophs has huge evolutionary implications. While obligately photosynthetic bacteria have not yet been recovered from deep-sea hydrothermal vent environments, photoheterotrophic bacteria, which can rely on either phototrophy or heterotrophy, were first discovered by V.

Yurkov and J.T. Beatty on the Juan de Fuca Ridge in 1998. These bacteria represent a recently discovered group of phototrophic microbes that can use light energy aerobically, unlike the anaerobic conditions required for photosynthesis by conventional purple and green bacteria or heliobacteria. At Vents 2002, I continued the search for photoheterotrophs, and more excitingly, for obligate phototrophs in organic-rich environments and habitats close to hot venting fluids, respectively. This involved inoculation of samples onto anaerobically incubated selective media for purple and green bacteria and aerobically grown rich organic medium for the aerobic anoxygenic phototrophs. Enumeration, isolation and characterization of interesting strains will follow in the laboratory. Axial Volcano has never been investigated for phototrophic microbes before.

The second aspect of my research at Axial Volcano in 2002 focuses on interactions of bacteria with heavy metals. Heavy elements such as tellurium are toxic to microbes at very low concentrations, but are often enriched in fluids and sediments at hydrothermal vents. Bacteria living near hydrothermal vents may therefore experience strong selection pressure to deal with heavy element toxicity. Mechanisms of detoxification include efflux pumping and reduction of elements to less toxic oxidation states. The implications of this research to biotechnology are enormous because bacteria resistant to heavy metals may be employed in bioremediation of terrestrial heavy metal pollution or in mining trace elements. My approach involved enrichment culturing for bacteria resistant to oxyanions of several metalloids and transition metals. Isolation and characterization of interesting strains will follow in the laboratory. In order to determine whether interesting phototrophic or heavy metal resistant strains are truly restricted to the vent environment, I investigated the vertical distribution of bacteria by inoculating relevant media with water collected from CTD casts over the vent field. An interesting link between the phototrophic and heavy metal facets of my research is that the aerobic anoxygenic phototrophs as a whole are highly resistant to heavy metals and therefore pose a very promising group to investigate at hydrothermal vents from both an evolutionary and a biotechnological perspective.

## **2.4 MACROBIOLOGY**

### **2.4.1 NeMO 2002 Macrobiology Studies of Gastropod Ecology and Larval Dynamics Amanda Bates and Tunnicliffe lab, Noreen Kelly, Anna Metaxas**

#### **Gastropod Ecology**

Lab work over the past year has revealed differences in the distribution of the three dominant gastropods at vents: the limpet *Lepetodrilus fucensis*, the glob snail *Depressigyra globulus* and the provannid snail *Provanna variabilis*. Adult limpets and glob snails are abundant in high flow areas, whereas the provannid snail and juveniles of both limpets and glob snails are abundant in low flow areas. This year's sampling and on-ship experiments were designed to increase our understanding of these distributional patterns.

Experiments at 1atm showed that the limpet and the provannid snail avoid temperatures above 14°C, while the glob snail does not avoid temperatures up to 21°C. None of the three gastropods avoided sulfide levels up to 3mmol. These data indicate that temperature and sulfide do not determine the observed gastropod distribution. Future work will attempt *in-situ* experiments to test other hypotheses.

Morphological evidence suggests that the limpet suspension feeds, grazes and gains nutrition from bacteria which live on its gill. In laboratory experiments, limpets from high flow have long and thin gills with dense populations of bacteria. Limpets from low flow areas have short and thick gills and sparse bacterial populations. These characters indicate that high flow animals may depend more on gill bacteria for nutrition than low flow animals. Samples were collected to determine whether high and low flow limpets use different feeding



strategies. A transplant study was conducted at Hell vent to determine whether bacterial density and gill shape change when limpets are moved from high to lower flow. This study will be completed next year.

### **Larval Dynamics**

We continue to collect data that will help us understand and quantify patterns in larval availability and recruitment. In 2001, a number of passive larval traps were deployed at Cloud, Virgin and ROPOS vents for 7 to 10 days. In 2002, we retrieved 4 larval traps that were capped (i.e. not collecting samples), but not recovered in 2001. Previous trap deployments indicated that the larval assemblage consists mainly of gastropods, and to a lesser extent of polychaetes, and larval supply is great (10s of thousands of individuals supplied  $^{-2} d^{-1}$ ). There are no pronounced differences in larval supply among vents or between years, suggesting a homogeneous larval pool across Axial Seamount.

In 2001, arrays of settlement plates were deployed at several different vents (Cloud, ROPOS, Gollum, Virgin and Virgin Daughter) to quantify patterns in larval recruitment and explore the factors that may influence such patterns. These arrays consisted of plates of two different substrates (pieces of basalt and scour pads) and for each substrate type, two levels of accessibility by grazers (high and low). In 2002, 4 larval settlement arrays were recovered, two from Cloud vent (one near venting and the other ~8 m away), one from ROPOS vent and one from Virgin Mound. Preliminary observations indicate extensive recruitment by gastropods and to a lesser degree by polychaetes. Unlike larval supply, recruitment appears to be spatially variable. For example, more larvae recruited to the array placed near flow at Cloud than to the one 8 m away. Also, there were fewer recruits at the hotter Virgin vent than the cooler ROPOS vent. Further examination of the settlement plates will reveal possible effects of grazing, and type of substrate on recruitment. Four new settlement arrays were deployed to replace those removed in 2002 at ROPOS, an anhydrite vent near Virgin's Daughter, and Cloud (in flow and far). We are looking forward to the recovery of all remaining arrays in 2003, to resolve temporal patterns in larval recruitment.

### **Temporal Change of New Lava Communities**

One vent collection was made at Cloud vent (near marker N6) to continue the temporal study of faunal succession. Most tubeworms had disappeared, unlike at ASHES, and the remaining few appeared in poor shape or dead.

### **Macrobiology sample list – NeMO 2002**

#### **Axial Volcano northern South Rift Zone**

R659-0007: Tubeworm grab near Mrk N6 at Cloud vent to complete a 4-yr time series  
R659-LA-G-0001: Settlement array G (deployed in 2001) recovered from Cloud vent; ~8 m from N6  
R659-LA-E-0003: Settlement array E recovered (deployed in 2001) from near marker N6 at Cloud vent  
R661-SS-0013: Suction sample of gastropods on basalt in low flux  
R661-SS-0012: Suction sample of gastropods on basalt in high flux  
R661-net-0022: Net tow for plankton (mesh size: 180  $\mu$ m) in the mid-caldera of Axial Volcano

#### **ASHES**

R662-LA-M-0003: Settlement array M (deployed in 2001) recovered from Virgin Mound  
R662-LA-L-0006: Settlement array L (deployed in 2001) recovered from ROPOS vent  
R662-SS-0009: Suction sample of gastropods on sulfide chimney in low flux at Hell vent  
R662-MP-0007: Integrated McLane pump sample, 1300 L, 2-20 mab, peripheral to vents at ASHES  
R662-SS-0010: Suction sample of gastropods on sulfide chimney in high flux at Hell vent  
R662-LT1-0023: Larval trap #1, deployed at ROPOS for 1 week in 2001, (capped but not recovered in 2001)  
R662-LT4-0024: Larval trap #4, deployed at ROPOS for 1 week in 2001, (capped but not recovered in 2001)  
R662-LT12-0025: Larval trap #12, deployed at Virgin Mound for 1 week in 2001, (capped but not recovered in 2001)  
R662-LT9-0026: Larval trap #9, deployed at Virgin Mound for 1 week in 2001, (capped but not recovered in 2001)

## 2.4.2 NeMO 2002 Investigations of the Effects of Environmental Stressors on the Physiology and Behavior of Vent Macrofauna

Ray Lee

Experiments were conducted to investigate the effects of environmental stressors on the physiology and behavior of vent macrofauna. The two stressors were investigated: elevated hydrogen sulfide and temperature, variables that result from the influence of hydrothermal fluids on organism microhabitat. Tolerance of deleterious environmental conditions has often been proposed to account for the dominance of species endemic to vents and the distribution and succession of endemic species within a given vent site. Preliminary results indicate that temperature exerts stronger negative effects on Juan de Fuca ridge invertebrates than does hydrogen sulfide.

Experiments were conducted in high pressure flow-through chambers in order to maintain organisms at in situ pressure. In some cases, additional experiments were conducted on animals kept at 1 atm. The primary organisms investigated were: the sulfide worm *Paralvinella sulfincola*, which can live in environments of strong vent flow, and the limpet *Lepetodrilus fucensis* and snail *Depressigyra globulus*. Progress was made towards the following objectives:

### Temperature

- a) thermal limit for short term exposure ( $U_{crit}$ ) - determine effect of temperature on activity and temperature that results in cessation of activity
- b) Determine effect of temperature on metabolic activity – respiration, excretion, sulfide detoxification

### Hydrogen sulfide

- a) Determine the length of time activity can be sustained in the presence of varying concentrations of sulfide.
- b) Quantify rates of sulfide detoxification

### Results analyzed to date:

Temperature tolerance – Experiments conducted at high pressure in which chamber temperature was ramped from 10 or 15 degrees C to a temperature endpoint at 10 C/h. Behaviors observed were: (a) activity, (b) reduced activity, (c) activity at the endpoint but no activity following return to cooler temperatures, (d) no activity at the endpoint and no return of activity at cooler temperatures.

Of the gastropods, *D. globulus* exhibited activity at temperatures up to 40 C, whereas no *L. fucensis* exhibited activity at temperatures in excess of 30 C. These results indicate that *D. globulus* is more tolerant of elevated temperature than *L. fucensis*. The sulfide worm *P. sulfincola* exhibited activity up to 50 C (56 C maximum for one individual) survival following cessation of activity was not observed. Other experiments showed that *P. sulfincola* survived 11 hours at 40 C, and sustained movement for 1 hour at 45 C, with activity resuming after return to lower temperature.

Sulfide tolerance – Experiments were conducted at high pressure under constant sulfide conditions. Activity times were assessed as length of exposure time required for no movement to be observed.

Gastropods maintained movement in the presence of high concentrations of sulfide (4 and 1.6 mM) for several hours. The effect observed does not appear to be the result of anaerobiosis since animals could maintain activity in the absence of oxygen longer than in the sulfide treatments.

**Conclusions:**

These results indicate that elevated temperature is a stronger stressor of vent macrofauna than hydrogen sulfide. For a hypothetical organism living in a microhabitat that where the water reflects a 10% influence of vent fluid, given an endmember temperature of 350 C and sulfide level of 20 mM, the organism would experience 35 C and 2 mM sulfide. For the limpet *L. fucensis*, 35 C would be lethal whereas 2 mM sulfide can be tolerated for several hours. Thus, given a rough approximation of the relationship between sulfide and temperature, lethal sulfide concentrations will only be encountered in waters well in excess of lethal temperatures.

Additional experiments included: measurement of autotrophic incorporation of bicarbonate and nitrate by *L. fucensis*. Testing for pressure effects on intracellular osmolytes. Sampling of freshly collected fauna for measurement of O and H isotopes in organic material.

## **2.5 PUBLIC OUTREACH**

### **2.5.1 NeMO 2002 Website and Public Outreach**

**Bill Chadwick, Susan Merle, Kimberly Williams, Nancy Steinberg, Andra Bobbitt, Bob Embley**

The NeMO 2002 web site (<http://www.pmel.noaa.gov/vents/nemo2002/expeditions.html>) offered daily updates on the cruise and allowed interested individuals to follow progress of the scientific expedition at the NeMO Observatory, Axial Volcano. The updates included a daily science report written by Bill Chadwick and a science summary by Chief Scientist Bob Embley. The web site featured a daily log by "Teacher At Sea" participant Kimberly Williams. Kimberly is a science teacher at Miller Place High School in Long Island, New York. She acted as the liaison between scientists on the NeMO expedition and the public. Andra Bobbitt and Susan Merle (NOAA Vents Program / OSU) coordinated their efforts (Susan on the ship, Andra on shore) to produce a daily NeMO web page. The updated information and pictures were also included in twice-daily presentations for the general public at HMSC, by the educator on shore, Nancy Steinberg. Feedback and questions from the general public were sent to the ship and answered by the scientific party. The questions were primarily from HMSC presentation audiences and family members of the science party participants.

### 3.0 NAVIGATION OVERVIEW AND POSITION INFORMATION

#### 3.1 NAVIGATION - NeMO 2002

##### ROPOS Navigation Team

During the NeMO 2002 cruise on the *R/V Thomas G. Thompson* underwater positioning was performed by integrated Long Baseline (LBL) Navigation. ROPOS navigation uses the Seascope 3.08 software, which integrates serial, and network NMEA type data inputs for position computation and distribution to other sources through the ROPOS and *Thompson's* networks. Primary navigation of the cage and vehicle is by acoustic long baseline, which uses a fixed array of transponders on the bottom and mobile relay transponders on the ROV, cage, elevators and moorings for positioning. In the Axial Volcano area, there are 3 separate acoustic arrays deployed during previous NOAA NeMO VENTS cruises. The North Rift and Ashes arrays were used this year for positioning. The arrays are comprised of 4 Benthos XT6000 transponders each moored 200 m above the seafloor. No calibration was performed this cruise on the arrays used. The calibrations made during previous cruises were assumed to be still accurate.

All transponders within the array had an interrogation frequency of 9 kHz. For positioning ROPOS and the elevator, transponders with interrogation frequencies of 14.5 and 15.0 kHz were used respectively. Acoustic navigation during the cruise was not used as much as planned. For much of the cruise, the EdgeTech 8010 Acoustic Transceiver mounted on the cage exhibited several problems and often was not functioning. The RASs (Remote Access Samplers) were equipped with EdgeTech 8242 acoustic releases that were interrogated at 9.0 kHz. An attempt was made to calibrate their positions using the mooring calibration function in SeaScape, but the NOAA Edgetech PS8010 mounted on the ship's pole failed. The RASs were found without problem by surveying the drop areas.

Acoustic navigation during the cruise was generally good except in cases where the proximity of the cage caused interference with hearing the direct reply of the relay transponder. On other dives, the acoustic navigation was problematic due to geometry within the array or due to line of sight problems while working in hollows.

##### Summary of the 2002 ROPOS navigation is as follows:

Dive	Area	Comments	Navigation quality
R657	Initial Axial dive	SIT camera cable failed during descent. No bottom time	Acoustic nav good during descent
R658	Elevator deployment	Relay positioned elevator dive terminated due to low oil pressure	Good acoustic nav many positions <4 m RMS
R659	RAS deployment	Positioned elevator by relay and calibrated RAS locations. Nav was not bad except in some areas where only one Xp heard	Acoustic nav fair
R660		Dive terminated early due to loose plankton net	No bottom time
R661	North-South Pressure sensor transects	Good cage and vehicle fixes except in small	Good nav
R662	Virgin/Gollum area	Problems finding elevator due to ambiguous 2 leg fixes	Good acoustic nav
R672	Virgin - RAS reposition dive	PS8010 failed during dive after 2 hours on bottom	Poor acoustic nav
R673	North rift Extensometer recovery	PS8010 failed after 2 ½ hours on the bottom	No acoustic nav during most of dive
R674	Ashes	PS8010 failed after 1 ½ hours on bottom	No acoustic nav during most of dive

Where acoustic navigation was not possible due to equipment failure or local conditions, bottom positions were estimated using dead reckoning. These positions if taken within 50 m of the cage are usually accurate to within

+/- 10 m. In some cases the vent sites were already positioned using acoustic navigation and the location was found again by positioning the ship (and cage) over the bottom position. Review of the navigation logs for each dive can be used to determine whether fixes were made by dead reckoning or LBL acoustic positioning.

### 3.2 NeMO 2002 TRANSPONDER POSITIONS

#### North Rift Net (deployed 1998)

Reply Frequency (kHz)	UTM X	UTM Y	Latitude	Longitude	Depth	Turn around time
9.5	420814.7	5098603.9	46° 02.1857	130° 01.3988	1433.9	0.003
10.5	422722.9	5097596.3	46° 01.6548	129° 59.9096	1395.4	0.0030
8.0	4220055.5	5095969.4	46° 00.7580	130° 01.9608	1377.9	0.0030
7.5	422074.9	5094971.2	46°00.2330	130° 00.3862	1294.5	0.0030

#### Ashes Net (deployed 1998)

Reply Frequency (kHz)	UTM X	UTM Y	Latitude	Longitude	Depth	Turn around time
11.5	424283.3	5087181.5	45° 56.0418	129° 58.6011	1305.4	0.0030
10.5	424221.6	5084426.8	45° 54.5540	129° 58.6227	1340.4	0.0030
9.5	422490.4	5086188.6	45° 55.4937	129° 59.9789	1324.7	0.0030
11.0	422556.7	5088014.5	45°56.4800	129° 59.9453	1330.9	0.003

### 3.3 VENT, MARKER AND BENCHMARK POSITIONS (Updated 12-2003)

Vents and Markers	Area/Vent	UTM X	UTM Y	lat deg	lat (min)	long deg	long (min)	lat (decdeg)	long (decdeg)	Depth
91Vent	NRZ	421661	5098834	46	2.3160000	-130	0.7450020	45.0386000	-130.0124167	-1640
AX-Bmrk-1	Magnesia	423663	5088544	45	56.7732000	-129	59.0940000	45.9462200	-129.9849000	-1532
AX-Bmrk-4 [Mkr-65]	Bag City	423255	5085192	45	54.9606000	-129	59.3778000	45.9160100	-129.9896300	-1534
AX-Bmrk-5	Mkr-33	423838	5087111	45	56.0010000	-129	58.9452000	45.9333500	-129.9824200	-1525
AX-Bmrk-63 - [Mkrs 60/61]	Cald center	421717	5089568	45	57.3132000	-130	0.6102000	45.9552200	-130.0101700	-1534
AX-Bmrk-66	South Anom	422089	5079332	45	51.7890000	-130	0.2226000	45.8631500	-130.0037100	-1723
Bag City [Mkr-36/21] ('01)	nSRZ	423272	5085209	45	54.9700000	-129	59.3655000	45.9161667	-129.9894250	-1537
Blue Nose	98 lava flow - E side	423755	5088451	45	56.7264000	-129	59.0220000	45.9454400	-129.9837000	-1527
Bob	NRZ	421629	5098870	46	2.3350002	-130	0.7699980	45.0389167	-130.0128333	-1641
BPR	Cald center	421717	5089568	45	57.3132000	-130	0.6102000	45.9552200	-130.0101700	-1534
Casper (Coquille)	S caldera	422997	5085346	45	55.0422000	-129	59.5786000	45.9173700	-129.9929767	-1538
Castle - big chimney ('01)	98 lava flow - E side	424011	5086311	45	55.5701000	-129	58.8034000	45.9261683	-129.9800567	-1522
Castle Flattop [Mkr-N5] ('01')	Castle	424032	5086301	45	55.5645000	-129	58.7875000	45.9260750	-129.9797917	-1522
Circ	98 lava flow	423887	5086283	45	55.5550002	-129	58.8990000	45.9259167	-129.9816500	-1525
Cloud [Mkr-N4]	Cloud	423896	5087119	45	56.0052000	-129	58.9002000	45.9334200	-129.9816700	-1523
Cloud [Mkr-N6/21]	Cloud	423901	5087116	45	56.0040000	-129	58.8960000	45.9334000	-129.9816000	-1524
Coquille Vent Field	nSRZ	422991	5085365	45	55.0518000	-129	59.5834980	45.9175300	-129.9930583	-1537
Crack	ASHES	421424	5087135	45	55.9980000	-130	0.8130000	45.9333000	-130.0135500	-1547
Crevice	nSRZ	423175	5084648	45	54.6660000	-129	59.4240000	45.9111000	-129.9904000	-1540
Daves	ASHES	421408	5087159	45	55.0110002	-130	0.8260020	45.9335167	-130.0137667	-1547
Dying	nSRZ	423084	5085286	45	55.0110000	-129	59.5110000	45.9168500	-129.9918500	-1536
Easy	98 lava flow	423677	5088443	45	56.7199998	-129	59.0830020	45.9453333	-129.9847167	-1535
FeCity	nSRZ	423291	5085361	45	55.0524000	-129	59.3514000	45.9175400	-129.9891900	-1536

Vents and Markers	Area/Vent	UTM X	UTM Y	lat deg	lat (min)	long deg	long (min)	lat (decdeg)	long (decdeg)	Depth
FeHyde	ASHES	421406	5087100	45	55.9789998	-130	0.8269980	45.9329833	-130.0137833	-1547
Gollum	ASHES	421422	5087166	45	56.0149998	-130	0.8149980	45.9335833	-130.0135833	-1547
Hairdo	ASHES	421391	5087157	45	56.0100000	-130	0.8389980	45.9335000	-130.0139833	-1547
Hell	ASHES	421372	5087135	45	55.9980000	-130	0.8539980	45.9333000	-130.0142333	-1550
Inferno	ASHES	421397	5087162	45	56.0130000	-130	0.8340000	45.9335500	-130.0139000	-1547
Joystick [Mkr-42]	nSRZ	423342	5085505	45	55.1302980	-129	59.3137800	45.9188383	-129.9885630	-1534
Lamphere Chimneys ('01)	CASM	420496	5093375	45	59.3602000	-130	1.5937000	45.9893367	-130.0265617	-1576
Magnesia [Mkr-67]	98 lava flow	423661	5088545	45	56.7739998	-129	59.0959980	45.9462333	-129.9849333	-1532
Marshmallow	ASHES	421395	5087175	45	56.0189760	-130	0.8159820	45.9336496	-130.0135997	-1547
Medusa	ASHES	421395	5087141	45	56.0010000	-130	0.8359980	45.9333500	-130.0139333	-1547
Milky [Mkr-N2]	98 lava flow	423673	5088424	45	56.7085200	-129	59.0851800	45.9451420	-129.9847530	-1533
Minisnow [Mkr-N9]	98 lava flow	423711	5088141	45	56.5570002	-129	59.0530020	45.9426167	-129.9842167	-1524
Mkr-108 Vent	98 lava flow	423784	5086589	45	55.7190000	-129	58.9819980	45.9286500	-129.9830333	-1524
Mkr-113 Vent ('01)	nSRZ	423372	5085937	45	55.3637000	-129	59.2943000	45.9227283	-129.9882383	-1526
Mkr-33 Vent ('01)	98 lava flow	423855	5087092	45	55.9906000	-129	58.9318000	45.9331767	-129.9821967	-1524
Mkr-65	BagCity nearby	423255	5085192	45	54.9608460	-129	59.3777340	45.9160141	-129.9896289	-1534
Mkr-N1	98 lava flow	423718	5087828	45	56.3880000	-129	59.0449980	45.9398000	-129.9840833	-1522
Mkr-N3	98 lava flow	423637	5088278	45	56.6280000	-129	59.1120000	45.9438000	-129.9852000	-1529
Mkr-N41	98 lava flow	423922	5087428	45	56.1730002	-129	58.8829980	45.9362167	-129.9813833	-1521
Mkr-N44	98 lava flow	423658	5087792	45	56.3680002	-129	59.0899980	45.9394667	-129.9848333	-1522
Mkr-N7	98 lava flow	423886	5087774	45	56.3580000	-129	58.9140000	45.9393000	-129.9819000	-1520
Mushroom	ASHES	421405	5087168	45	56.0160000	-130	0.8280000	45.9336000	-130.0138000	-1547
Nascent [Mkr-M]	98 lava flow	423905	5087387	45	56.1504000	-129	58.8958200	45.9358400	-129.9815970	-1520
OldFlow	98 lava flow - E side	423898	5087455	45	56.1868020	-129	58.9023000	45.9364467	-129.9817050	-1522
OldWorms	98 lava flow - E side	423785	5088418	45	56.7063000	-129	58.9984980	45.9451050	-129.9833083	-1526
Ouzo	98 lava flow	423680	5088497	45	56.7490002	-129	59.0809980	45.9458167	-129.9846833	-1529
Oxide	98 lava flow	423648	5088456	45	56.7270000	-129	59.1049980	45.9454500	-129.9850833	-1533
Phoenix	ASHES	421391	5087130	45	55.9950000	-130	0.8389980	45.9332500	-130.0139833	-1547
Pillar	nSRZ	423591	5085929	45	55.3620000	-129	59.1250020	45.9227000	-129.9854167	-1524
Roof	98 lava flow	423690	5088129	45	56.5500000	-129	59.0689980	45.9425000	-129.9844833	-1523
ROPOS	ASHES	421386	5087134	45	55.9969998	-130	0.8430000	45.9332833	-130.0140500	-1547
Shepherd Vent ('01)	CASM	420446	5093324	45	59.3321000	-130	1.6320000	45.9888683	-130.0272000	1580
Snail [Mkr-N8]	Snail	423877	5087088	45	55.9920000	-129	58.9140000	45.9332000	-129.9819000	-1524
Snow	98 lava flow	423827	5086417	45	55.6270002	-129	58.9470000	45.9271167	-129.9824500	-1525
SnowBlower	98 lava flow	423719	5087835	45	56.3920002	-129	59.0440020	45.9398667	-129.9840667	-1522
SteveMound	ASHES	421348	5087129	45	55.9950000	-130	0.8050020	45.9332500	-130.0134167	-1547
Styx	ASHES	421412	5087132	45	55.9969998	-130	0.8220000	45.9332833	-130.0137000	-1547
T&S Spires ('01)	CASM	420449	5093355	45	59.3492000	-130	1.6301000	45.9891533	-130.0271683	-1583
ThePit	98 lava flow	423718	5087823	45	56.3850000	-129	59.0449980	45.9397500	-129.9840833	-1522
Tombstone	W of ASHES	421590	5086597	45	55.7689998	-130	0.6799980	45.9294833	-130.0113333	
Tunncliffe	W of ASHES	421249	5087178	45	56.0200002	-130	0.9490020	45.9336667	-130.0158167	-1546
Village (Diffuse)	nSRZ	423969	5086306	45	55.5672000	-129	58.8358000	45.9261200	-129.9805967	-1523
Virgin	ASHES	421430	5087174	45	56.0190000	-130	0.8089980	45.9336500	-130.0134833	-1547
Virgin's Daughter	ASHES	421430	5087182	45	56.0228160	-130	0.8090820	45.9337136	-130.0134847	-1547
Vixen (Coquille)	nSRZ	422995	5085336	45	55.0368000	-129	59.5802000	45.9172800	-129.9930033	-1538
White [Mkr-I]	ASHES	421419	5087183	45	56.0239998	-130	0.8179980	45.9337333	-130.0136333	-1545

## 4.0 ROPOS SAMPLES/EXPERIMENTS 2002

### 4.1 SAMPLE ABBREVIATIONS/DESCRIPTIONS

Sample Type	abbreviations	Sample Type	abbreviations
Biology	Bio	McLane Pump	MP
Bacteria Trap	BT	Rock	RK
Gas Tight Bottle	GTB	Sulfide	SF
Hot Fluid Sample	HFS	Iron Oxides	FeO
Hobo	hobo	Niskin	niskin
MTR	MTR	Suction Sample	SS
Larval net	net	Tubeworm grab	TWG
Larval Array	LA	water	water
Larval Trap	LT	wood	wood

#### Temperature probe description:

hobo 152 - 419 degrees C  
MTR 2 - 70 degrees C

#### Sample Number Format:

Dive# - Sample Type - Sample Descriptor (if applicable) - Sample#  
Example: R765-HFS-20-0001

### 4.2 R658 - 2002 Samples

Sample	Location	Mkr	Z	Hdg	Time	R658 2002 Sample Descriptions	Investigator
R658-MP-0001	above Cloud		1258	320	08:04:14 Jul 16 2002	McLane pump stopped. Sample in water column on the way down.	Leveille

### 4.3 R659 - 2002 Samples

Sample	Location	Mkr	Z	Hdg	Time	R659 2002 Sample Descriptions	Investigator
R659-LA-G-0001	Cloud periphery		1523	47	17:16:01 Jul 16 2002	Recovering Larval Array G (LA-G) from the "far" site (8m SW of Mkr-N6). Not nearly as much stuff on the plates as at the near site. Looks like some limpets on it.	Metaxas
R659-SS-J3-0002	Cloud	N6	1524	2	18:07:08 Jul 16 2002	Suction sample for temperature at the hole (Mkr-N6). Temperature was 5.6 degrees in the hole and steady (temperature is from the alien). Start 1807 End 1811.	Butterfield
R659-LA-E-0003	Cloud	N6	1524	341	20:57:15 Jul 16 2002	Larval array E from last year recovered near Cloud N6.	Metaxas
R659-MTR-340&1051-0004	Cloud	N6	1524	24	21:22:40 Jul 16 2002	3 hour MTR measurement - twin pack of MTRs (340 and 1051). The MTRs were in the hole for 3 hours. The temperature was consistently 8.3 - 8.4C. Logged as one sample - the exception to the rule.	Moyer
R659-SS-J2-0005	Cloud	N6	1524	57	21:58:17 Jul 16 2002	Suctioning particulate matter (filamentous bacterial mat?) from old tubeworms into jar-2. Start 2157 End 2205.	Leveille
R659-SS-J1-0006	Cloud	N6	1525	337	22:10:08 Jul 16 2002	Suction sample of particulate matter from live tubeworms with filamentous bacteria into jar-1. Start 22:11 End 2214.	Leveille
R659-TWG-0007	Cloud	N6	1525	341	22:16:20 Jul 16 2002	Tubeworm grab into port bio box from the region just suction sampled.	Tunncliffe
R659-MTR-4101-0008	Cloud	N6	1525	333	22:25:43 Jul 16 2002	MTR-4101 (deployed 2001) recovered from the hole at Mkr-N6. It was attached to MTR-3292 which will be sample 0009.	Embley
R659-MTR-3292-0009	Cloud	N6	1525	336	22:26:43 Jul 16 2002	MTR-3292 recovered. It was deployed in 2001 - attached to MTR-4101 (sample # 0008).	Embley
R659-hobo-128-0010	Castle		1520	107	23:23:17 Jul 16 2002	Recovered HOBO-128 temperature probe from the big chimney (deployed in 2001).	Embley

### R660 - 2002 Dive Aborted. No samples

#### 4.4 R661 - 2002 Samples

Sample	Location	Mkr	Z	Hdg	Time	R661 2002 Sample Descriptions	Investigator
R661-MTR-3 201-0001	Castle		1521	299	00:53:27 Jul 18 2002	Recovered MTR-3201 (deployed in '01). Placed in biobox.	Embley
R661-MTR-3 049-0002	Bag City		1535	354	23:44:53 Jul 18 2002	Recovered MTR-3049 (deployed '01). Placed in port side biobox.	Embley
R661-MTR-3 029-0003	Bag City		1535	359	23:47:38 Jul 18 2002	Recovered MTR-3029 (deployed '01). Placed into port side biobox.	Embley
R661-hobo-1 53-0004	Vixen		1537	218	00:43:08 Jul 19 2002	Recovered hobo-153 (depl '01). Placed in port biobox. The chimney had fallen over but grew back up around it. Tmax=323C.	Embley
R661-hobo-1 52-0005	Vixen		1538	213	00:44:19 Jul 19 2002	Recovered hobo-152. Placed in port biobox. Vixen is vigorously venting - knocked over part of the chimney. Tmax=323C.	Embley
R661-MTR-4 128-0006	Casper		1538	89	01:10:44 Jul 19 2002	Recovering MTR-4128 (depl '01). Placed in port biobox.	Embley
R661-MP-00 21	Snail to Magnesia		1425	34	06:14:58 Jul 19 2002	McLane Pump. Start 0540. End 0614. 205 L pumped. Pump on during transit from Snail to Magnesia. Total distance 800m.	Leveille
R661-SS-J4- 0007	Mkr-33	33	1525	191	03:23:00 Jul 19 2002	Suction sample jar-4. Suctioning for particulates in flow near crack at Mkr 33. Start 0323 End 0329.	Leveille
R661-SS-J5- 0008	Mkr-33	33	1525	195	03:40:10 Jul 19 2002	Suctioning microbial mat in jar-5. Start 0340 End 0343.	Moyer
R661-SS-J6- 0009	Mkr-33	33	1525	197	03:48:53 Jul 19 2002	Suctioning large white microbial mat into jar-6. Marker 33 crack. Start 0348 End 0354.	Moyer
R661-SS-J7- 0010	Mkr-33	33	1524	187	03:56:30 Jul 19 2002	Suctioning sample for tubeworms (Ridgeia) in crack at Mkr 33 into jar-7. Note: video recorded onto Bob's DV deck. Start 0356 End 0403.	Leveille [ssmp: Moyer]
R661-SS-J1- 0011	Mkr-33	33	1524	213	04:15:58 Jul 19 2002	Turning pump on to initiate suction sample on lowest speed. Water sample at highest temp spot (T=7.5 on T2). Start 0415 End 0420.	Butterfield
R661-SS-J2- 0012	Mkr-33	33	1524	210	04:23:06 Jul 19 2002	Suction limpets in high flow area into jar-2. Start 0423 End 0430. T=10.	Bates
R661-SS-J3- 0013	Mkr-33	33	1524	186	04:44:16 Jul 19 2002	Suctioning limpets from low flux area into jar-3. Start 0348. End 0354.	Bates
R661-MTR-3 053-0014	Mkr-33	33	1524	184	04:51:16 Jul 19 2002	Recovering MTR-3053 to starboard biobox (depl '01). MTR furthest east position in the crack.	Embley
R661-BT-61- 0015	Mkr-33	33	1524	203	05:03:24 Jul 19 2002	BacTrap-61 into starboard biobox (depl '01). From the crack area.	Moyer [ssmp: Bates]
R661-BT-62- 0016	Mkr-33	33	1524	197	05:05:35 Jul 19 2002	Recovering BacTrap-62 into starboard biobox (depl '01). MTR attached and will be logged in the next sample number.	Moyer
R661-MTR-3 043-0017	Mkr-33	33	1524	197	05:07:01 Jul 19 2002	MTR-3043 (depl '01) recovered attached to BacTrap-62.	Embley
R661-MTR-3 039-0018	Mkr-33	33	1524	209	05:15:54 Jul 19 2002	Recovering MTR-3039 (depl '01) and stowing in starboard biobox.	Embley
R661-MTR-3 054-0019	Snail		1524	96	05:34:25 Jul 19 2002	Recovering MTR-3054 (depl '01) into starboard biobox.	Embley
R661-MTR-3 055-0020	Snail		1524	302	05:41:04 Jul 19 2002	Recovering MTR-3055 (depl '01) to starboard biobox. Located in a clump of dead tubeworms.	Embley
R661-MP-00 21	Snail to Magnesia		1425	34	06:14:58 Jul 19 2002	McLane Pump. Start 0540. End 0614. 205 L pumped. Pump on during transit from Snail to Magnesia. Total distance 800m. [Snail to Magnesia]	Leveille
R661-net-00 22	Magnesia to BPR area		1530	300	08:29:44 Jul 19 2002	Starboard net. 2-3 m off bottom. Speed avg 1.1 knots. Traveled 1237m +/- 30m. Start 0829 End 0913. Bearing 297. [500m N of Magnesia to BPR area]	Metaxas



## 4.5 R662 - 2002 Samples

Sample	Location	Mkr	Z	Hdg	Time	R662 2002 Sample Descriptions	Investigator
R662-LA-L-0006	ROPOS		1545	137	05:41:20 Jul 20 2002	Larval Array L successfully placed in the biobox.	Metaxas / Kelly
R662-hobo-126-0001	Virgin		1547	343	03:58:24 Jul 20 2002	Hobo-126 recovered from Virgin. (The 2 hobos at were attached to LA-K when it was recovered).	Embley
R662-hobo-130-0002	Virgin		1547	346	04:00:25 Jul 20 2002	Recovered hobo-130 (it was attached to LA-M at Virgin) [4214320/5087174 45 56.019 130 0.809]	Embley
R662-LA-0003	Virgin		1548	27	04:08:12 Jul 20 2002	Larval Array M from Virgin Mound secured in biobox (deployed '01). Part of anhydrite chimney was attached to the array and fell into the biobox.	Metaxas / Kelly
R662-GTB-12-0004	Virgin		1548	62	04:17:04 Jul 20 2002	Starboard Gas Tight Bottle-12.	Evans [ssmp: Butterfield / Lilley
R662-GTB-6-0005	Virgin		1547	61	04:17:19 Jul 20 2002	Port Gas Tight Bottle-6.	Evans [ssmp: Butterfield / Lilley
R662-MP-1-0007	ROPOS		1544	235	07:20:39 Jul 20 2002	McLane pump. Start at ROPOS Vent 0610. Stop 0720 at elevator. Integrated sample; 1300 L total volume. Sample peripheral to vent sites. [Locations: Ropos 45 55.997 130 0.843; Elevator 45 55.958 130 0.830]	Tunncliffe / Skebo
R662-SS-J1-0008	Hell		1546	307	09:29:21 Jul 20 2002	Suction sample of limpets from high venting at base of Hell vent and on chimney. Placing in jar-1. Tmax=17. Looking at specimens in jar. Time actually 0922.	Bates
R662-SS-J2-0009	Hell		1546	297	09:58:43 Jul 20 2002	Suction sample into jar-2 - around transplant cage. Low flow sample but area potentially seeded with inflow limpets (escapes from transplant cage transfer).	Bates
R662-SS-J3-0010	Hell		1545	303	10:15:20 Jul 20 2002	First suction sample from sulfide worms on Hell Vent at base of beehive - highest flow, into jar-3. Start 10:15 End 10:21.	Leveille
R662-SS-J4-0011	Hell		1545	307	10:23:50 Jul 20 2002	Second suction sample from sulfide worms on Hell - 1 ft from first suction on beehive - lower flow than previous sample. Start 10:23 End 10:26.	Leveille
R662-SS-J5-0012	Hell		1545	302	10:30:58 Jul 20 2002	Third suction sample from sulfide worms - 2 ft further back from original suction on beehive - lower flow than previous sample, into jar-5. Start 10:30 End 10:33.	Leveille
R662-MTR-3041-0013	Gollum		1544	6	11:00:13 Jul 20 2002	Recovering MTR-3041 (depl '01).	Embley
R662-MTR-3334-0014	Gollum		1545	330	11:06:09 Jul 20 2002	Recovering MTR-3334 (depl '01).	Embley
R662-MP-2-0015	Gollum		1545	331	11:06:45 Jul 20 2002	McLane pump port side - 200L at approx. 9 L/min - 1377 seconds of pumping. Start 1035. Not sure when stopped - need to calculate.	Leveille
R662-BT-64-0016	Gollum		1545	304	11:08:37 Jul 20 2002	Recovered BacTrap-64 (depl '01).	Moyer
R662-BT-63-0017	Gollum		1544	242	11:13:43 Jul 20 2002	Recovering BacTrap-63 (depl '01).	Moyer
R662-SS-J6-0018	Fe-Hyde		1545	309	12:38:28 Jul 20 2002	Slurping iron oxides into jar-6. Start 1238 End 1240. Start2 1241 End2 1243.	Moyer
R662-SS-J7-0019	Fe-Hyde		1545	315	12:46:28 Jul 20 2002	Slurping more iron oxides into jar-7. Start 1246 End 1250.	Moyer
R662-anhydrite-0021	Virgin		1470	155	20:16:02 Jul 20 2002	Anhydrite that had grown over the larval array at Virgin. A few chunks.	Embley
R662-JFM-0020	Crack		1546	115	19:57:24 Jul 20 2002	Johnson Flow Meter at Crack vent recovered to the 7 function arm; stashed in the bio box.	Johnson
R662-wood-0022	Crack		938	65	20:43:51 Jul 20 2002	Wood that Verena left on the bottom a year ago (depl '01). Picked up at the end of the dive (sample time incorrect).	Tunncliffe
R662-LT-1-0023	ROPOS		938	65	20:43:51 Jul 20 2002	Larval Tube-1 that has been capped on the bottom since summer '01. It was deployed at ROPOS vent before it was capped. (time not correct for this entry)	Metaxas

Sample	Location	Mkr	Z	Hdg	Time	R662 2002 Sample Descriptions	Investigator
R662-LT-4-0024	ROPOS		938	65	20:43:51 Jul 20 2002	Larval Tube-4 that has been capped on the bottom since summer '01. It was deployed at ROPOS vent before it was capped. (time not correct for this entry)	Metaxas
R662-LT-12-0025	Virgin		938	65	20:43:51 Jul 20 2002	Larval Tube-12 that has been capped on the bottom since summer '01. It was deployed at Virgin before it was capped. (time not correct for this entry)	Metaxas
R662-LT-9-0026	Virgin		938	65	20:43:51 Jul 20 2002	Larval Tube-9 that has been capped on the bottom since summer '01. It was deployed at Virgin before it was capped. (time not correct for this entry)	Metaxas

## R663 - R672 at Explorer Ridge

### 4.6 R673 - 2002 Samples

Sample	Location	Mkr	Z	Hdg	Time	R673 2002 Sample Descriptions	Investigator
R673-EX-3-0001	North Rift Zone		1588	267	04:00:00 Aug 03 2002	Recovering extensometer 3. On jumbled lobate on the west edge of the rift. [420975/5096753]	Chadwick
R673-EX-4-0002	North Rift Zone		1594	197	04:33:24 Aug 03 2002	Recovering extensometer 4. Sitting on jumbled sheet flow; 2m higher than surrounding lobate flow. On the west side of the rift. [420767/5096797].	Chadwick
R673-EX-1-0003	North Rift Zone		1592	158	05:23:20 Aug 03 2002	Recovering extensometer 1 on a jumbled ridge. East side of the rift. [421196/5096711]	Chadwick
R673-EX-2-0005	North Rift Zone		1592	179	06:33:02 Aug 03 2002	Recovering extensometer 2 on jumbled ridge. East side of Rift. [421035/5096739]	Chadwick
R673-EX-5-0005	North Rift Zone		1596	258	07:50:49 Aug 03 2002	Recovering extensometer 5 in area of lobate lavas with some small collapsed pits. [420590/5096865]	Chadwick

### 4.7 R674 - 2002 Samples

Sample	Location	Mkr	Z	Hdg	Time	R674 2002 Sample Descriptions	Investigator
R674-GTB-s tbd-0001	Vixen		1536	251	22:15:08 Aug 03 2002	Firing Starboard gas tight bottle-12 at 22:15.	Evans [ssmp: Butterfield / Lilley]
R674-GTB-p ort-0002	Vixen		1536	253	22:16:51 Aug 03 2002	Firing port gas tight bottle-6 at 22:17.	Evans [ssmp: Butterfield / Lilley]
R674-RK-00 03	Vixen		1536	305	22:29:41 Aug 03 2002	A chunk of anhydrite from the base of Vixen was sampled. Placed in the starboard bio box.	Embley
R674-SS-J4- 0004	near Vixen		1536	318	22:44:29 Aug 03 2002	Suction sample of fluid and floc into jar-4. 30C on the intake 20C on the output of the suction sampler. Start 22:44 Stop 22:46. [422995/5085336]	Butterfield [ssmp: Bolton]
R674-MTR-4 108-0005	greater Coquille		1536	172	23:16:03 Aug 03 2002	MTR-4108 recovered to starboard biobox. [42291/5085365]	Embley
R674-SS-JJ 2-0006	FeCity		1534	107	00:24:18 Aug 04 2002	Suction sample of iron oxide started into jar-J2. Tmax=4C. Start 00:18 End 00:42. fecity.log file on alien probe.	Moyer
R674-SS-JJ 3-0007	FeCity		1534	89	00:42:13 Aug 04 2002	Suction sample of iron oxide started into jar-J3. Tmax=4C. Start 00:42 end 00:50. Note: scale worm covered in yellow-stained bacteria in sample. fecity.log file on alien probe.	Moyer
R674-SF-00 08	Castle		1520	38	02:27:50 Aug 04 2002	Large chunk of sulfide chimney from Castle - placed in stbd biobox. Depth=1516.	Lupton [ssmp: Embley / Williams-Jones]

Sample	Location	Mkr	Z	Hdg	Time	R674 2002 Sample Descriptions	Investigator
R674-SF-ba cmat-0009	Castle		1513	39	02:39:13 Aug 04 2002	Another part of Castle's sulfide covered with white filamentous bacteria. Into starboard biobox. This sample was supposed to be a sulfide sample for Embley - but turned into a bacteria sample for Moyer. depth=1514.	Moyer
R674-SS-J5- 0010	Village		1523	183	02:56:57 Aug 04 2002	Water sample into jar-5; T1=14 T2=7 Tmax=21. Start 3:00 Stop 3:02	Butterfield
R674-SS-J7- 0011	Village		1523	186	03:02:33 Aug 04 2002	Big fat limpets into the flush jar-J7. Tmax=7.7 Start 3:03:45 Stop 3:05:50.	Lee [ssmp: Bates]
R674-SS-J2- 0012	Village		1523	185	03:07:15 Aug 04 2002	Peripheral limpets on basalt into jar-2. Tmax=0.7C; alien stopped working. Two sites sampled - one not in the flow - another in slight flow. Start 0313 Stop 0320. alien temp log filename: villaman.log	Bates
R674-RK-00 13	Village		1523	136	03:30:26 Aug 04 2002	Basalt sample collected in diffuse flow; part of new flow.	Gillis / Channing
R674-SS-J4- 0014	Village		1523	167	03:49:28 Aug 04 2002	Suction sampling bacterial mats into jar-4. Start 0349 End 0356.	Moyer
R674-MP-00 15	Cloud	Mkr- N4	1521	130	06:13:15 Aug 04 2002	Stbd McLane pump - A few meters off the bottom while approaching Cloud. The pump is averaging 7.5 L/min. Vol=9240 L 1914 seconds. Start 0541 End 0613.	Leveille
R674-BT-66- 0016	Cloud	Mkr- N4	1522	301	06:55:13 Aug 04 2002	Bacterial trap-66 placed in port biobox - deployed R659.	Moyer
R674-BT-65- 0017	Cloud	Mkr- N4	1521	298	06:57:07 Aug 04 2002	Bacterial trap-65 placed in port side biobox - deployed R629.	Moyer
R674-RK-00 18	Cloud	Mkr- N4	1524	281	07:13:50 Aug 04 2002	A chunk of basalt from the orifice around Cloud placed in the purse.	Channing / Gillis
R674-osmo- 0019	Cloud	Mkr- N4	1523	309	07:22:54 Aug 04 2002	Retrieving the Osmo-sampler at Cloud - deployed R627.	Wheat
R674-MTR-3 045-0020	Cloud	Mkr- N4	1523	235	07:57:48 Aug 04 2002	Recovered MTR-3045 at Mkr-N4 Cloud. Deployed on dive R625. Placed in port biobox. MTR is covered in limpets.	Embley

## 5.0 ROPOS DIVES - 2002

### 5.1 ROPOS 2002 DIVE STATISTICS

9 ROPOS Dives at Axial	R657 - R662, R672 - R674
Total Wet Time	112.3 hours
Total Bottom Time	92.63 hours
Total Number of ROPOS Samples	84

### 5.2 ROPOS 2002 DIVE SUMMARIES

Dive	Area	wet time (UTC)	Julian Day(s)	wet time (hrs)	bottom time (UTC)	Julian Day(s)	bottom time (hrs)	smp #	NeMO 2002 ROPOS Dive Summary
R657	nSRZ (n/a)	7/15 2258 - 7/16 0039	196 197	1.68	n/a		n/a	0	ROPOS made it down to 960 meters then had to come back to the surface. The sit-cam was not working and there could be other problems. Dive aborted before getting to the bottom.
R658	nSRZ (n/a)	7/16 0712 - 7/16 1057	197	3.75	7/16 0822 - 7/16 1007	197	1.75	1	The dive was aborted because a gauge fell off the vehicle, but first we found the elevator. Biobox and larval traps set down south of the elevator. Did not make it to Cloud. Dive aborted.
R659	nSRZ (Cloud, Castle)	7/16 1431 - 7/17 0142	197 198	11.2	7/16 1530 - 7/17 0115	197 - 198	9.75	10	<b>Cloud</b> Recovered LA-G, 2 MTR, 3 SS, 1 TWG. Deployed LA-O at Cloud "far" site, LA-P at "near" site, 2BT, 2MTR. <b>Castle</b> Recovered hobo and tried positioning nose-cone for RAS.
R660	Southern Pillow Mound	7/17 1102 - 7/17 1549	198	4.78	7/17 1234 - 7/17 1435	198	2.02	0	Pressure sensor dive. Started at the <b>South Pillow Mound</b> Bmrk-66. The first pressure sensor measurement was successful (30 minutes) at Bmrk-66. When ROPOS ascended to head to BagCity it was discovered the plankton net mounting had come loose. Dive aborted.
R661	Southern pillow mound to caldera center	7/17 2027 - 7/19 1155	198 199 200	39.5	7/17 2142 - 7/19 1031	198 - 200	36.82	22	Pressure sensor measurements completed. Started at <b>BagCity</b> Bmrk-4 but couldn't find it. On to <b>Mkr-33</b> area Bmrk-5, <b>Magnesia</b> Bmrk-1, <b>BPR</b> Bmrk-63, <b>Magnesia</b> Bmrk-1, <b>Mkr-33</b> area Bmrk-5, <b>BagCity</b> Bmrk-4 (found it this time), <b>SPM</b> Bmrk-66, <b>BagCity</b> Bmrk-4, <b>Mkr-33</b> area Bmrk-5, <b>Magnesia</b> Bmrk-1, <b>BPR</b> Bmrk-63 to close the loop. <b>Castle</b> Check if it is good candidate for RAS - it's not. Recovered MTR. <b>BagCity</b> Recovered 2 MTR. <b>Vixen</b> Recovered 2 hobos. <b>Casper</b> Recovered 1 MTR. <b>Mkr-33</b> Recovered 3 MTR, 2 BT, 7 SS. Deployed 2 MTR. <b>Snail</b> Rec 2 MTR. Snail to <b>Magnesia</b> : 1McLane. <b>Magnesia</b> to <b>BPR</b> 1 McLane.

Dive	Area	wet time (UTC)	Julian Day(s)	wet time (hrs)	bottom time (UTC)	Julian Day(s)	bottom time (hrs)	smp #	NeMO 2002 ROPOS Dive Summary
R662	ASHES (Marshmallow, Virgin, ROPOS, Hell, Gollum, Dave's)	7/19 2350 - 7/20 2144	200 201	21.9	7/20 0109 - 7/20 2016	200 - 201	19.12	26	Located the elevator and 2 RAS samplers, then sampled and deployed experiments. <b>Marshmallow</b> Deployed LA-K. <b>Virgin</b> Recovered LA-M, 2 hobos, 2 LT (9&12), 2 GTB, 1 anhydrite. Positioned high-temp RAS for year-long deployment at Virgin. <b>ROPOS</b> Recovered LA-L, 2 LT (1&4) 1McLane. Deployed LA-Z. <b>Hell</b> 5 SS. Deployed Amanda's transplant cage. <b>Gollum</b> Recovered 2 MTR, 2 BT, 1McLane. Deployed 2 BT. <b>FeHyde</b> 2 SS. <b>Marshmallow</b> Deployed LA-K. <b>Crack</b> Recovered Johnson flow meter, wood. Attempt to depl lo-temp RAS at <b>Dave's</b> . Both RAS tasks must be finished next dive. Problems with hi-temp RAS temp program. Lo-temp RAS is too heavy. ROPOS was having a problem with the arm and the color cam had been knocked out of place. Left big Johnson flow-meter to deploy at Crack on next dive.
R672	ASHES (Virgin, Crack)	8/2 1756 - 8/2 2212	214	4.27	8/2 1909 - 8/2 2118	214	2.15	0	<b>Virgin</b> Righted the hot RAS tripod. <b>Crack</b> The cold RAS and the Johnson flow meter were positioned. The dive was a great success - and with only 2 hours on the bottom.
R673	NRZ (Extensometers, Bob)	8/3 0220 - 8/3 1510	215	12.8	8/3 0326 - 8/3 1418	215	10.87	5	<b>NRZ</b> Recovered the 5 extensometers on the NRZ. EX 1-4 deployed 2000; EX-5 deployed 1999. Also visited <b>Bob</b> vent to look around. Did not recover the transponders up here. All extensometers made it to the surface in the elevator and on board.
R674	nSRZ (Coquille, FeCity, Castle, Village, Cloud)	8/3 2057 - 8/4 0922	215 216	12.4	8/3 2204 - 8/4 0813	215 - 216	10.15	20	Visited vents on the east side of the caldera. Started at Coquille vent field and ended at Cloud. <b>Vixen</b> Recovered 1 MTR, 2 GTB, 1 RK, 1 SS. Deployed 2 hobos. <b>Coquille diffuse flow</b> Recovered 1 MTR. <b>FeCity</b> 2 SS. <b>Castle</b> Recovered 2 SF, 1 with bacmat. Deployed 1 hobo. <b>Village</b> Recovered 1 MTR, 4 SS, 1 RK. Deployed 1 MTR. <b>Cloud</b> Recovered 1 MTR, 1 osmo, 2BT, 1 McLane, 1RK. Deployed 1 MTR. Digital images were recorded at all vents with new digital 5-megapixel camera.
	Totals		196 -200; 214-216	112		197 - 200; 214 - 216	92.63	84	

### 5.3 R657 - 2002 Dive Log

ROPOS made it down to 960 meters then had to come back to the surface. The sit-cam was not working and there could be other problems. Dive aborted before getting to the bottom.

Time (UTC)	Z (m)	Hdg	R657 2002 Comments	Samples	Investigator	FrGrab
22:58:58 Jul 15 2002	1	70	ROPOS in the water.			
23:33:58 Jul 15 2002	702	327	McLane Pump tuned on. 8L/min pumping rate.			
23:47:57 Jul 15 2002	964	331	Problems with ROPOS. Ground fault - lost the sitcam. Will be returning to the surface.			
23:50:40 Jul 15 2002	893	323	ROPOS coming back up.			
00:01:14 Jul 16 2002	0	0	Can't stop the McLane pump. Will not use sample.			
00:12:15 Jul 16 2002	0	0	Lost serial data transmission.			
00:16:14 Jul 16 2002	320	262	Data back.			
00:39:17 Jul 16 2002	2	66	ROPOS on deck. End of Dive.			

## 5.4 R658 - 2002 Dive Log

The dive was aborted because a gauge fell off the vehicle, but first we found the elevator. Biobox and larval traps set down south of the elevator. Did not make it to Cloud. Dive aborted.

Time (UTC)	Z (m)	Hdg	R658 2002 Comments	Samples	Investigator	FrGrab
07:12:59 Jul 16 2002	2	72	ROPOS in water.			
07:39:36 Jul 16 2002	581	245	McLane pump on at 8.5 L/min.			
08:04:14 Jul 16 2002	1258	320	McLane pump sample. Start 0739 Stop 0804. Sample taken in the water column on the way down. [above Cloud]	R658-MP-0001	Leveille	
08:12:05 Jul 16 2002	1454	143	ROPOS cage stopped at 1455 meters.			
08:12:49 Jul 16 2002	1457	207	ROPOS leaving cage.			
08:22:51 Jul 16 2002	1515	258	Bottom sighted.			
08:25:08 Jul 16 2002	1520	189	Looking for elevator.			
08:26:32 Jul 16 2002	1516	188	Cage at 1489 meters.			
08:31:04 Jul 16 2002	1515	292	Still looking for elevator.			
08:35:48 Jul 16 2002	1515	290	Dimming lights to look for strobe - still looking for elevator.			
08:42:34 Jul 16 2002	1519	187	Cage motor off - still looking for that rascally elevator.			
08:44:43 Jul 16 2002	1518	249	Elevator location fixed - due North - still looking.			
08:45:55 Jul 16 2002	1521	357	Color camera seems to be fritzing on and off but it's still running.			
08:48:50 Jul 16 2002	1519	3	Getting fix on ROV - cage motor off.			
08:51:06 Jul 16 2002	1518	243	Oh where oh where has the elevator gone...			
08:57:13 Jul 16 2002	1514	353	Oh where oh where can it be...			
09:00:33 Jul 16 2002	1509	232	With its larval traps and its yellow floats on...			
09:02:51 Jul 16 2002	1520	169	Way down deep under the sea - hey there's the weight from last years elevator.			
09:03:36 Jul 16 2002	1519	166	ROPOS cage.			R658-001
09:03:45 Jul 16 2002	1520	170	Elevator sighted - strobe does not seem to be on - Metaxas VCR starting.			
09:04:18 Jul 16 2002	1519	143	Elevator.			R658-002
09:07:52 Jul 16 2002	1520	142	Getting traps out of boxes on elevator.			
09:12:20 Jul 16 2002	1521	234	Coming up on elevator to retrieve larval traps.			
09:13:36 Jul 16 2002	1522	240	Elevator close up.			R658-003
09:16:48 Jul 16 2002	1523	240	Grabbing the monkey fist and opening the box.			
09:20:51 Jul 16 2002	1523	221	Larval traps on elevator.			R658-004
09:21:14 Jul 16 2002	1523	216	Still working on opening the box.			
09:28:28 Jul 16 2002	1523	122	The box continues to misbehave.			
09:33:22 Jul 16 2002	1523	112	Box is off the elevator - setting it on bottom so ROPOS can grab it by the handles.			
09:37:45 Jul 16 2002	1525	139	Have the box by the handle - heading to Cloud.			
09:42:20 Jul 16 2002	1520	83	Still on the way to Cloud.			
09:43:21 Jul 16 2002	1519	92	Crab.			
09:45:07 Jul 16 2002	1515	83	Ship is moving toward Cloud.			
09:48:38 Jul 16 2002	1518	196	Ship has arrived - ROPOS still moving to Cloud.			
09:50:01 Jul 16 2002	1512	200	Waiting for cage movement to ease - still looking for Cloud.			
09:56:20 Jul 16 2002	1521	248	A gauge seems to have disappeared on the ROV - stopped to find it using the camera.			

Time (UTC)	Z (m)	Hdg	R658 2002 Comments	Samples	Investigator	FrGrab
10:00:22 Jul 16 2002	1521	267	Trying to decide what to do with Metaxas box so ROV can come back to find the gauge.			
10:01:48 Jul 16 2002	1521	332	Back at elevator - leaving box here so ROPOS can come up to find out what happened to the gauge.			
10:02:44 Jul 16 2002	1524	353	What is this??? Might be iron oxidation.			R658-005
10:03:27 Jul 16 2002	1524	324	Box is on the bottom south of the elevator facing North.			
10:07:09 Jul 16 2002	1483	325	Heading for cage to come up.			
10:07:37 Jul 16 2002	1483	290	ROPOS in cage - end of bottom time.			
10:51:48 Jul 16 2002	4	298	ROPOS at the surface.			
10:57:29 Jul 16 2002			ROPOS is on deck - end of dive R658.			



## 5.5 R659 - 2002 Dive Log

Cloud Recovered LA-G, 2 MTR, 3 SS, 1 TWG. Deployed LA-O at Cloud "far" site, LA-P at "near" site, 2BT, 2MTR. Castle Recovered hobo and tried positioning nose-cone for RAS.

Time (UTC)	Z (m)	Hdg	R659 2002 Comments	Samples	Investigator	FrGrab
14:31:27 Jul 16 2002	1	29	ROPOS in the water.			
15:28:52 Jul 16 2002	1501	297	Workboat keeps crashing.			
15:30:58 Jul 16 2002	1519	304	ROPOS on the bottom in the area of the elevator near Cloud.			
15:31:54 Jul 16 2002	1520	306	Spotted the elevator.			
15:33:40 Jul 16 2002	1520	348	The elevator.			R659-001
15:34:08 Jul 16 2002	1524	346	Anna's Larval Array Box is visited by a crab.			R659-002
15:36:40 Jul 16 2002	1524	11	Starting Anna's video.			
15:39:38 Jul 16 2002	1523	356	Going to pick up the LA box and take it to Cloud. We'll be picking up the arrays from last year and replacing them with new arrays.			
15:41:36 Jul 16 2002	1524	295	Man vs. Nature.			R659-003
15:45:26 Jul 16 2002	1524	325	Moving the array box toward Cloud vent.			
15:48:24 Jul 16 2002	1523	73	We're at Mkr-N8 - Snail vent. It looks dead.			R659-004
15:49:04 Jul 16 2002	1523	76	Mkr-N8.			R659-005
15:51:46 Jul 16 2002	1523	353	Amanda says there are limpets and snails there - so it's not totally dead.			
15:55:22 Jul 16 2002	1525	11	They dropped the biobox here at Snail - but the guys are picking it up again and heading to Cloud.			
16:00:24 Jul 16 2002	1522	224	Bearing 036 and 40 meters to Cloud from here - if the nav was good way back when.			
16:03:45 Jul 16 2002	1520	35	There's the arrays and the RAS at Cloud (near Mrk N6). yippee!			
16:03:52 Jul 16 2002	1521	35	Larval settling array.			R659-006
16:04:39 Jul 16 2002	1522	38	RAS			R659-007
16:05:18 Jul 16 2002	1521	32	Cloud is still venting - we see cloudy water here.			
16:07:36 Jul 16 2002	1523	23	Larval settling array with Richard's smiley face in the center. Richard's tray has pyrite cubes and massive sulfides (over 60% sulfide minerals).			R659-008
16:10:39 Jul 16 2002	1524	24	Placing the biobox near last year's larval settling arrays.			
16:12:18 Jul 16 2002	1524	59	Side shot of larval array.			R659-009
16:13:20 Jul 16 2002	1524	53	We will be retrieving one of the two periphery arrays that were deployed last year - (about 8 meters SW of N6). It will be replaced with LA O. One of the near (inflow) arrays will also be replaced.			
16:14:14 Jul 16 2002	1524	55	Trying to grab the new settlement array box so the lid can be lifted.			R659-010
16:16:29 Jul 16 2002	1524	26	We haven't seen the RAS recovery mooring yet.			
16:20:28 Jul 16 2002	1524	335	ROPOS is manipulating the biobox into position.			
16:30:07 Jul 16 2002	1524	17	We're trying to find a flat spot to put the biobox down.			
16:31:33 Jul 16 2002	1524	20	We're taking the biobox over near N6 - somewhere flat - so that we can work with it. "The mountain is going to Mohammed" says Anna (we'll bring the arrays to N6 from N4).			
16:33:19 Jul 16 2002	1524	21	ROPOS is trying to close the biobox so it can be moved to a less "ridgely" location.			R659-011
16:37:25 Jul 16 2002	1524	360	The biobox is placed on a flat spot near N6. The box will be opened and the arrays moved to N4.			

Time (UTC)	Z (m)	Hdg	R659 2002 Comments	Samples	Investigator	FrGrab
16:38:04 Jul 16 2002	1524	9	Biobox near N6 - at its flat spot.			R659-012
16:40:08 Jul 16 2002	1524	12	Off with the lid. Notice the new settling arrays that will be deployed this year at Mkr-N4 (Cloud Vent).			R659-013
16:40:29 Jul 16 2002	1524	11	Whoops the biobox has fallen down - but it should be OK.			
16:45:36 Jul 16 2002	1523	22	Starting a new tape for Anna.			
16:48:35 Jul 16 2002	1525	17	Settlement array visible just to the left of the RAS sampler.			R659-014
16:49:03 Jul 16 2002	1525	17	RAS sampler			R659-015
16:50:36 Jul 16 2002	1525	14	We're looking at the RAS and arrays near N6 (the pit).			
16:54:42 Jul 16 2002	1524	23	Grabbing new settlement array (LA-O) out of box.			R659-016
16:54:42 Jul 16 2002	1524	23	To reiterate: One LA will be replaced at each area (periphery and near). One will remain at each location for a time-series. The near periphery array will be LA-O.			
16:56:51 Jul 16 2002	1525	25	New array (LA-O) being removed from the box at Cloud.			R659-017
17:00:02 Jul 16 2002	1525	29	ROPOS is pulling the larval array out of the box			R659-018
17:00:26 Jul 16 2002	1525	32	The arrays out of the box (cat's out of the bag). It will be deployed/dropped? on the ridge.			
17:07:28 Jul 16 2002	1524	202	We're moving with LA-O toward the periphery area. We'll be deploying the array.			
17:08:06 Jul 16 2002	1522	253	Two larval arrays from last year at the periphery site (8 M SW of Mkr-N6)			R659-019
17:09:35 Jul 16 2002	1523	245	We see a passing jellyfish in the sit-cam.			
17:10:35 Jul 16 2002	1522	254	Array O has been deployed at the "far" sight (periphery).			
17:10:53 Jul 16 2002	1523	272	ROPOS dropping off the new Larval array (LA-O) at its new location (the "far" site)- 8 meters SW of Cloud Mkr-N6.			R659-020
17:13:27 Jul 16 2002	1522	108	The larval array at the far site (last year's array - LA-G) has lots less gunk on it than the one at the near site).			
17:14:14 Jul 16 2002	1523	36	Close up shot of larval array "G".			R659-021
17:15:27 Jul 16 2002	1523	46	Recovering LA-G.			R659-022
17:16:01 Jul 16 2002	1523	47	Recovering Larval Array G (LA-G) from the "far" site (8m SW of Mkr-N6). Not nearly as much stuff on the plates as at the near site. Looks like some limpets on it. [Cloud Mrk-N6]	R659-LA-G-0001	Metaxas	
17:17:20 Jul 16 2002	1523	68	Side shot of Larval array.			R659-023
17:19:40 Jul 16 2002	1521	71	RAS and LA-G.			R659-024
17:20:44 Jul 16 2002	1523	359	Placing LA-G in the biobox.			
17:22:38 Jul 16 2002	1523	12	LA-G is in the biobox.			
17:26:22 Jul 16 2002	1525	71	To reiterate: We have recovered LA-G from last year and replaced it with LA-O. This is the "far" site (also called the "periphery" site): 8m SW of Mkr-N6.			
17:29:32 Jul 16 2002	1524	5	We're leaving the biobox in between the two sites and will be doing the RAS operations now.			
17:30:15 Jul 16 2002	1525	17	Moving the larval array biobox out of the way.			
17:38:02 Jul 16 2002	1524	353	We're closing the biobox.....			
17:42:24 Jul 16 2002	1525	355	Starting DV-Bob for Bob and Dave. The RAS operations will be getting underway shortly.			

Time (UTC)	Z (m)	Hdg	R659 2002 Comments	Samples	Investigator	FrGrab
17:44:30 Jul 16 2002	1524	347	Cloud Mkr-N6 area. RAS to the right and larval arrays at the center. MTR's and other experiments visible. Lots of bacterial mat.			R659-025
17:46:52 Jul 16 2002	1525	349	Another look at Mkr-N6 area of Cloud vent. Notice venting in the center of the image.			R659-026
17:48:24 Jul 16 2002	1525	345	We will move the large biobox out of the way (SE of the RAS) so it doesn't get damaged (that biobox contains LA-G).			
17:52:44 Jul 16 2002	1524	20	Close-up of the RAS.			R659-027
17:52:49 Jul 16 2002	1524	8	Cloud Mkr-N6 and experiments.			R659-028
17:54:00 Jul 16 2002	1524	346	Cloud -6.			R659-029
17:54:11 Jul 16 2002	1524	341	The pit at -6. Not as many tubeworms as last year.			R659-030
17:54:15 Jul 16 2002	1524	345	The tubeworms are not as abundant as last year. Venting is less vigorous than last year.			
17:55:03 Jul 16 2002	1524	5	Mkr-6 area at Cloud with osmo (white object in center of image)			R659-031
17:55:59 Jul 16 2002	1524	10	Retrieving temperature probes from the RAS - which were place in the hole at Mkr-N6.			
17:56:56 Jul 16 2002	1524	16	Recovering the RAS intake and second temperature probe.			R659-032
17:57:52 Jul 16 2002	1524	23	Recovering the RAS intake and second temperature probe.			
17:58:19 Jul 16 2002	1524	22	Mkr-6 area at Cloud with freshly recovered temperature probe. Note absence of tube worms in area			R659-033
18:04:48 Jul 16 2002	1524	4	Mkr-6 area at Cloud with closeup of vent			R659-034
18:04:59 Jul 16 2002	1524	3	Starting STS to get McLane pumps and temperature probe to work.			
18:05:21 Jul 16 2002	1524	349	Mkr-6 area at Cloud with closeup of bacteria in vent			R659-035
18:05:48 Jul 16 2002	1524	350	Mkr-6 area at Cloud with closeup of bacterial trap float and vent wall			R659-036
18:07:08 Jul 16 2002	1524	2	Suction sample for temperature at the hole (Mkr-N6). T=5.6 degrees in the hole and steady (temperature is from the alien). Start 1807 End 1811.	R659-SS-J3-0002	Butterfield	
18:15:31 Jul 16 2002	1524	9	Now we're going to put an MTR into the hole to measure the temperature - just in case the alien is not giving the correct temp (the alien is on the suction sampler).			
18:20:45 Jul 16 2002	1524	6	MTR#340 and MTR#1051 are being DEPLOYED into the hole at N6. They will stay there for only a short time - and be recovered on this dive. It's in the flow.			
18:21:49 Jul 16 2002	1524	5	MTR#340 MTR#1051 put into the hole at Mkr-N6 for a short-term deployment (to get another temperature measurement).			R659-037
18:23:03 Jul 16 2002	1524	10	On to get the RAS.			
18:26:36 Jul 16 2002	1524	12	Lifting the RAS.			
18:28:37 Jul 16 2002	1523	12	The RAS after a year down. Notice the limpets.			R659-038
18:30:34 Jul 16 2002	1524	326	We're bringing the RAS to the RAS recovery mooring.			
18:31:44 Jul 16 2002	1523	263	The RAS - carrying it toward the RAS recovery mooring (which we haven't located yet).			R659-039
18:34:16 Jul 16 2002	1519	293	RAS and lava pillars. ROPOS is carrying the RAS - searching for the RAS recovery mooring.			R659-040
18:40:52 Jul 16 2002	1508	303	We're wandering around searching for the RAS recovery mooring.			
18:43:36 Jul 16 2002	1522	278	The mooring is ahead of us.			

Time (UTC)	Z (m)	Hdg	R659 2002 Comments	Samples	Investigator	FrGrab
18:45:09 Jul 16 2002	1521	267	Starting DV-Bob.			
18:46:23 Jul 16 2002	1521	250	Part of the RAS recovery mooring.			R659-041
19:06:48 Jul 16 2002	1523	310	Recovering RAS with mooring in background.			R659-042
19:13:04 Jul 16 2002	1522	318	Successful attachment.			R659-043
19:13:22 Jul 16 2002	1522	318	RAS recovery.			R659-044
19:25:20 Jul 16 2002	1520	317	Start transit to Cloud.			
19:41:19 Jul 16 2002	1521	192	Transporting larval array back to the elevator.			
20:04:31 Jul 16 2002	1522	277	A box is secured; removing the second larval array "P" for deployment			
20:37:33 Jul 16 2002	1525	17	Another shot of the instruments at Cloud.			R659-045
20:38:41 Jul 16 2002	1525	29	The biobox on the bottom with the larval array (LA-P) inside.			R659-046
20:45:33 Jul 16 2002	1525	45	LA-P set down near Cloud Mkr-N6			
20:54:30 Jul 16 2002	1524	279	Last year's larval array in the foreground. It will be recovered. LA-P in the background ready for a year deployment.			R659-047
20:56:09 Jul 16 2002	1524	278	Recovering LA-E. It's covered in white filamentous bacteria.			R659-048
20:57:15 Jul 16 2002	1524	341	LA-E from last year - recovered from near Cloud N6.	R659-LA-E-0003	Metaxas	
21:06:28 Jul 16 2002	1525	37	Box closed.			R659-049
21:07:48 Jul 16 2002	1523	44	We're going to recover the MTR's that we deployed at the beginning of the dive.			
21:11:04 Jul 16 2002	1524	3	New larval array (LA-P) in the background. MTR mooring in the foreground.			R659-050
21:15:04 Jul 16 2002	1524	13	Recovering MTR's #340 and #1051. They were deployed for three hours.			R659-051
21:20:33 Jul 16 2002	1524	19	Rope broken.			R659-052
21:21:33 Jul 16 2002	1524	25	MTR into box.			R659-053
21:22:40 Jul 16 2002	1524	24	3 hour MTR measurement - twin pack of MTR's (340 and 1051). The MTR's were in the hole for 3 hours. The temperature was consistently 8.3 - 8.4C. Logged as one sample - the exception to the rule. [Cloud Mkr-N6]	R659-MTR-340&1051-0004	Moyer	
21:24:09 Jul 16 2002	1524	26	Bacteria traps coming out of box.			R659-054
21:24:24 Jul 16 2002	1524	26	Lowering bacterial traps.			R659-055
21:24:35 Jul 16 2002	1524	26	Dropping into hole.			R659-056
21:27:35 Jul 16 2002	1520	253	Bacterial traps 65 & 66 DEPLOYED at Cloud Mkr-N6.			
21:29:10 Jul 16 2002	1520	279	Second box is now at the elevator (LA-E).			R659-057
21:31:33 Jul 16 2002	1522	41	Putting array onto elevator.			R659-058
21:31:59 Jul 16 2002	1522	34	Frame grab of the array.			R659-059
21:33:08 Jul 16 2002	1522	23	Array in place.			R659-060
21:38:08 Jul 16 2002	1522	21	Box secured.			R659-061
21:40:40 Jul 16 2002	1522	13	Strap to attachment point.			R659-062
21:41:13 Jul 16 2002	1522	16	Strap secured.			R659-063
21:48:09 Jul 16 2002	1522	211	Fluid sampler.			R659-064
21:50:46 Jul 16 2002	1521	87	Carrying Dave's fluid sampler cap back to Cloud.			
21:57:09 Jul 16 2002	1524	49	Flushing the suction sampler.			R659-065
21:57:50 Jul 16 2002	1524	46	Start suctioning particulate matter from old tube worms near cloud N6.			

Time (UTC)	Z (m)	Hdg	R659 2002 Comments	Samples	Investigator	FrGrab
21:58:01 Jul 16 2002	1524	45	Suctioning particulates off of old tubeworms.			R659-066
21:58:17 Jul 16 2002	1524	57	Suctioning particulate matter (filamentous bacterial mat?) from old tube worms. Start 2157 End 2205. [Cloud near N6]	R659-SS-J2-0005	Leveille	
21:58:34 Jul 16 2002	1524	42	Suctioning over old tubeworms.			R659-067
21:58:54 Jul 16 2002	1524	43	Filamentous bacteria.			R659-068
21:59:03 Jul 16 2002	1524	42	Suctioning bacteria.			R659-069
21:59:20 Jul 16 2002	1524	44	Starting the suction sample.			R659-070
22:00:15 Jul 16 2002	1524	56	Continued suctioning.			R659-072
22:01:28 Jul 16 2002	1524	57	Viewing jar 2 for nature of the sample delivered.			R659-074
22:02:03 Jul 16 2002	1524	55	Continued sampling.			R659-075
22:05:25 Jul 16 2002	1524	66	Finished suctioning into jar 2. A look inside the jar.			R659-076
22:05:38 Jul 16 2002	1524	65	Flushing suction sampler into jar 8.			
22:09:33 Jul 16 2002	1525	336	End of suction sample next to the array.			R659-077
22:10:08 Jul 16 2002	1525	337	Suction sample of particulate matter from live tubeworms with filamentous bacteria into jar#1. Start 22:11 End 2214. [Cloud N6]	R659-SS-J1-0006	Leveille	
22:10:52 Jul 16 2002	1525	333	Suctioning particulates from filamentous bacteria and live tubeworms.			R659-078
22:12:58 Jul 16 2002	1525	345	Suctioning inside filamentous bacteria.			R659-079
22:14:15 Jul 16 2002	1525	345	View inside the suction jar.			R659-080
22:14:24 Jul 16 2002	1525	342	Large amount of sample material observed in jar 1.			
22:15:19 Jul 16 2002	1525	337	Grabbing tubeworms.			R659-081
22:16:20 Jul 16 2002	1525	341	Tube worm grab into port bio box from the region just suction sampled. [Cloud N6 area]	R659-TWG-0007	Tunncliffe	
22:16:29 Jul 16 2002	1525	341	Tubeworm grab going into biobox.			R659-082
22:18:41 Jul 16 2002	1525	341	Add an extra "scoop" of delicious tube worms to the pile.			
22:22:34 Jul 16 2002	1525	323	Traps to go into hole (not sure if they're talking about bacterial or larval traps).			R659-083
22:24:20 Jul 16 2002	1525	330	Trial sampling cone for the RAS at Castle. It's a spare - just to see if it will fit over the chimney.			R659-084
22:25:41 Jul 16 2002	1525	331	The hole (Mkr-N6) with MTR ropes visible.			R659-085
22:25:43 Jul 16 2002	1525	333	MTR 4101 (deployed2001) recovered from the hole at Mkr-N6. It was attached to MTR-3292 which will be sample 0009. [Cloud Mkr-N6]	R659-MTR-4101-0008	Embley	
22:25:46 Jul 16 2002	1525	332	Pulling a MTR out of the hole.			R659-086
22:26:01 Jul 16 2002	1525	333	The numbers on the MTR's look like 4101 and 3292.			R659-087
22:26:16 Jul 16 2002	1525	332	MTR recovery.			R659-088
22:26:43 Jul 16 2002	1525	336	MTR-3292 recovered. It was deployed in 2001 - attached to MTR4101 (sample # 0008). [Cloud Mkr-N6]	R659-MTR-3292-0009	Embley	R659-089
22:30:46 Jul 16 2002	1525	7	Fluid sampler cone - test deployment.			R659-090
22:31:39 Jul 16 2002	1525	11	Transporting cone attachment (RAS) to Castle for test of site suitability.			
22:41:15 Jul 16 2002	1519	208	Bottom in sight.			
22:47:18 Jul 16 2002	1520	200	Navigation was out for the transit. Reset now.			
22:50:32 Jul 16 2002	1522	147	Spotted diffuse venting. (Vent later named Village). Dave says it wasn't there last year. [45 55.5672/129 58.8358' 423969/5086306]			

Time (UTC)	Z (m)	Hdg	R659 2002 Comments	Samples	Investigator	FrGrab
22:56:36 Jul 16 2002	1521	344	Spotted Castle with small anhydrite chimney.			
22:58:20 Jul 16 2002	1520	58	See a bactrap.			
22:59:30 Jul 16 2002	1522	64	Attempting to place RAS cap on high temperature vent at Castle.			
23:00:00 Jul 16 2002	0	0	Searching for more venting at Castle.			
23:00:08 Jul 16 2002	1522	65	Broke off part of anhydrite chimney.			
23:04:23 Jul 16 2002	1521	48	RAS fluid funnel is on high temperature vent. Testing position. Deciding whether to leave it there or not.			
23:23:17 Jul 16 2002	1520	107	Recovered HOB0-128 temperature probe (deployed in 2001). [Castle]	R659-hobo-128-0010	Embley	
23:27:02 Jul 16 2002	1517	282	Going back to the cage to end dive.			
23:35:55 Jul 16 2002	1384	108	Sub approaching cage for ascent.			
23:39:42 Jul 16 2002	1283	110	Ascent; 1285 meters line out.			
23:41:25 Jul 16 2002	1239	132	PST time 5:41 pm. 1235 meters.			
23:50:30 Jul 16 2002	1522	144	Diffuse venting on transit to Castle. Not been seen before.			R659-091
23:51:10 Jul 16 2002	1523	178	Diffuse venting at new site on transit to Castle.			R659-092
23:51:21 Jul 16 2002	1523	181	Debris due to disturbance by ROPOS at new diffuse venting site on transit to Castle.			R659-093
23:53:52 Jul 16 2002	1520	92	Chimney at Castle on approach			R659-094
23:55:53 Jul 16 2002	1520	356	HOB0 will be recovered at Castle.			R659-095
23:56:29 Jul 16 2002	1521	337	Venting at Castle.			R659-096
23:57:07 Jul 16 2002	1520	39	HOB0 and venting and tubeworm tubes at Castle.			R659-097
23:57:44 Jul 16 2002	1521	58	Base of anhydrite chimney at Castle.			R659-098
23:58:22 Jul 16 2002	1521	57	Anhydrite chimney at Castle			R659-099
23:58:41 Jul 16 2002	1521	63	Shimmering water at Castle.			R659-100
23:59:17 Jul 16 2002	1521	63	Positioning tripod at Castle.			R659-101
23:59:53 Jul 16 2002	1522	63	Chimney broke due to tripod positioning at Castle.			R659-102
00:04:27 Jul 17 2002	1521	47	Final position of tripod (fluid funnel) after test-fitting (Close-up).			R659-103
00:06:50 Jul 17 2002	1522	88	Final position of fluid funnel after test-fitting. Angle 1.			R659-104
00:10:11 Jul 17 2002	1521	335	Final position of fluid funnel after test-fitting. Angle 2.			R659-105
00:13:01 Jul 17 2002	1521	110	Final position of fluid funnel after test-fitting. Angle 3.			R659-106
00:20:22 Jul 17 2002	1522	47	Mineral formation in front of fluid funnel at Castle.			R659-107
00:24:27 Jul 17 2002	1520	71	HOB0 recovered from Castle vent after fluid funnel test fitting. (Sample logged at 2323 - R659-0010).			R659-108
00:30:00 Jul 17 2002			ROPOS left the bottom.			
01:41:40 Jul 17 2002	1	348	ROPOS on deck at 7-17 0142.			

## 5.6 R660 - 2002 Dive Log

Pressure sensor dive. Started at the **South Pillow Mound** Bmrk-66. The first pressure sensor measurement was successful (30 minutes) at Bmrk-66. When ROPOS ascended to head to BagCity it was discovered the plankton net mounting had come loose. Dive aborted.

Time (UTC)	Z (m)	Hdg	R660 2002 Comments	Samples	Investigator	FrGrab
11:02:58 Jul 17 2002	1	28	ROPOS in the water.			
12:34:42 Jul 17 2002	1716	237	ROPOS on the bottom.			
12:40:04 Jul 17 2002	1721	276	ROPOS is moving west-looking for the benchmark-66.			
12:43:30 Jul 17 2002	1716	90	Moving east - still hunting for benchmark at the South Pillow Mound.			
13:02:23 Jul 17 2002	1719	312	Still searching for the benchmark.			
13:13:15 Jul 17 2002	1718	5	We're on the crack and going to follow it north.			
13:15:24 Jul 17 2002	1721	15	The fissure at S. Pillow Mound.			R660-001
13:18:01 Jul 17 2002	1718	282	We've found it! Benchmark 66 at the South Pillow Mound.			
13:18:24 Jul 17 2002	1721	266	Approaching benchmark 66.			R660-002
13:18:41 Jul 17 2002	1722	258	We reach benchmark 66 and are ready to use the pressure sensor.			R660-003
13:26:41 Jul 17 2002	1724	255	We're putting the pressure sensor on the benchmark.			
13:28:11 Jul 17 2002	1723	254	ROPOS positions the pressure sensor on benchmark 66.			R660-004
13:28:32 Jul 17 2002	1724	254	Starting pressure reading - which will last for 30 minutes.			
13:58:41 Jul 17 2002	1724	254	End of pressure reading at Bmrk-66.			
14:01:44 Jul 17 2002	1723	17	The fissure!!			R660-005
14:02:34 Jul 17 2002	1719	89	Heading back to the cage.			
14:03:27 Jul 17 2002	1707	20	We were 20 meters south of the cage when we were at the benchmark. The stern of the ship has been right over the benchmark target.			
14:04:46 Jul 17 2002	1697	329	Video off.			
14:08:13 Jul 17 2002	1694	247	ROPOS has been returned to the cage.			
14:17:59 Jul 17 2002	1428	330	Moving the ship to the next location for more pressure readings at Bag City.			
14:47:28 Jul 17 2002	898	288	At 14:35 the dive was aborted. ROPOS is coming up because the mounting for the plankton net came loose. It could damage other equipment on the sub.			
15:39:59 Jul 17 2002	53	198	ROPOS in the cage.			
15:48:57 Jul 17 2002	2	159	ROPOS on deck. End of dive.			

## 5.7 R661 - 2002 Dive Log

Pressure sensor measurements completed. Started at **BagCity** Bmrk-4 but couldn't find it. On to **Mkr-33** area Bmrk-5, **Magnesia** Bmrk-1, **BPR** Bmrk-63, **Magnesia** Bmrk-1, **Mkr-33** area Bmrk-5, **BagCity** Bmrk-4 (found it this time), **SPM** Bmrk-66, **BagCity** Bmrk-4, **Mkr-33** area Bmrk-5, **Magnesia** Bmrk-1, **BPR** Bmrk-63 to close the loop. **Castle** Check if it is good candidate for RAS - it's not. Recovered MTR. **BagCity** Recovered 2 MTR. **Vixen** Recovered 2 hobos. **Casper** Recovered 1 MTR. **Mkr-33** Recovered 3 MTR, 2 BT, 7 SS. Deployed 2 MTR. **Snail** Rec 2 MTR. Snail to **Magnesia**: 1McLane. **Magnesia** to **BPR** 1 McLane

Time (UTC)	Z (m)	Hdg	R661 2002 Comments	Samples	Investigator	FrGrab
20:27:32 Jul 17 2002	0.9	74	ROPOS is in the water.			
21:39:25 Jul 17 2002	1486	249	ROPOS is out of its cage.			
21:42:54 Jul 17 2002	1532	255	ROPOS on the bottom.			R661-001
21:51:47 Jul 17 2002	1535	280	Meandering on to Bmrk-4 at BagCity vent field.			
22:16:28 Jul 17 2002	1536	71	Lava drips.			R661-002
22:16:40 Jul 17 2002	1535	72	Lava drips.			R661-003
22:21:37 Jul 17 2002	1534	112	Big rattail.			R661-004
23:01:10 Jul 17 2002	1527	4	Giving up on Bmrk-4 at BagCity. Back to the cage. Will be going to Bmrk-5 at Mkr-33. First we'll stop at Castle to check Dave's RAS tripod and the site as a possible location for RAS deployment.			
23:32:04 Jul 17 2002	1478	50	Transit to Castle.			
00:13:05 Jul 18 2002	1474	104	We're on site at Castle.			
00:14:45 Jul 18 2002	1474	135	Dropped cage down to 1480m. Castle is at 1522m.			
00:18:12 Jul 18 2002	1514	181	Looking for Castle vent.			
00:23:18 Jul 18 2002	1522	178	Spider crab and collapsed magma chamber near Castle.			R661-005
00:26:06 Jul 18 2002	1516	177	Found Castle.			
00:30:37 Jul 18 2002	1518	115	Found the titanium RAS tripod.			
00:32:57 Jul 18 2002	1522	75	Minerals at Castle near fluid funnel.			R661-006
00:33:56 Jul 18 2002	1521	86	Titanium RAS fluid funnel at Castle 1 day after deployment.			R661-007
00:34:32 Jul 18 2002	1521	85	We're assessing the placement of the RAS tripod cap and the surrounding area. It could be difficult to place the RAS here.			
00:41:04 Jul 18 2002	1522	254	Presumed iron oxides at Castle very near fluid funnel.			R661-008
00:44:33 Jul 18 2002	1523	266	Looks like the RAS won't go here as the terrain is too rough. Instead - both RAS's will probably be placed at ASHES.			
00:45:47 Jul 18 2002	1523	343	Presumed MTR that turned out to be only rope.			R661-009
00:45:53 Jul 18 2002	1523	355	We're looking for an MTR to recover.			
00:46:57 Jul 18 2002	1522	19	Extreme close-up of sediments by MTR at Castle.			R661-010
00:47:21 Jul 18 2002	1523	344	Recovering the MTR.			
00:49:22 Jul 18 2002	1523	17	NO MTR at the end of the rope!			
00:49:47 Jul 18 2002	1523	6	Crab versus ROPOS at Castle.			R661-011
00:50:51 Jul 18 2002	1522	346	Fluid funnel one- day after deployment at Castle: Angle 2.			R661-012
00:52:00 Jul 18 2002	1521	293	Looking for the actual MTR.			
00:52:38 Jul 18 2002	1521	311	Bactraps at Castle.			R661-013
00:53:21 Jul 18 2002	1521	303	Recovery of true MTR at Castle.			R661-014
00:53:27 Jul 18 2002	1521	299	Recovered MTR #3201 (depl '01). Placed in biobox. [Castle]	R661-MTR-3201-0001	Embley	
00:56:26 Jul 18 2002	1512	2	Going back to the cage.			



Time (UTC)	Z (m)	Hdg	R661 2002 Comments	Samples	Investigator	FrGrab
01:03:05 Jul 18 2002	1479	129	Moving ship to Mkr-33; Bmrk-5.			
01:52:44 Jul 18 2002	1524	0	We've arrived at Mkr-33 vent.			
02:00:09 Jul 18 2002	1520	232	Lava spire near Mkr-33			R661-015
02:00:46 Jul 18 2002	1519	266	Searching for Bmrk-5.			
02:03:07 Jul 18 2002	1524	240	Just spotted the RAS recovery mooring anchor deployed a couple of days ago.			
02:03:07 Jul 18 2002	1524	240	RAS mooring anchor.			R661-016
02:07:52 Jul 18 2002	1523	166	Spotted Mkr-33 vent.			
02:08:47 Jul 18 2002	1524	186	Mkr-33 vent			R661-017
02:10:01 Jul 18 2002	1523	290	Spotted the benchmark # 5 (Bmrk-5).			
02:10:10 Jul 18 2002	1524	273	Bmrk-5.			R661-018
02:14:04 Jul 18 2002	1525	224	Deploying pressure sensor at Bmrk-5.			R661-019
02:15:53 Jul 18 2002	1524	224	Starting pressure reading.			
02:15:55 Jul 18 2002	1525	224	Pressure sensor in place at start of pressure reading.			R661-020
02:45:15 Jul 18 2002	1525	226	Stopping pressure reading.			
02:50:23 Jul 18 2002	1525	227	Going back to cage.			
02:52:50 Jul 18 2002	1525	225	Moving to Mkr-33 to have a look and to get a good fix.			
02:55:02 Jul 18 2002	1521	196	Approaching Mkr-33 vent.			
02:56:12 Jul 18 2002	1525	211	Osmo sampler at Mkr-33			R661-021
02:56:31 Jul 18 2002	1525	208	There's some venting at Mkr-33 near osmosampler. Some tubeworms and polychaetes visible.			
02:57:18 Jul 18 2002	1525	207	Tubeworms at Mkr-33.			R661-022
02:57:43 Jul 18 2002	1524	207	Tubeworms at Mkr-33.			R661-023
02:58:51 Jul 18 2002	1525	207	Tubeworms at Mkr-33.			R661-024
02:59:33 Jul 18 2002	1524	208	Tubeworms at Mkr-33.			R661-025
03:01:34 Jul 18 2002	1525	207	Mkr-33 vent.			R661-026
03:02:01 Jul 18 2002	1524	208	Mkr-33 vent.			R661-027
03:03:49 Jul 18 2002	1525	208	Tubeworms at Mkr-33.			R661-028
03:04:59 Jul 18 2002	1524	211	Transiting to the cage.			
03:37:17 Jul 18 2002	1477	335	Transiting to Bmrk-1.			
04:36:45 Jul 18 2002	1526	188	Searching bottom for Bmrk-1.			
04:48:07 Jul 18 2002	1522	267	Navigation not responding - No fixes.			
05:02:56 Jul 18 2002	1529	223	Turning cage motor off to get a nav fix.			
05:13:50 Jul 18 2002	1524	252	Searching for Bmrk-1.			
05:18:41 Jul 18 2002	1525	220	On site at Mkr-67; Bmrk-1; Magnesia vent.			
05:18:43 Jul 18 2002	1525	219	Fish and Bmrk-1.			R661-029
05:19:06 Jul 18 2002	1527	220	Magnesia vent and Bmrk-1.			R661-030
05:20:57 Jul 18 2002	1528	163	Opening the box to access pressure sensor.			
05:22:53 Jul 18 2002	1528	165	Deploying pressure sensor at Bmrk-1.			
05:24:14 Jul 18 2002	1528	164	Pressure measurements at Bmrk-1; Magnesia Vent.			R661-031
05:24:23 Jul 18 2002	1528	162	Starting pressure reading.			
05:25:37 Jul 18 2002	1528	164	Checking gauges.			
05:54:59 Jul 18 2002	1528	165	End of pressure reading.			

Time (UTC)	Z (m)	Hdg	R661 2002 Comments	Samples	Investigator	FrGrab
05:55:31 Jul 18 2002	1528	194	Stowing pressure sensor in box for transit to next benchmark.			
05:58:31 Jul 18 2002	1521	148	Starting transit to mid-Caldera for next pressure reading.			
06:07:38 Jul 18 2002	1477	327	Jellyfish.			R661-032
07:15:38 Jul 18 2002	1457	131	Still moving.			
07:25:36 Jul 18 2002	1481	10	Heading down to benchmark.			
07:31:43 Jul 18 2002	1532	1	On the bottom.			
07:32:50 Jul 18 2002	1530	4	Searching to the north.			
07:35:05 Jul 18 2002	1531	43	Located Bmrk-63 at the caldera center - near the BPR.			
07:39:42 Jul 18 2002	1535	336	Taking out pressure sensor instrument.			
07:39:59 Jul 18 2002	1535	335	Positioning instrument.			
07:40:23 Jul 18 2002	1535	337	Started recording pressure.			
07:59:27 Jul 18 2002	1535	337	Rattail fish checking out the camera.		Embley	R661-033
08:11:26 Jul 18 2002	1535	334	Finished taking pressure measurements.			
08:11:37 Jul 18 2002	1535	335	Stowing pressure sensor in box.			
08:12:38 Jul 18 2002	1533	339	Postponing net samples until last leg of journey - when back at this benchmark again.			
08:14:19 Jul 18 2002	1534	343	Heading back to cage.			
08:24:03 Jul 18 2002	1501	41	Back at cage.			
08:32:00 Jul 18 2002	1458	69	Ship is moving - a few kilometers away from Bmrk-1. ROPOS is following behind.			
08:50:12 Jul 18 2002	1449	108	Checking gauges.			
08:55:31 Jul 18 2002	1444	87	Still in transit.			
09:05:22 Jul 18 2002	1440	102	Still trucking' along.			
09:19:24 Jul 18 2002	1430	122	Checking gauges again.			
09:36:37 Jul 18 2002	1435	115	Approaching site.			
09:51:11 Jul 18 2002	1516	169	Heading to the bottom.			
09:53:10 Jul 18 2002	1524	105	Bottom in sight.			
09:55:28 Jul 18 2002	1526	175	On the bottom.			
10:00:35 Jul 18 2002	1526	112	Looking for marker or benchmark at Magnesia vent area.			
10:04:30 Jul 18 2002	1527	20	The marker (Bmrk-1) has been located			
10:06:26 Jul 18 2002	1527	79	Approaching benchmark.			
10:09:33 Jul 18 2002	1527	79	Removing pressure sensor from box.			
10:10:37 Jul 18 2002	1527	78	Deploying sensor on bench.			
10:15:48 Jul 18 2002	1527	66	Begin recording pressure measurements.			
10:28:10 Jul 18 2002	1527	66	Pressure measurements at Bmrk-1; Magnesia vent.			R661-034
10:45:42 Jul 18 2002	1527	67	Pressure measurements finished.			
10:46:32 Jul 18 2002	1527	67	Returning pressure sensor to box.			
10:49:12 Jul 18 2002	1520	69	Heading back to cage.			
10:54:24 Jul 18 2002	1463	160	Shift change - Sheryl logging now.			
10:56:33 Jul 18 2002	1458	12	Ship heading to Bmrk-5 near Mkr-33.			

Time (UTC)	Z (m)	Hdg	R661 2002 Comments	Samples	Investigator	FrGrab
11:56:44 Jul 18 2002	1489	172	Nearing Bmrk-5. ROPOS is descending.			
11:58:20 Jul 18 2002	1513	172	ROPOS is on the bottom.			
12:03:10 Jul 18 2002	1522	175	A message.			R661-035
12:04:31 Jul 18 2002	1523	148	Spotted an old elevator anchor.			R661-036
12:07:19 Jul 18 2002	1520	224	We have arrived at Bmrk-5.			
12:08:22 Jul 18 2002	1523	221	Bmrk-5 at Mkr-33.			R661-037
12:09:09 Jul 18 2002	1523	218	ROPOS is sitting on the bottom preparing to take measurements.			
12:11:04 Jul 18 2002	1523	209	Letting out tether from the cage.			
12:15:09 Jul 18 2002	1523	205	Placing pressure sensor on Bmrk-5.			
12:19:43 Jul 18 2002	1523	208	Starting pressure measurement.			
12:19:56 Jul 18 2002	1523	207	Pressure sensor on Bmrk-5 near Marker 33 Vent.			R661-038
12:21:08 Jul 18 2002	1523	209	Shutting off cage motor to get a nav fix.			
12:49:35 Jul 18 2002	1523	207	Hooray! We are done with the pressure measurement - for now.			
12:51:27 Jul 18 2002	1517	154	Returning pressure sensor to ROPOS.			
12:53:39 Jul 18 2002	1520	168	Starting up cage motor again.			
12:54:02 Jul 18 2002	1521	169	Heading back to the cage.			
12:56:08 Jul 18 2002	1486	34	Back at cage - heading to Bmrk-4 near BagCity.			
14:05:31 Jul 18 2002	1489	181	Nearing Bmrk-4. ROPOS heading down.			
14:10:04 Jul 18 2002	1533	204	ROPOS on the bottom.			
14:13:18 Jul 18 2002	1534	327	Searching for Bmrk-4.			
14:18:14 Jul 18 2002	1533	40	Looking for a marker at Bag City - started near collapse and headed East over uncollapsed region - still large amounts of tubeworms present.			
14:21:33 Jul 18 2002	1531	31	Region around BagCity still healthy with lots of shimmering water.			
14:22:26 Jul 18 2002	1530	53	Turning cage motor off to get a vehicle nav fix - having trouble locating the benchmark.			
14:23:30 Jul 18 2002	1531	70	3 transponder fix on cage.			
14:24:04 Jul 18 2002	1531	68	Putting sub in bypass.			
14:25:56 Jul 18 2002	1531	69	Mkr-36 at BagCity.			R661-039
14:26:43 Jul 18 2002	1532	67	Sub coming out of bypass - got some partial fixes on sub position - we are NE of where we want to be - go 24m heading 222			
14:29:10 Jul 18 2002	1533	194	AHA! We have found the benchmark.			
14:30:01 Jul 18 2002	1532	171	Bmrk-4 near BagCity vent!			R661-040
14:32:47 Jul 18 2002	1535	123	Sub sitting on bottom for measurement.			
14:34:27 Jul 18 2002	1535	125	Pressure sensor in place.			
14:35:40 Jul 18 2002	1535	125	Starting pressure sensor measurement.			
14:35:40 Jul 18 2002	1535	125	Taking a pressure reading at BagCity Bmrk-4.			R661-041
14:40:26 Jul 18 2002	1535	123	Bacterial mat at BagCity (note - not a bag). This is the view from Bmrk-4.			R661-042
14:44:33 Jul 18 2002	1535	124	Tubeworm bush at BagCity.			R661-043
14:52:37 Jul 18 2002	1535	122	Some type of worm grazing on the tubeworms.			R661-044

Time (UTC)	Z (m)	Hdg	R661 2002 Comments	Samples	Investigator	FrGrab
14:57:46 Jul 18 2002	1535	125	View out over venting at BagCity.			R661-045
15:05:38 Jul 18 2002	1535	125	End of pressure measurement at BagCity.			
15:10:42 Jul 18 2002	1532	141	Heading to S Pillow Mound (Bmrk-66) after checking our position here at BagCity.			
18:27:13 Jul 18 2002	1689	203	Heading down to the bottom after a 3 hour transit from BagCity to South Pillow Mound (at 1.5 knots).			
18:28:41 Jul 18 2002	1718	195	Starting the video.			
18:31:33 Jul 18 2002	1722	101	Pillow lava in the background and jumbled in the foreground.			R661-046
18:31:58 Jul 18 2002	1720	169	We've spotted Bmrk-66.			
18:32:28 Jul 18 2002	1721	173	Bmrk-66 as we approach it. Notice the fissure to the left.			R661-047
18:39:42 Jul 18 2002	1723	116	Starting pressure measurement at Bmrk-66 South Pillow Mound.			
18:39:44 Jul 18 2002	1723	117	Pressure measurement at Bmrk-66.			R661-048
18:47:07 Jul 18 2002	1723	117	Rattail at the rift. This was from Bmrk-66 S Pillow Mound.			R661-049
18:51:43 Jul 18 2002	1723	113	Rattail moons ROPOS at Bmrk-66. [S. Pillow Mound]			R661-050
18:59:59 Jul 18 2002	1723	118	18:57 pressure sensor jiggled; engineers suspect a minor seismic event; not enough to loosen the sensor; Bill decides to keep sensor in place a little longer.			
19:20:33 Jul 18 2002	1722	110	Finished pressure measurement at Bmrk-66. Sub is going back to the cage.			
19:37:47 Jul 18 2002	1689	105	Transit to BagCity Bmrk-04.			
22:34:55 Jul 18 2002	1533	47	On the bottom.			
22:39:45 Jul 18 2002	1533	57	Benchmark 4 at BagCity.			R661-051
22:46:16 Jul 18 2002	1520	85	Up off the bottom for a bit of tether management.			
22:50:51 Jul 18 2002	1534	47	Back on the bottom.			
23:00:52 Jul 18 2002	1534	117	Beginning of pressure measurement at Bmrk-4 at BagCity.			R661-052
23:00:58 Jul 18 2002	1534	118	Starting pressure reading.			
23:30:15 Jul 18 2002	1534	118	Measurement completed.			
23:36:27 Jul 18 2002	1531	358	Bob's highlight video has begun.			
23:38:35 Jul 18 2002	1532	130	Arrival at BagCity vent field for MTR recovery.			R661-053
23:39:16 Jul 18 2002	1531	12	Found Mkr-36.			
23:40:20 Jul 18 2002	1533	352	Tubeworms at mkr 36 at BagCity.			R661-054
23:43:43 Jul 18 2002	1535	306	Tube worms during recovery of MTR-3039 at Mkr-36 at BagCity.			R661-055
23:44:11 Jul 18 2002	1535	339	Recovery of MTR-3049 at Mkr-36 at BagCity.			R661-056
23:44:53 Jul 18 2002	1535	354	Recovered MTR-3049 (deployed '01). Placed in port side biobox. [BagCity Mkr-36]	R661-MTR-3049-0002	Embley	
23:46:26 Jul 18 2002	1535	339	Recovery of MTR-3029 at BagCity at Mkr-36.			R661-057
23:47:38 Jul 18 2002	1535	359	Recovered MTR-3029 (deployed '01). Placed into port side biobox. [BagCity Mkr-36]	R661-MTR-3029-0003	Embley	
23:54:13 Jul 18 2002	1495	293	Heading to Casper vent in the Coquille vent field. Will try to recover hobos.			
00:25:52 Jul 19 2002	1534	16	We're at the bottom near Casper vent.			

Time (UTC)	Z (m)	Hdg	R661 2002 Comments	Samples	Investigator	FrGrab
00:31:59 Jul 19 2002	1537	310	Anemones near Casper associated with tubeworms (next frame)			R661-058
00:32:44 Jul 19 2002	1537	181	Tubeworms near Casper			R661-059
00:34:01 Jul 19 2002	1534	203	Looking for Casper vent.			
00:34:59 Jul 19 2002	1535	225	Anhydrite chimney at Vixen.			R661-060
00:35:01 Jul 19 2002	1535	224	Found a chimney. Will look around - should be 2 vents/chimneys.			
00:36:38 Jul 19 2002	1535	212	Looks like we've found Vixen. The anhydrite chimney is dark colored - could be sulfides.			
00:36:42 Jul 19 2002	1535	223	Second anhydrite (?) chimney at Casper.			R661-061
00:37:25 Jul 19 2002	1537	256	Hobos and chimney at Vixen vent.			R661-062
00:37:29 Jul 19 2002	1537	255	We've found the chimney with the hobos - it's Vixen.			
00:38:57 Jul 19 2002	1537	220	Hobo at Vixen vent.			R661-063
00:40:04 Jul 19 2002	1538	215	Top of Vixen vent.			R661-064
00:40:08 Jul 19 2002	1538	214	Vixen chimney.			R661-065
00:40:25 Jul 19 2002	1538	214	Vixen vent.			R661-066
00:40:53 Jul 19 2002	1538	216	One of the hobos (#153) tips looks like it is out of the vent (actually sticking right through the chimney). The chimney may have crumbled. The other one (#152) looks fine.			
00:42:23 Jul 19 2002	1537	215	Recovery of hobo-153 with Vixen vent in background.			R661-067
00:43:08 Jul 19 2002	1537	218	Recovered hobo-153 from Vixen (depl '01). Placed in port biobox. The chimney had fallen over but grew back up around it. Tmax=323C. [Vixen]	R661-hobo-153-000 4	Embley	
00:44:19 Jul 19 2002	1538	213	Recovered hobo-152 (depl '01). Placed in port biobox. Vixen is vigorously venting - knocked over part of the chimney. Tmax=323C. [Vixen]	R661-hobo-152-000 5	Embley	
00:44:53 Jul 19 2002	1537	215	Recovery of hobo-152 with fast venting and disturbed Vixen chimney in background.			R661-068
00:47:04 Jul 19 2002	1538	217	Vixen vent after disturbance.			R661-069
00:52:46 Jul 19 2002	1538	217	We're trying to get a grab sample of the chimney base. It appears to have sulfides on top of the anhydrite. The sulfides are friable and float away like dust when ROPOS grabs at it.			
00:53:23 Jul 19 2002	1538	217	Trying to sample Vixen vent chimney material.			R661-070
00:57:13 Jul 19 2002	1537	225	We could not get a grab sample. Going to Casper to look for the MTR.			
01:04:20 Jul 19 2002	1537	21	Tubeworms near Casper vent while still searching for Casper vent.			R661-071
01:06:06 Jul 19 2002	1537	255	Casper vent.			R661-072
01:06:33 Jul 19 2002	1537	234	Casper in view.			
01:07:44 Jul 19 2002	1538	182	Maneuvering to recover MTR.			
01:10:01 Jul 19 2002	1537	90	Casper vent.			R661-073
01:10:42 Jul 19 2002	1538	89	MTR-4128 recovery at Casper vent.			R661-074
01:10:44 Jul 19 2002	1538	89	Recovering MTR-4128 (depl '01). Placed in port biobox. [Casper]	R661-MTR-4128-00 06	Embley	
01:11:08 Jul 19 2002	1538	100	MTR-4128 recovery at Casper vent.			R661-075
01:11:57 Jul 19 2002	1538	125	Casper vent chimney after MTR-4128 recovery.			R661-076

Time (UTC)	Z (m)	Hdg	R661 2002 Comments	Samples	Investigator	FrGrab
01:12:06 Jul 19 2002	1538	119	Off to Mkr-33 Bmrk-5. Bob's highlight tape is being turned off.			
01:42:50 Jul 19 2002	1445	36	We're going through a plume! From Coquille to Mkr-33.			
01:58:01 Jul 19 2002	1447	32	On the way to Mkr-33.			
02:08:06 Jul 19 2002	1477	15	We've arrived on site near Mkr-33.			
02:12:02 Jul 19 2002	1490	347	Going to the bottom.			
02:14:00 Jul 19 2002	1522	268	We're at the bottom.			
02:15:51 Jul 19 2002	1524	309	We've spotted Mkr-33 vent.			
02:17:13 Jul 19 2002	1524	313	Passing Mkr-33 vent while looking for Bmrk-5.			R661-077
02:20:08 Jul 19 2002	1524	230	Approaching the benchmark (Bmrk-5).			
02:22:15 Jul 19 2002	1525	225	Starting the pressure reading.			
02:22:15 Jul 19 2002	1525	225	Pressure reading at Bmrk-5 near Mkr-33.			R661-078
03:02:47 Jul 19 2002	1525	223	End pressure measurement at 03:03. Now moving to Marker 33 vent to sample.			
03:05:08 Jul 19 2002	1523	221	Organizing sampling - issues with the DV.			
03:16:40 Jul 19 2002	1524	193	Suction sample position.			R661-079
03:17:10 Jul 19 2002	1525	192	Preparing to suction sample for tubeworm/particulates in flow at Mkr-33.			
03:17:40 Jul 19 2002	1524	191	Suctioning into J3 but jar was misaligned. Temp peeked at 21C (plus ambient temp ~2C).			
03:22:30 Jul 19 2002	1524	193	J3 is still clean. Moving to J4 to retry sample.			
03:23:00 Jul 19 2002	1525	191	Suction sample Jar-4. Suctioning for particulates in flow near crack. Start 0323 End 0329. [Mkr-33]	R661-SS-J4-0007	Leveille	
03:24:15 Jul 19 2002	1524	192	Still pumping. Limpets etc. in jar.			
03:26:08 Jul 19 2002	1524	189	DV deck turned off a few minutes prior and restarted at this point.			
03:27:40 Jul 19 2002	1525	189	Pumping stopped momentarily.			
03:28:40 Jul 19 2002	1525	191	Still suctioning and looking for tubeworms.			
03:29:32 Jul 19 2002	1525	192	Stopped pumping and looking at quantity of sample.			
03:29:49 Jul 19 2002	1525	190	Suction sample into jar-4 at Mkr-33 vent.			R661-080
03:31:30 Jul 19 2002	1525	193	Preparing for a suction sample near the bactraps in crack.			
03:40:10 Jul 19 2002	1525	195	Microbial mat sampling at Mkr-33.			R661-081
03:40:10 Jul 19 2002	1525	195	Suctioning microbial mat in jar-5. Start 0340. End 0343. [Mkr-33]	R661-SS-J5-0008	Moyer	
03:43:23 Jul 19 2002	1525	198	Scraping mat off rock.			
03:43:43 Jul 19 2002	1525	195	Turning pump off and checking the jar.			
03:44:53 Jul 19 2002	1525	197	End sample. Looking for a second site to suction into jar-6 for another bacterial mat sample.			
03:46:38 Jul 19 2002	1524	198	Cleared substrate after suctioning bacterial mat.			R661-082
03:48:53 Jul 19 2002	1525	197	Suctioning large white microbial mat into jar-6 at the crack. Start 0348 End 0354. [Mkr-33]	R661-SS-J6-0009	Moyer	
03:49:40 Jul 19 2002	1524	198	Bacterial mat in jar-6.			R661-083
03:53:25 Jul 19 2002	1524	189	Video feed malfunctioning.			
03:54:17 Jul 19 2002	1525	188	Finished suctioning bacmat into Jar-6.			

Time (UTC)	Z (m)	Hdg	R661 2002 Comments	Samples	Investigator	FrGrab
03:55:00 Jul 19 2002	1524	188	Proceeding with sampling without video. Note: video recorded onto Bob's DV deck.			
03:56:30 Jul 19 2002	1524	187	Suction sample for tubeworms (Ridgeia) in crack. Start 0356 End 0403. [Mkr-33]	R661-SS-J7-0010	Leveille [ssmp: Moyer]	
03:58:23 Jul 19 2002	1524	212	Suctioning turned on.			
04:02:30 Jul 19 2002	1524	210	Attempting to uproot Ridgeia with the claw and suction loosened worm into jar-7.			
04:03:53 Jul 19 2002	1524	214	End suction sample.			
04:07:49 Jul 19 2002	1524	214	Flushing into jar-8 in preparation for Dave's water sample - which will be suctioned at low power into jar-1.			
04:11:08 Jul 19 2002	1524	213	Finding the highest temperature before taking suction sample.			
04:12:51 Jul 19 2002	1524	210	Note: video input still down.			
04:15:58 Jul 19 2002	1524	213	Turning pump on to initiate suction sample on lowest speed. Water sample at highest temp spot. T2=7.5. Start 0415 End 0420. [Mkr-33]	R661-SS-J1-0011	Butterfield	
04:18:06 Jul 19 2002	1524	213	Video feed back on.			
04:20:06 Jul 19 2002	1524	213	T2=7.5C. Stop pumping.			
04:22:58 Jul 19 2002	1524	214	Before suction jar-2.			R661-084
04:23:06 Jul 19 2002	1524	210	Suction limpets in high flow area. Start 0423 End 0430. T=10C. [Mkr-33]	R661-SS-J2-0012	Bates	
04:26:08 Jul 19 2002	1524	212	Turning the pump off to look at jar-2.			
04:27:10 Jul 19 2002	1524	214	Turning the pump back on to get more limpets.			
04:30:10 Jul 19 2002	1524	211	Stopping the pump.			
04:30:38 Jul 19 2002	1524	210	Suction sample jar-2.			R661-085
04:32:23 Jul 19 2002	1524	209	Suction sample jar 2 (again).			R661-086
04:35:05 Jul 19 2002	1524	212	End suctioning jar-2 - on to jar-3.			
04:38:05 Jul 19 2002	1524	210	Flushing jar-2.			
04:41:33 Jul 19 2002	1524	185	Low-flux limpets suction sample.			R661-087
04:43:35 Jul 19 2002	1524	188	Low-flux suction sample.			R661-088
04:44:16 Jul 19 2002	1524	186	Suctioning limpets from low-flux area into jar-3. [Mkr-33]	R661-SS-J3-0013	Bates	
04:47:18 Jul 19 2002	1524	190	End of low-flux suction sampling.			R661-089
04:47:26 Jul 19 2002	1524	186	Stop suction.			
04:49:03 Jul 19 2002	1524	187	Preparing to recover MTRs and bactraps which will go in the starboard biobox.			
04:51:16 Jul 19 2002	1524	184	Recovering MTR-3053 to starboard biobox (depl '01). MTR at the furthest east position in the crack. [Mkr-33]	R661-MTR-3053-0014	Embley	
04:51:20 Jul 19 2002	1524	188	Recovering MTR-3053.			R661-090
04:59:41 Jul 19 2002	1524	201	Deploying MTR-3213.			R661-091
04:59:46 Jul 19 2002	1524	201	Deployed MTR-3213 in same position as MTR-3053 at Mrk-33.			
05:03:18 Jul 19 2002	1524	199	Recovering bactrap.			R661-092
05:03:24 Jul 19 2002	1524	203	BacTrap-61 from the crack into starboard biobox (depl '01). [Mkr-33]	R661-BT-61-0015	Moyer	

Time (UTC)	Z (m)	Hdg	R661 2002 Comments	Samples	Investigator	FrGrab
05:05:35 Jul 19 2002	1524	197	Recovering BacTrap-62 into starboard biobox (depl '01). MTR attached and will be logged in the next sample number. [Mkr-33]	R661-BT-62-0016	Moyer	
05:07:01 Jul 19 2002	1524	197	MTR-3043 (depl '01) recovered attached to BacTrap 62. [Mkr-33]	R661-MTR-3043-0017	Embley	
05:09:05 Jul 19 2002	1524	199	Deployed MTR-4127 at Mkr-33.			
05:15:54 Jul 19 2002	1524	209	Recovering MTR-3039 (depl '01) and stowing in starboard biobox. [Mkr-33]	R661-MTR-3039-0018	Embley	
05:21:55 Jul 19 2002	1524	210	Deployed MTR-3185(#?) The MTR numbers seem to be messed up - not sure on this number.			
05:27:23 Jul 19 2002	1524	204	Moving to Snail vent Mkr-N8.			
05:30:42 Jul 19 2002	1525	62	Turning on Bob's DV deck to view a new vent. Turning off cage motor to get a fix.			
05:34:25 Jul 19 2002	1524	96	Recovering MTR-3054 (depl '01) into starboard biobox. [Snail Mkr-N8]	R661-MTR-3054-0019	Embley	
05:41:04 Jul 19 2002	1524	302	Recovering MTR-3055 (depl '01) to starboard biobox. Located in a clump of dead tubeworms. [Snail Mkr-N8]	R661-MTR-3055-0020	Embley	
05:44:09 Jul 19 2002	1524	306	Bob's DV deck off.			
05:45:00 Jul 19 2002	1523	356	Leaving Snail for Magnesia Bmrk-1.			
05:46:17 Jul 19 2002	1520	88	McLane Pump is on. 10m from bottom now and going up to the cage.			
05:51:52 Jul 19 2002	1488	274	Back at cage. McLane pumped 40L at avg. rate of 7L/min. Still pumping. Ready to transit to Magnesia.			
06:00:10 Jul 19 2002	1440	355	ROPOS up to the cage. 90L pumped.			
06:14:58 Jul 19 2002	1425	34	McLane Pump. Start 0540. End 0614. 205 L pumped. Pump on during transit from Snail to Magnesia. Total distance 800m. [Snail to Magnesia]	R661-MP-0021	Leveille	
06:44:05 Jul 19 2002	1442	5	Nearing Bmrk-1.			
07:09:35 Jul 19 2002	1523	267	Arrived at Bmrk-1.			
07:15:21 Jul 19 2002	1528	142	Taking pressure sensor out of box.			
07:15:49 Jul 19 2002	1528	142	Positioning pressure sensor on benchmark.			
07:17:08 Jul 19 2002	1528	142	Starting pressure measurements.			
07:23:42 Jul 19 2002	1528	143	Bmrk-1 pressure reading at Magnesia.			R661-093
07:40:04 Jul 19 2002	1528	142	End of pressure measurement.			
07:41:14 Jul 19 2002	1528	142	Returning pressure sensor to box.			
07:54:26 Jul 19 2002	1523	294	Setting up vehicle for net tows.			
08:01:19 Jul 19 2002	1521	305	Moving ship into position.			
08:06:53 Jul 19 2002	1525	293	Moving to next benchmark (Bmrk-63 at the caldera center). Waiting until we are 500m past Magnesia to start net tows.			
08:21:37 Jul 19 2002	1528	301	At 500 m past Magnesia. Unfurling nets. Started video - time 8:20.			
08:22:20 Jul 19 2002	1528	298	Nets didn't open properly. Trying again.			
08:22:43 Jul 19 2002	1528	300	Nets still not opening properly.			
08:24:06 Jul 19 2002	1528	303	Port (left) net not opening - cycling to try to open it.			
08:27:53 Jul 19 2002	1530	306	Starboard (right) net open - port (left) did not open. Proceeding with only the starboard net. Camera looking straight out.			
08:28:23 Jul 19 2002	1528	302	Quickly looking at gauges.			



Time (UTC)	Z (m)	Hdg	R661 2002 Comments	Samples	Investigator	FrGrab
08:29:44 Jul 19 2002	1530	300	Starboard net. 2-3 m off bottom. Speed avg 1.1 knots. Traveled 1237m +/- 30m. Start 0829 End 0913. Bearing 297. [500m N of Magnesia to BPR area]	R661-net-0022	Metaxas	
08:34:33 Jul 19 2002	1529	301	Ship has to slow down to put in new line. ROV still moving on bottom.			
08:37:41 Jul 19 2002	1529	304	Ship slowed down to 0.5 knots but ROV never stopped and net stayed open.			
08:39:00 Jul 19 2002	1529	302	Ship moving again and picking up speed. Continuing as before.			
09:06:54 Jul 19 2002	1530	287	Ship slowing down again. ROV slowing to 0.5 knots but not stopping.			
09:10:31 Jul 19 2002	1528	301	ROV speeding back up again (trying to keep to end of tether).			
09:12:20 Jul 19 2002	1529	306	Ship speeding up again.			
09:12:46 Jul 19 2002	1530	303	Closed and cinched nets. End time 9:13 for net tow and video. Bearing 297 - distance traveled 1237 m +/- 30 m. Start position: 45 56.9454'N 129 59.5807'W. End position: N 45 57.2490'N 130 00.4343'W.			
09:13:37 Jul 19 2002	1531	301	Almost at Bmrk-63 at the center of the caldera.			
09:29:06 Jul 19 2002	1524	304	At benchmark - waiting for cage to swing down.			
09:33:14 Jul 19 2002	1529	358	Cage has caught up and starting to look around for Bmrk-63.			
09:37:50 Jul 19 2002	1522	23	Located BPR mooring. 10m from bottom and going down.			
09:40:20 Jul 19 2002	1535	41	Found benchmark.			
09:42:42 Jul 19 2002	1535	26	Positioning pressure sensor.			
09:56:44 Jul 19 2002	1535	34	Start of pressure measurement.			
10:04:03 Jul 19 2002	1535	35	Checking gauges.			
10:28:29 Jul 19 2002	1535	35	Chalcopyrite (?) on the tip of one of the hobo probes that was at Vixen vent.			R661-094
10:30:22 Jul 19 2002	1535	51	End of measurements.			
10:30:46 Jul 19 2002	1532	57	ROPOS off the bottom. Storing sensor.			
11:46:00 Jul 19 2002	72.5	194	ROPOS is back in the cage.			
11:51:11 Jul 19 2002	2.1	107	ROPOS is at the surface.			
11:55:40 Jul 19 2002	2	94	ROPOS is on deck - end of dive R661.			

## 5.8 R662 - 2002 Dive Log

Located the elevator and 2 RAS samplers, then sampled and deployed experiments. **Marshmallow** Deployed LA-K. **Virgin** Recovered LA-M, 2 hobos, 2 LT (9&12), 2 GTB, 1 anhydrite. Positioned high-temp RAS for year-long deployment at Virgin. **ROPOS** Recovered LA-L, 2 LT (1&4) 1McLane. Deployed LA-Z. **Hell** 5 SS. Deployed Amanda's transplant cage. **Gollum** Recovered 2 MTR, 2 BT, 1McLane. Deployed 2 BT. **FeHyde** 2 SS. **Marshmallow** Deployed LA-K. **Crack** Recovered Johnson flow meter, wood. Attempt to deploy lo-temp RAS at **Dave's**. Both RAS tasks must be finished next dive. Problems with hi-temp RAS temp program. Lo-temp RAS is too heavy. ROPOS was having a problem with the arm and the color cam had been knocked out of place. Left big Johnson flow-meter to deploy at Crack on next dive.

Time (UTC)	Z (m)	Hdg	R662 2002 Comments	Samples	Investigator	FrGrab
23:50:45 Jul 19 2002	1	168	ROPOS is in the water.			
23:55:21 Jul 19 2002	51	189	ROPOS left the cage.			
00:01:17 Jul 20 2002	111	240	Video overlay is not receiving the serial data.			
00:02:41 Jul 20 2002	131	277	Video overlay is now working.			
01:09:19 Jul 20 2002	1536	81	We're at the bottom.			
01:11:56 Jul 20 2002	1546	56	Larval trap box from last year.			R662-001
01:13:28 Jul 20 2002	1546	29	Spotted last year's larval trap cage. Now at Johnson's flow meter at Crack vent. Will leave the new flow meter here now. Also leaving 2 hobos here.			
01:14:30 Jul 20 2002	1547	25	Grabbing the Johnson flow meter			R662-002
01:17:57 Jul 20 2002	1547	37	Pumping starboard McLane pump at unknown rate for 1 minute. Bates doing a test of the pump.			
01:19:09 Jul 20 2002	1547	40	Pumping starboard McLane at 10L/min.			
01:20:25 Jul 20 2002	1547	38	Dropping off the Johnson flow meter at the cement base.			
01:20:49 Jul 20 2002	1547	37	Setting down second hobo at Johnson's cement box.			R662-003
01:22:58 Jul 20 2002	1541	61	Looking for the elevator.			
01:23:47 Jul 20 2002	1540	78	McLane pump stopped after 37 seconds.			
01:24:55 Jul 20 2002	1542	75	Pumping again on starboard McLane pump. It appears to be stopping every 37 seconds.			
01:27:02 Jul 20 2002	1545	68	Stopping the pump again to reset at 10L/min. The minimum value was set too high and the pump was stopping automatically.			
01:29:13 Jul 20 2002	1545	43	Starting pumping on starboard McLane pump at 10L/min.			
01:31:32 Jul 20 2002	1537	310	Still looking for the elevator.			
01:37:36 Jul 20 2002	1544	270	Octopus with mantle skirt.			R662-004
01:38:08 Jul 20 2002	1545	253	Did not respond to laser.			R662-005
01:41:06 Jul 20 2002	1544	221	We're back at the Johnson flow meter.			
01:49:48 Jul 20 2002	1543	331	Spotted larval array M (LA-M) at Virgin Mound. It is covered in anhydrite.			
02:07:35 Jul 20 2002	1543	241	Still looking for the elevator.			
02:16:19 Jul 20 2002	1542	351	Still can't find the elevator. We're going to move the ship and range on the cage.			
02:17:03 Jul 20 2002	1542	275	McLane pump running for 19 minutes. It is being restarted to pump some more.			
02:42:42 Jul 20 2002	1543	2	Turns out we've been ranging on the cold RAS.			
02:43:27 Jul 20 2002	1543	5	Found the hot RAS. It's near Paul Johnson's flow meter - about 10m west of Crack Vent.			
02:43:29 Jul 20 2002	1543	9	RAS - while searching for elevator.			R662-006
02:49:58 Jul 20 2002	1543	227	We're at Phoenix. There's venting and tubeworms, and possibly other fauna.			

Time (UTC)	Z (m)	Hdg	R662 2002 Comments	Samples	Investigator	FrGrab
02:50:15 Jul 20 2002	1543	213	Phoenix vent.			R662-007
02:51:06 Jul 20 2002	1542	218	We're now passing ROPOS vent - can see the larval arrays.			
02:54:25 Jul 20 2002	1543	207	Found the elevator! It took about 1.5 hours. It is SW of the Johnson flow meter. [45 55.9701'N 130 00.8223'W]			
03:07:21 Jul 20 2002	1545	193	Releasing biobox from elevator with Larval Array K (LA-K) for transport to Virgin. Turning cage motor off.			
03:09:39 Jul 20 2002	1545	193	Setting down the biobox with arrays that will be deployed Virgin.			R662-008
03:12:38 Jul 20 2002	1544	2	Approaching Phoenix Vent. McLane pump turned off. Vol=439L pumped.			
03:19:55 Jul 20 2002	1546	57	LA-M at Virgin.			R662-009
03:20:01 Jul 20 2002	1547	71	Landing at Virgin. Array and two hobos evident.			
03:20:27 Jul 20 2002	1547	68	Larval settlement Array M (LA-M) deployed in 2001.			R662-010
03:35:24 Jul 20 2002	1547	2	Moving to Virgin Mound to scope out if the vent is a good spot for deployment.			
03:39:59 Jul 20 2002	1547	48	LA-N at Virgin's Daughter has limpets. Richard's DV deck turned on for view of sulfide blocks attached to array.			
03:41:49 Jul 20 2002	1547	42	LA-N at Virgin's Daughter.			R662-011
03:46:40 Jul 20 2002	1546	255	Marshmallow and White vents (Mkr-1).			R662-012
03:46:53 Jul 20 2002	1547	272	Richard's DV deck off.			
03:47:28 Jul 20 2002	1547	273	Deploying LA-K at Marshmallow Vent.			
03:47:45 Jul 20 2002	1546	275	Deployment of LA-K at Marshmallow.			R662-013
03:48:53 Jul 20 2002	1547	278	Deployment of LA-K at Marshmallow.			R662-014
03:49:44 Jul 20 2002	1545	295	Leaving highlights on to capture Virgin Mound.			
03:52:36 Jul 20 2002	1547	171	Larval Array M (LA-M).			R662-015
03:53:17 Jul 20 2002	1547	178	LA-M at Virgin.			R662-016
03:54:26 Jul 20 2002	1547	175	Moving LA-M from Virgin Mound to the biobox for recovery.			
03:54:47 Jul 20 2002	1547	165	Close-up of the LA-M.			R662-017
03:55:06 Jul 20 2002	1546	111	Close-up at LA-M with orange filamentous bacteria.			R662-018
03:56:20 Jul 20 2002	1546	355	Rattail.			R662-019
03:58:24 Jul 20 2002	1547	343	Recovered hobo-126 from Virgin. Two hobos were attached to LA-K when it was recovered (hobo-126 and hobo-130). [Virgin]	R662-hobo-126-000 1	Embley	
04:00:25 Jul 20 2002	1547	346	Recovered hobo-130. Two hobos were attached to LA-K when it was recovered (hobo-126 and hobo-130). [Virgin]	R662-hobo-130-000 2	Embley	
04:04:33 Jul 20 2002	1548	18	Closing biobox. Gas sampling (Evans) will proceed.			
04:08:12 Jul 20 2002	1548	27	LA-M from Virgin secured in biobox (deployed '01). Part of anhydrite chimney was attached to the array and fell into the biobox. [Virgin]	R662-LA—0003	Metaxas / Kelly	
04:11:44 Jul 20 2002	1547	63	Preparing to sample for gases at Virgin.			
04:14:49 Jul 20 2002	1548	61	Trying to figure which buttons to push to get the gas tight sample.			

Time (UTC)	Z (m)	Hdg	R662 2002 Comments	Samples	Investigator	FrGrab
04:17:04 Jul 20 2002	1548	62	Starboard gastight bottle#12. [Virgin]	R662-GTB-12-0004	Evans [ssmp: Butterfield / Lilley]	
04:17:19 Jul 20 2002	1547	61	Port gastight bottle#6. [Virgin]	R662-GTB-6-0005	Evans [ssmp: Butterfield / Lilley]	
04:19:03 Jul 20 2002	1547	61	Virgin Mound after removal of LA-M.			R662-020
04:19:26 Jul 20 2002	1548	61	Checking gauges.			
04:21:38 Jul 20 2002	1547	354	Taking the biobox with LA-M back to the elevator.			
04:27:53 Jul 20 2002	1546	173	McLane pump turned on for transit to elevator. Pumping at max of 10 L/min.			
04:37:17 Jul 20 2002	1545	120	Securing the biobox with LA-M to the elevator.			
04:48:18 Jul 20 2002	1544	202	McLane pump stopped and being restarted. 180L was pumped.			
04:51:27 Jul 20 2002	1544	187	Restarted McLane pump.			
04:55:31 Jul 20 2002	1544	254	Checking gauges.			
04:58:36 Jul 20 2002	1544	187	Biobox with LA-M secured on elevator. Starting to remove lines securing second biobox with LA-Z.			
05:06:54 Jul 20 2002	1544	194	Second biobox successfully retrieved from the elevator. Heading for Ropos Vent.			
05:11:50 Jul 20 2002	1544	4	Arriving at Ropos vent. Turned off McLane Pump. Vol=161L pumped.			
05:14:42 Jul 20 2002	1547	97	Larval settlement arrays at Ropos Vent (Array's I and L).			R662-021
05:22:43 Jul 20 2002	1547	106	Opening biobox to access LA-Z for deployment.			
05:34:24 Jul 20 2002	1547	167	Larval settlement at Ropos.			R662-022
05:35:14 Jul 20 2002	1547	145	Preparing to retrieve Larval Array (I or L) nearest to flow at Ropos vent.			
05:35:50 Jul 20 2002	1547	143	LA-L at Ropos.			R662-023
05:37:01 Jul 20 2002	1547	148	Note: evident fluid flow from vent after removal of Larval Array.			R662-024
05:37:48 Jul 20 2002	1547	99	Moving LA-L to biobox.			
05:41:20 Jul 20 2002	1545	137	Larval Array L (LA-L) successfully placed in the biobox. [ROPOS]	R662-LA-L-0006	Metaxas / Kelly	
05:43:39 Jul 20 2002	1547	121	Adjusting array position in the biobox to allow closure. Array jarred - note that animals changed position on substrates.			
05:53:22 Jul 20 2002	1548	113	Biobox with Array? Successfully closed and ready for transport to the elevator.			
05:57:16 Jul 20 2002	1546	137	Deploying LA-Z in same position as Array L? just recovered.			
05:59:20 Jul 20 2002	1547	162	Positioning LA-Z to maximize flow through the substrates.			
05:59:48 Jul 20 2002	1547	160	Position of LA-Z at Ropos.			R662-025
06:00:26 Jul 20 2002	1546	133	Heading to the elevator.			
06:04:41 Jul 20 2002	1545	207	Starting McLane pump for transit to the elevator.			
06:10:29 Jul 20 2002	1543	29	Arrived at the elevator. Securing the biobox.			

Time (UTC)	Z (m)	Hdg	R662 2002 Comments	Samples	Investigator	FrGrab
06:15:14 Jul 20 2002	1544	191	Biobox fully secured on the elevator. Taking time to re-plan dive due to change in placement of bacstraps and MTRs that was not in the dive plan.			
06:20:54 Jul 20 2002	1540	71	Tether management and gauge checks.			
06:36:51 Jul 20 2002	1543	313	Searching for the elevator.			
06:48:25 Jul 20 2002	1544	125	Found Ropos Vent. Now we're oriented and moving to the elevator.			
07:00:41 Jul 20 2002	1544	72	Removing bacstraps from Moyer's biobox on the elevator.			
07:11:26 Jul 20 2002	1544	166	Ropos opening biobox with bacstraps.			R662-026
07:13:50 Jul 20 2002	1545	204	Placing bacstraps (67 & 68) on port side of ROPOS biobox.			
07:18:28 Jul 20 2002	1545	225	Removing transplant cage from elevator.			
07:20:39 Jul 20 2002	1544	235	McLane pump. Start at ROPOS vent 0610. Stop 0720 at elevator. Integrated sample; Vol=1300L. Sample peripheral to vent sites. [Locations: [Ropos to the elevator]	R662-MP-1-0007	Tunncliffe / Skebo	
07:37:41 Jul 20 2002	1543	247	Moving to Johnson's box near Crack vent to drop off transplant Cage (TC).			
08:03:29 Jul 20 2002	1544	19	Still looking.			
08:13:55 Jul 20 2002	1542	38	Johnson's box located.			
08:15:10 Jul 20 2002	1546	62	Placing transplant cage by Johnson's box.			
08:15:57 Jul 20 2002	1546	62	Heading to Virgin to pick up hobos.			
08:19:48 Jul 20 2002	1543	326	Checking out Gollum on the way to Virgin.			
08:28:42 Jul 20 2002	1546	8	Picking up two hobos from Virgin and carrying them to larval trap box.			
08:35:48 Jul 20 2002	1546	354	Proceeding to larval trap box.			
08:42:33 Jul 20 2002	1545	269	Placing the two hobos that were at Virgin hobos near the larval trap box.			
08:43:01 Jul 20 2002	1546	276	Picking up TC at Johnson's cement box and looking for a good site with high flow from which to sample limpets.			
08:46:55 Jul 20 2002	1546	324	Where did this ½ glass globe come from?		Metaxas	R662-027
08:52:10 Jul 20 2002	1543	275	Scoping out Hell.			
08:53:55 Jul 20 2002	1545	295	Richard's DV started recording.			
08:54:40 Jul 20 2002	1545	302	Location of where transplant cage will be placed.		Bates	R662-028
09:01:12 Jul 20 2002	1546	306	Placed transplant cage (TC) at Hell - opening lid.			
09:08:33 Jul 20 2002	1546	302	Placing opened transplant cage near high venting at base of Hell chimney.			
09:16:29 Jul 20 2002	1546	313	Area to suction sample at Hell vent.			R662-029
09:16:53 Jul 20 2002	1546	312	Preparing to take suction sample of limpets. Flushing into jar 8 before sample.			
09:20:05 Jul 20 2002	1546	312	Flushing into jar 8.			
09:29:21 Jul 20 2002	1546	307	Suction sample of limpets from high venting at base of Hell vent and on chimney into jar#1. Tmax=17. Looking at specimens in jar. Time actually 0922. [Hell]	R662-SS-J1-0008	Bates	
09:45:51 Jul 20 2002	1546	308	Removing tubeworms encrusted with limpets to place in transplant cage. Limpet grab for Amanda's transplant experiment.			R662-030

Time (UTC)	Z (m)	Hdg	R662 2002 Comments	Samples	Investigator	FrGrab
09:49:12 Jul 20 2002	1546	298	Grabbing limpets to place in transplant cage.			R662-031
09:51:10 Jul 20 2002	1546	299	Specimen being placed into the transplant cage.			R662-032
09:52:35 Jul 20 2002	1546	298	Closing lid of transplant cage.			
09:56:33 Jul 20 2002	1546	297	Location of the transplant cage at Hell vent.			R662-033
09:57:14 Jul 20 2002	1546	297	Deployment of transplant cage: placed 2 ft (0.5 m) from beehive structure at base of Hell chimney.			
09:58:43 Jul 20 2002	1546	297	Suction sample into jar#2 from area around transplant cage. Low flow sample but area potentially seeded with inflow limpets (escapees from transplant cage transfer). [Hell]	R662-SS-J2-0009	Bates	
10:02:04 Jul 20 2002	1546	303	Suctioning samples around transplant cage.			R662-034
10:11:27 Jul 20 2002	1545	298	Looking at worms on Hell chimney.			
10:11:46 Jul 20 2002	1545	298	Sample site for suction sample in jar #3.			R662-035
10:15:20 Jul 20 2002	1545	303	First suction sample of sulfide worms on Hell vent at base of beehive - highest flow. Start 10:15 End 10:21.[Hell]	R662-SS-J3-0010	Leveille	
10:17:57 Jul 20 2002	1546	299	Suctioning samples in jar #3.			R662-036
10:23:50 Jul 20 2002	1545	307	Second suction sample of sulfide worms on Hell - 1 foot from first suction on beehive. Lower flow than previous sample. Start 10:23 End 10:26. [Hell]	R662-SS-J4-0011	Leveille	
10:30:58 Jul 20 2002	1545	302	Third suction sample of sulfide worms - 2 feet further back from original suction on beehive. Lower flow than previous sample. Start 10:30 End 10:33 [Hell]	R662-SS-J5-0012	Leveille	
10:34:59 Jul 20 2002	1546	299	Sample site (Hell vent) for suction sample into jar#5.			R662-037
10:35:11 Jul 20 2002	1545	295	Richard switching McLane pump from starboard to port.			
10:35:11 Jul 20 2002	1545	295	ROPOS off the ground and heading to Gollum. Richard's McLane pump started 10:35.			
10:46:59 Jul 20 2002	1542	92	Found MTR 3041 at Gollum - Sheryl logging now.			
10:52:26 Jul 20 2002	0	0	MTR-3041.			R662-038
10:54:30 Jul 20 2002	1544	358	Checking contents of biobox - will deploy bacteria traps 67 and 68 here at Gollum.			
10:56:17 Jul 20 2002	1544	357	Deploying BT-67.			R662-039
10:56:44 Jul 20 2002	1544	359	Removing BT-67 from box at Gollum.			
10:58:42 Jul 20 2002	1544	5	Taking BT-68 out of biobox.			R662-040
10:59:22 Jul 20 2002	1544	4	BT-68 out of the biobox.			
11:00:13 Jul 20 2002	1544	6	Recovering MTR-3041 (depl '01). [Gollum]	R662-MTR-3041-0013	Embley	
11:00:27 Jul 20 2002	1544	7	The scene at Gollum.			R662-041
11:05:17 Jul 20 2002	1545	325	Recovery of MTR-3041			R662-042
11:06:09 Jul 20 2002	1545	330	Recovering MTR-3334 (depl '01). [Gollum]	R662-MTR-3334-0014	Embley	
11:06:20 Jul 20 2002	1544	328	Recovery of MTR-3334			R662-043
11:06:45 Jul 20 2002	1545	331	McLane Pump Port side - Vol=200L at approx. 9 L/min - 1377 seconds of pumping. Start 1035. Not sure when stopped - need to calculate. [Gollum]	R662-MP-2-0015	Leveille	
11:08:30 Jul 20 2002	1545	307	Recovery of bactrap (BT-64) from Gollum.			R662-044
11:08:37 Jul 20 2002	1545	304	Recovered BT-64 (depl '01). [Gollum]	R662-BT-64-0016	Moyer	

Time (UTC)	Z (m)	Hdg	R662 2002 Comments	Samples	Investigator	FrGrab
11:13:43 Jul 20 2002	1544	242	Recovered BT-63 (depl '01). [Gollum]	R662-BT-63-0017	Moyer	
11:13:54 Jul 20 2002	1543	244	Recovery of BT-63 (previous was BT-64).			R662-045
11:23:23 Jul 20 2002	1544	351	Preparing to deploy BT-68 at Gollum.			
11:26:33 Jul 20 2002	1545	342	Final deployment of BT-68 at Gollum.			R662-046
11:27:31 Jul 20 2002	1545	344	BT-68 is set.			
11:31:14 Jul 20 2002	1544	332	BT-67 has been placed next to BT- 68.			
11:31:20 Jul 20 2002	1544	330	Final deployment of BT-67 at Gollum.			R662-047
11:32:50 Jul 20 2002	1543	322	Heading to FeHyde. Will pick up a couple hobos on the way at Crack.			
11:36:16 Jul 20 2002	1544	171	Found the hobos 126 and 130. Will recover and put on elevator.			
11:37:12 Jul 20 2002	1545	61	Grabbing hobos for transit			R662-048
11:41:59 Jul 20 2002	1545	262	Have the two HOBOS from Crack. Taking to the elevator.			
11:45:36 Jul 20 2002	1541	234	At the elevator. Ready to deposit some hobos.			
11:50:34 Jul 20 2002	1541	326	Hobos on elevator (samples 1 and 2 from Virgin Vent).			R662-049
11:58:34 Jul 20 2002	1542	322	Hobos safe in biobox.			R662-050
11:59:15 Jul 20 2002	1542	318	Closed the biobox lid on the elevator with hobos inside. Ready to head to Fe-Hyde.			
12:09:01 Jul 20 2002	1543	326	At Fe-Hyde. Looking for iron oxides to slurp.			
12:33:58 Jul 20 2002	1543	170	Still searching for a place to slurp.			
12:38:28 Jul 20 2002	1545	309	Suction sampling iron oxides (FeO) into jar#6. Start 1238 End 1240. Start2 1241 End2 1243. [FeHyde]	R662-SS-J6-0018	Moyer	
12:38:38 Jul 20 2002	1545	309	Jar#6 Fe Hyde slurp site.			R662-051
12:40:36 Jul 20 2002	1545	309	Stop slurping. Take a look in jar.			
12:41:17 Jul 20 2002	1545	311	Pumping again.			
12:43:34 Jul 20 2002	1545	312	Stop pumping. Moving to jar 7.			
12:46:28 Jul 20 2002	1545	315	Jar#7 suction.			R662-052
12:46:28 Jul 20 2002	1545	315	Suctioning more Iron oxides into jar#7. Start 1246 End 1250. [FeHyde]	R662-SS-J7-0019	Moyer	
12:48:38 Jul 20 2002	1545	301	More bottle 7 suction.			R662-053
12:50:53 Jul 20 2002	1545	299	Stop slurping. Moving to jar#8. Ready to go place a RAS.			
12:53:23 Jul 20 2002	1545	297	Heading to the RAS near Crack.			
12:59:00 Jul 20 2002	1542	51	DV - Bob is recording.			
13:00:38 Jul 20 2002	1542	299	Elevator with RAS.			R662-054
13:00:58 Jul 20 2002	1544	306	Found the RAS.			
13:03:11 Jul 20 2002	1545	1	Released the drop anchor on RAS.			
13:04:49 Jul 20 2002	1543	355	Taking RAS to Virgin.			
13:09:08 Jul 20 2002	1542	32	Set RAS down to find spot to put it.			
13:11:08 Jul 20 2002	1542	331	Need to pick up RAS and tum it around so cables can reach the vent.			
13:16:56 Jul 20 2002	1542	321	New Hi-8 tape. Tape number 7.			
13:18:11 Jul 20 2002	1542	299	RAS is turned around and facing the right way.			

Time (UTC)	Z (m)	Hdg	R662 2002 Comments	Samples	Investigator	FrGrab
13:22:34 Jul 20 2002	1545	86	Still some adjusting to be done. Pushing one corner away from vent to get RAS more level.			
13:30:04 Jul 20 2002	1542	26	Grab the rope again and move RAS to get it off the mound it's sitting on.			
13:34:28 Jul 20 2002	1545	245	RAS position looks good.			
13:35:11 Jul 20 2002	1545	228	Pulling transducer cable loose.			R662-055
13:36:08 Jul 20 2002	1544	255	Tilt meter looks OK.			
13:39:08 Jul 20 2002	1545	74	Releasing High temp intake cone.			
13:39:08 Jul 20 2002	1545	74	Releasing tripod.			R662-056
13:42:08 Jul 20 2002	1545	46	Moving tripod.			R662-057
13:45:41 Jul 20 2002	1545	82	Placing tripod.			R662-058
13:46:43 Jul 20 2002	1545	81	Trying to place intake cone over the vent.			
13:47:28 Jul 20 2002	1545	81	Righting tripod.			R662-059
13:49:19 Jul 20 2002	1545	72	Pulling more of the tripod's tether loose from RAS.			
13:50:51 Jul 20 2002	1545	81	2nd attempt to place tripod.			R662-060
13:53:13 Jul 20 2002	1545	70	Repositioning RAS frame again.			
14:03:13 Jul 20 2002	1543	327	Turning DV Bob off for now.			
14:08:47 Jul 20 2002	1545	41	Digital video back on.			
14:10:34 Jul 20 2002	1545	43	RAS frame is good now. Are we sure??			
14:20:23 Jul 20 2002	1546	68	Placing tripod over the vent.			
14:22:13 Jul 20 2002	1545	68	Oh no! The tripod has fallen.			
14:30:56 Jul 20 2002	1546	27	Tripod in place again.			R662-061
14:34:03 Jul 20 2002	1546	339	The RAS in place.			R662-062
14:40:38 Jul 20 2002	1546	341	This RAS has been brought to you by our sponsors at...			R662-063
14:51:11 Jul 20 2002	1546	349	Interrogating the RAS. We'll try to put the RAS probe in the flow at Virgin.			
15:01:31 Jul 20 2002	1542	266	A view of RAS at Virgin. Tripod water sampler removed and positioned over vent.			R662-064
15:02:04 Jul 20 2002	1542	237	A shot of RAS at Virgin with view of vent in the back right.			R662-065
15:05:26 Jul 20 2002	1545	179	Removing the temperature probe from the frame of RAS.			
15:12:41 Jul 20 2002	1543	169	Pulled T2 (auxiliary/secondary) probe off the RAS and will be placing it now. T1 is inside the tripod and it's the primary probe. There's a third temperature probe within the McLane frame. It measures sample temps right before bottling.			
15:33:59 Jul 20 2002	1546	352	Trying to get more length on temp probe. The temp probe (T2) just pulled out of its titanium guard. The temp probe is still connected to the RAS - but has no titanium guard.			
15:35:01 Jul 20 2002	1546	349	Titanium guard without the cable. OOOPS! The cable is still connected to the RAS - just more fragile now.			R662-066
15:46:35 Jul 20 2002	1546	13	We're trying to get more cable for T2 - it's at the end of its rope.			
15:50:00 Jul 20 2002	1543	172	RAS at Virgin before deploying secondary temperature probe.			R662-067



Time (UTC)	Z (m)	Hdg	R662 2002 Comments	Samples	Investigator	FrGrab
15:53:09 Jul 20 2002	1545	217	Moving the RAS slightly closer to the vent so the cable for T2 will be long enough.			
15:56:58 Jul 20 2002	1543	347	Tripod (primary temperature sensor) with RAS at Virgin.			R662-068
15:57:05 Jul 20 2002	1543	8	Virgin vent with tripod water collector and RAS. Dave's request for this image.			R662-069
15:58:53 Jul 20 2002	1546	43	Attempting to place the temp probe (T2) again. The RAS was moved closer to the vent.			
16:04:40 Jul 20 2002	1546	43	Dave's requested pictures of secondary temperature probe placement at Virgin.			R662-070
16:05:04 Jul 20 2002	1546	43	Dave's Request: Secondary temperature probe in its final resting spot at Virgin.			R662-071
16:05:22 Jul 20 2002	1546	44	T2 (auxiliary probe) in final?? position.			
16:05:25 Jul 20 2002	1546	45	Dave's request: A different view of the secondary temperature probe placed at Virgin.			R662-072
16:06:13 Jul 20 2002	1546	45	Interrogating the T2 probe with the acoustic modem to see what the temp is. The sampler is working - but the temperatures are not making sense.			
16:10:04 Jul 20 2002	1546	44	This year the RAS has only 2 temperature probes. T1 is in the collector (titanium tripod) - where the fluid is sampled. T2 is an auxiliary probe and is placed in the vent.			
16:15:04 Jul 20 2002	1546	45	We're going to try to center the tripod a bit better.			
16:23:30 Jul 20 2002	1546	147	Manipulating the tripod - trying to straighten it up a bit. It looks good now.			
16:24:19 Jul 20 2002	1546	143	A close-up of the titanium tripod temperature sensor at Virgin.			R662-073
16:24:53 Jul 20 2002	1545	95	Temperature sensing tripod in its final resting spot at Virgin.			R662-074
16:33:40 Jul 20 2002	1546	50	Dave says temperature in the tophat is 42C. We're going to move the probe (T2) and check temperature against RAS reading.			
16:39:55 Jul 20 2002	1546	49	We're testing what happens to the software when we get a reading above 100C on T2. Looks like a software glitch.			
16:50:47 Jul 20 2002	1546	47	Engineers are going to ping on the probe one more time.			
16:58:33 Jul 20 2002	1547	48	We're going to place the probe T2 as best we can and go on to get the next RAS (the low temp one).			
17:04:55 Jul 20 2002	1545	195	Bacteria traps and an unidentified sunken object at Gollum.			R662-075
17:06:50 Jul 20 2002	1546	239	Close-up shot of bactraps at Gollum.			R662-076
17:07:42 Jul 20 2002	1546	239	Location of bactraps at Gollum - you can almost read the numbers on top (67? 23?).			R662-077
17:11:31 Jul 20 2002	1546	202	Trying to get a temperature here at Gollum with the fluid sampler. T=7 in the diffuse flow near the bactraps.			
17:15:14 Jul 20 2002	1546	205	The Gollum site is not so good for RAS. Only 7 degrees and not much flow there.			
17:21:32 Jul 20 2002	1543	246	Mushroom vent.			R662-078
17:23:31 Jul 20 2002	1547	270	Sulfide worms at the base of Mushroom.			R662-079
17:25:15 Jul 20 2002	1547	311	Beehive at Mushroom.			R662-080
17:26:09 Jul 20 2002	1547	332	Close-up of a beehive at Mushroom.			R662-081

Time (UTC)	Z (m)	Hdg	R662 2002 Comments	Samples	Investigator	FrGrab
17:26:36 Jul 20 2002	1547	327	Temperature measurement at the base of Mushroom about 9C.			
17:26:40 Jul 20 2002	1547	328	ROPOS taking a temperature reading at a beehive (sulfide spires) at Mushroom. It will probably work (Tmax=25C). We're heading to ROPOS to check it out for possible RAS deployment.			R662-082
17:39:11 Jul 20 2002	1547	230	Anemones at Dave's.			R662-083
17:40:44 Jul 20 2002	1547	231	This is the spot we want to put the low temp RAS. We believe we're at Dave's vent.			
17:42:01 Jul 20 2002	1545	191	The anchor drop weight landed right next to the vent where we will deploy it (Dave's Vent).			
17:45:32 Jul 20 2002	1546	180	We're heading south trying to find the low-temp RAS.			
17:48:43 Jul 20 2002	1544	180	We're going to ping on the other RAS to aid in locating it.			
18:09:05 Jul 20 2002	1544	177	Didn't find RAS yet - but did find a sea star.			R662-084
18:12:02 Jul 20 2002	1542	266	We have found the RAS after searching for a half hour.			
18:14:44 Jul 20 2002	1543	267	The RAS.			R662-085
18:18:08 Jul 20 2002	1543	274	We're bringing the low temp RAS to Dave's vent.			
18:19:51 Jul 20 2002	1543	204	RAS (lo-temp.)			R662-086
18:28:54 Jul 20 2002	1546	284	The color camera was slightly mis-aligned by the ROPOS arm when trying to manipulate the RAS (it seems to be stuck). The RAS is still at the drop spot.			
18:41:35 Jul 20 2002	1545	290	Frame for Ly "Hi Kids".			R662-087
18:51:05 Jul 20 2002	1546	111	RAS is overly-heavy from the sound of it. They're trying to figure out what weight they can take off. Not sure if it's hooked up or not.			
18:53:33 Jul 20 2002	1545	276	Distance shot of RAS south of FeHyde at southern fringe of Ashes vent field.			R662-088
18:59:56 Jul 20 2002	1546	274	RAS south of FeHyde-Southern fringe of ASHES vent field sporting Hi to school.			R662-089
19:07:36 Jul 20 2002	1538	1	40 lb weight removed from RAS; sub picked it up again for transport to low temperature vent			
19:14:21 Jul 20 2002	1542	317	A momentary flatline of sub? Both cameras went out. No line-out from cage			
19:20:35 Jul 20 2002	1544	17	Back in business.			
19:34:03 Jul 20 2002	1545	264	At the Johnson Box (crack vent).			
19:38:38 Jul 20 2002	1547	276	Johnson temperature probe was removed from the cement box and set off to the side.			
19:45:06 Jul 20 2002	1546	269	Johnson flow meter. Will be deployed on the next dive.			R662-090
19:53:44 Jul 20 2002	1546	136	Temperature probe recovery.			R662-091
19:57:24 Jul 20 2002	1546	115	Johnson's cement box temperature probe (Johnson Flow Meter ) recovered to the 7 function arm; stashed in the biobox. [Crack]	R662-JFM-0020	Johnson	
20:16:02 Jul 20 2002	1470	155	A few chunks of anhydrite that had grown over the larval array. [Virgin]	R662-anhydrite-0021	Embley	
20:43:51 Jul 20 2002	938	65	Sub goes up for recovery and eventual repair of camera, laser and 7 function arm. Sub in cage. ROPOS left the bottom at 2016.			
20:43:51 Jul 20 2002	938	65	ROPOS on deck at 2144.			

Time (UTC)	Z (m)	Hdg	R662 2002 Comments	Samples	Investigator	FrGrab
20:43:51 Jul 20 2002	938	65	Wood that Verena left on the bottom a year ago (depl '01). Picked up at the end of the dive (sample time incorrect). [Crack]	R662-wood-0022	Tunncliffe	
20:43:51 Jul 20 2002	938	65	Larval Tube 1 (LT-1) that has been capped on the bottom since summer '01. It was deployed at ROPOS vent before it was capped (time not correct for this entry). [ROPOS]	R662-LT-1-0023	Metaxas	
20:43:51 Jul 20 2002	938	65	Larval Tube 4 (LT-4) that has been capped on the bottom since summer '01. It was deployed at ROPOS vent before it was capped (time not correct for this entry). [ROPOS]	R662-LT-4-0024	Metaxas	
20:43:51 Jul 20 2002	938	65	Larval Tube 12 that has been capped on the bottom since summer '01. It was deployed at Virgin before it was capped (time not correct for this entry). [Virgin]	R662-LT-12-0025	Metaxas	
20:43:51 Jul 20 2002	938	65	Larval Tube 9 (LT-9) that has been capped on the bottom since summer '01. It was deployed at Virgin before it was capped (time not correct for this entry). [Virgin]	R662-LT-9-0026	Metaxas	

## 5.9 R672 - 2002 Dive Log

Virgin Righted the hot RAS tripod. Crack The cold RAS and the Johnson flow meter were positioned. The dive was a great success - and with only 2 hours on the bottom.

Time (UTC)	Z (m)	Hdg	R672 2002 Comments	Samples	Investigator	FrGrab
17:56:22 Aug 02 2002	2	168	The dive has begun. ROPOS is in the water.			
18:35:53 Aug 02 2002	782	344	The Submarine Ring of Fire!			R672-001
19:09:17 Aug 02 2002	1542	329	The sub is on the bottom.			
19:10:25 Aug 02 2002	1540	333	The cold RAS is in sight.			
19:14:59 Aug 02 2002	1539	347	The hot RAS at Virgin Mound is in sight.			
19:17:18 Aug 02 2002	1544	64	Sampling cone.			R672-002
19:18:04 Aug 02 2002	1544	33	Its is actually 12:18 pm PDT (1900 UTC) August 2, 2002.			
19:19:10 Aug 02 2002	1545	40	Temperature probe.			R672-003
19:19:14 Aug 02 2002	1545	38	The T1 temp probe tip is not in the hot water. The flow is focused ~ 3" above the tip of T2.			
19:19:40 Aug 02 2002	1545	38	Moving of the temperature probe.			R672-004
19:21:06 Aug 02 2002	1545	38	The chimney was knocked over.			
19:23:13 Aug 02 2002	1545	37	The chimney was about a foot high.			
19:29:51 Aug 02 2002	1545	65	Sampling cone.			R672-005
19:30:41 Aug 02 2002	1545	66	Weight on the sampling cone.			R672-006
19:32:39 Aug 02 2002	1545	64	Weight on the cone.			R672-007
19:37:25 Aug 02 2002	1545	62	Trying to catch the third leg.			R672-008
19:37:37 Aug 02 2002	1545	61	Trying to position the hula hoop weight around the sample cone.			
19:38:49 Aug 02 2002	1545	58	Working on the tripod.			R672-009
19:39:23 Aug 02 2002	1545	60	Working on the tripod.			R672-010
19:39:29 Aug 02 2002	1545	59	The Hula Hoop is in place.			
19:39:29 Aug 02 2002	1545	59	Working on the tripod.			R672-011
19:41:24 Aug 02 2002	1545	62	Sit camera view of the tripod.			R672-012
19:41:52 Aug 02 2002	1545	62	Tripod with Ropos arm.			R672-013
19:43:20 Aug 02 2002	1545	60	Attempting to re-install the T2 temperature probe.			
19:43:36 Aug 02 2002	1545	32	Temperature probe.			R672-014
19:44:02 Aug 02 2002	1545	29	Working on the temperature probe.			R672-015
19:45:10 Aug 02 2002	1545	28	Working on the temperature probe.			R672-016
19:46:27 Aug 02 2002	1545	17	Temperature probe and tripod.			R672-017
19:48:13 Aug 02 2002	1545	22	Temperature probe.			R672-018
19:48:21 Aug 02 2002	1545	21	A compromise position for T2 was arrived at empirically.			
19:49:38 Aug 02 2002	1545	22	Tip of the temperature probe.			R672-019
19:50:30 Aug 02 2002	1545	24	Temperature probe and tripod.			R672-020
19:52:01 Aug 02 2002	1543	4	Tripod and RAS.			R672-021
19:52:13 Aug 02 2002	1542	358	Tripod and RAS at Virgin.			R672-022
19:52:37 Aug 02 2002	1538	352	The sub is moving from the hot RAS to go to the cold RAS.			
19:53:05 Aug 02 2002	1535	175	27 digital photos were transferred, the last of which is number 943.			
19:56:13 Aug 02 2002	1542	315	We are trying to find the low temp vent where we will deploy the cold RAS.			

Time (UTC)	Z (m)	Hdg	R672 2002 Comments	Samples	Investigator	FrGrab
20:05:58 Aug 02 2002	1543	254	Spot for the cold RAS.			R672-023
20:06:07 Aug 02 2002	1544	300	A good spot was found near the anchor weight for the hot RAS (when it was dropped).			
20:07:09 Aug 02 2002	1544	71	The cold RAS is nearly due east of the diffuse vent site.			
20:07:17 Aug 02 2002	1543	63	Cold RAS.			R672-024
20:08:03 Aug 02 2002	1543	358	Cold RAS.			R672-025
20:10:40 Aug 02 2002	1542	326	The cold RAS is in the grasp.			
20:12:11 Aug 02 2002	1542	327	Cold RAS.			R672-026
20:13:45 Aug 02 2002	1541	268	Moving the cold RAS.			R672-027
20:14:28 Aug 02 2002	1535	274	RAS is in transit.			
20:16:19 Aug 02 2002	1540	267	Spot for the cold RAS.			R672-028
20:17:52 Aug 02 2002	1542	238	The cold RAS was set down next to the target vent - which is Dave's Vent (what a coincidence).			
20:18:02 Aug 02 2002	1542	221	Cold RAS on spot.			R672-029
20:18:39 Aug 02 2002	1542	161	Cold RAS at Dave's vent.			R672-030
20:19:52 Aug 02 2002	1545	203	Visual inspection indicates that the RAS is fairly level with respect to gravitation - at least on one end.			
20:22:17 Aug 02 2002	1545	200	Grabbing.			R672-031
20:22:35 Aug 02 2002	1545	198	T1 probe of the cold RAS was freed of its tie wraps.			
20:25:46 Aug 02 2002	1545	345	Fluid collector.			R672-032
20:26:12 Aug 02 2002	1545	344	The pull pin to release the sample collector cap was removed.			
20:27:03 Aug 02 2002	1544	311	Fluid collector.			R672-033
20:27:23 Aug 02 2002	1543	343	Fluid collector.			R672-034
20:29:39 Aug 02 2002	1545	89	Placing the fluid collector.			R672-035
20:30:30 Aug 02 2002	1545	96	Fluid collector on location.			R672-036
20:30:48 Aug 02 2002	1545	95	The fluid collector cap was placed. 24 more digital photos were transferred - the last of which was number 917.			
20:31:47 Aug 02 2002	1545	81	Grabbing T2.			R672-037
20:35:47 Aug 02 2002	1545	98	Grabbing T2.			R672-038
20:35:47 Aug 02 2002	1545	98	T2 probe was freed from its tie wraps.			
20:37:06 Aug 02 2002	1545	96	T2 and fluid collector.			R672-039
20:37:06 Aug 02 2002	1545	96	T2 was placed outside the collector.			
20:42:00 Aug 02 2002	1545	133	T1 and fluid collector.			R672-040
20:42:25 Aug 02 2002	1545	135	T1 and fluid collector.			R672-041
20:42:26 Aug 02 2002	1545	136	T1 probe and intake installed in the hole in the top of the collector cap.			
20:43:06 Aug 02 2002	1545	131	Fluid collector.			R672-042
20:46:09 Aug 02 2002	1545	260	Pull the gimble pin.			R672-043
20:46:23 Aug 02 2002	1545	267	Gimble pin was removed to allow the acoustic modem to be leveled.			
20:48:33 Aug 02 2002	1542	317	Transit to Crack vent and the cement "Johnson box". 28 digital photos transferred to the hard disk, the last of which was 999.			
20:55:28 Aug 02 2002	1545	65	Johnson flow meter.			R672-045
20:55:46 Aug 02 2002	1545	62	Johnson flow meter deployment was completed at Crack Vent.			

Time (UTC)	Z (m)	Hdg	R672 2002 Comments	Samples	Investigator	FrGrab
20:56:29 Aug 02 2002	1544	254	Johnson flow meter.			R672-046
20:56:51 Aug 02 2002	1544	302	Johnson flow meter.			R672-047
21:00:56 Aug 02 2002	1545	35	19 more digital photos were transferred - the last of which was number 1018.			
21:03:11 Aug 02 2002	1545	32	Possibly a temporary recovery of hobo probes 128 & 153 from the Crack Vent region. These are not yet samples.			
21:07:02 Aug 02 2002	1545	25	Attempts at verifying an exit flow from the Johnson flow meter were not positive.			
21:08:05 Aug 02 2002	1543	280	Transit to Gollum.			
21:08:54 Aug 02 2002	1541	176	The trip to Gollum is cancelled due to tether considerations. There are too many instruments around here.			
21:12:12 Aug 02 2002	1544	308	Transit to Ropos vent instead.			
21:12:51 Aug 02 2002	1544	326	Larval arrays			R672-048
21:14:55 Aug 02 2002	1544	310	Larval arrays old and new were photographed at Ropos Vent.			
21:17:17 Aug 02 2002	1531	117	The sub is off the bottom and heading for the cage.			
21:18:26 Aug 02 2002	1504	93	19 more digital photos were transferred, the last of which was number 1036.			
22:06:18 Aug 02 2002	57	185	The sub is in the cage.			
22:12:17 Aug 02 2002	1	126	The sub is on deck.			

## 5.10 R673 - 2002 Dive Log

NRZ Recovered the 5 extensometers on the NRZ. EX 1-4 deployed 2000; EX-5 deployed 1999. Also visited **Bob** vent to look around. Did not recover the transponders up here. All extensometers made it to the surface in the elevator and on board.

Time (UTC)	Z (m)	Hdg	R673 2002 Comments	Samples	Investigator	FrGrab
02:21:58 Aug 03 2002	0	128	ROPOS in the water at 0220.			
03:27:54 Aug 03 2002	1594	35	We are on the bottom at 0326.			
03:30:09 Aug 03 2002	1594	9	Turning cage motor off to get a fix.			
03:36:21 Aug 03 2002	1588	9	We got a good fix on the cage [420860/5096766] and are getting ready to recover Extensometer 3. We are heading at bearing 95 range 110m.			
04:00:00 Aug 03 2002	1588	267	Recovering Extensometer 3. On jumbled lobate EX-3 on the west edge of the rift. [NRZ 420975/5096753]	R673-EX-3-0001	Chadwick	
04:00:28 Aug 03 2002	1589	270	Heading back to the elevator. Heading 245 range 110m.			
04:08:48 Aug 03 2002	1595	140	At the PMEL elevator; stowing EX-3 in its tube and pulling the bungy on the elevator tube.			
04:11:13 Aug 03 2002	1589	19	Heading at bearing 287 range 103m.			
04:17:55 Aug 03 2002	1594	253	Turning the cage motor off to get a fix. Note that bottom is covered with lobate lavas with minimal sediments.			
04:25:47 Aug 03 2002	1594	286	Heading west. Fix indicates that we are half-way.			
04:30:16 Aug 03 2002	1594	281	Bearing 298 range 63m from the cage to EX-4.			
04:32:27 Aug 03 2002	1594	185	EX-4 in site. Turned south and came right to EX-4.			
04:33:24 Aug 03 2002	1594	197	Recovering Extensometer 4. Sitting on jumbled sheet flow; 2m higher than surrounding lobate flow. On the west side of the rift. [NRZ 420767/5096797].	R673-EX-4-0002	Chadwick	
04:36:06 Aug 03 2002	1594	148	Following the tether to the cage at Heading 60 Range 102m.			
04:40:50 Aug 03 2002	1593	2	At the elevator; stowing the extensometer in its tube; pulling the bungy on the elevator tube.			
04:42:42 Aug 03 2002	1595	352	Moving the ship between EX-1 and EX-2.			
04:50:37 Aug 03 2002	1574	250	Checking gages.			
04:56:19 Aug 03 2002	1574	240	Turned off the SVHS at 0443 during transit.			
05:00:03 Aug 03 2002	1574	199	Taking a digital sit-cam of a jellyfish.			
05:15:00 Aug 03 2002	1546	97	The flying disc-ball.			R673-001
05:15:15 Aug 03 2002	1546	126	Taking a digital sit-cam of a huge deep-sea jellyfish.			
05:18:44 Aug 03 2002	1583	132	Heading back down to the bottom.			
05:19:18 Aug 03 2002	1592	141	On the bottom. Heading 100 range 72m to the extensometer.			
05:20:21 Aug 03 2002	1592	103	Turning the SVHS back on.			
05:22:15 Aug 03 2002	1592	98	Looking for EX-1 in jumbled ridge.			
05:23:19 Aug 03 2002	1592	157	Extensometer 1.			R673-002
05:23:20 Aug 03 2002	1592	158	Recovering Extensometer 1 on a jumbled ridge. East side of the rift. [NRZ 421196/5096711]	R673-EX-1-0003	Chadwick	
05:23:46 Aug 03 2002	1592	174	A close up of EX-1.			R673-003
05:25:14 Aug 03 2002	1593	166	ROPOS grabbing Extensometer 1 in 7-function arm.			R673-004
05:26:16 Aug 03 2002	1591	163	Heading to EX-2.			
05:28:43 Aug 03 2002	1590	221	Bearing 276 range 92m from cage to EX-2.			
05:36:44 Aug 03 2002	1594	254	Trying to get a fix.			
05:51:17 Aug 03 2002	1592	322	Still looking for EX-2.			

Time (UTC)	Z (m)	Hdg	R673 2002 Comments	Samples	Investigator	FrGrab
05:55:17 Aug 03 2002	1592	236	We were due north of the cage. Heading SW in direction of EX-2.			
05:58:34 Aug 03 2002	1592	149	Heading back to the cage as a base for launching another search for EX-2.			
06:10:25 Aug 03 2002	1593	273	Reeling in tether to position ROPOS under the cage. Moving the ship to the position of E-2.			
06:25:51 Aug 03 2002	1591	285	Sited EX-2.			
06:27:27 Aug 03 2002	1589	171	Extensometer 2.			R673-005
06:28:37 Aug 03 2002	1592	196	Preparing to grab EX-2 with the 5-function arm for the return to the elevator.			
06:33:02 Aug 03 2002	1592	179	Recovering EX-2 on jumbled ridge. East side of rift. [NRZ 421035/5096739]	R673-EX-2-0005	Chadwick	
06:33:34 Aug 03 2002	1592	178	ROPOS picking up EX-2.			R673-006
06:33:58 Aug 03 2002	1592	176	Successfully recovered EX-2 with the 5-function arm. Calling the bridge to move the ship back to the elevator.			
06:37:37 Aug 03 2002	1586	84	Transferring 15 digital sit-cam images. First image is 1037.			
06:46:48 Aug 03 2002	1555	250	SVHS video turned off at 0636.			
06:57:50 Aug 03 2002	1564	322	Ship is moving back to the elevator.			
06:58:50 Aug 03 2002	1589	274	Back on the bottom.			
07:00:24 Aug 03 2002	1591	272	Heading to the elevator.			
07:01:42 Aug 03 2002	1592	269	Turning on SVHS video at 0701.			
07:02:07 Aug 03 2002	1592	280	Located the elevator.			
07:02:52 Aug 03 2002	1592	265	The elevator.			R673-007
07:05:40 Aug 03 2002	1592	268	At the PMEL elevator; stowing EX-2 in its tube.			
07:05:42 Aug 03 2002	1592	266	Extensometers being dropped into a black tube on the elevator.			R673-008
07:05:46 Aug 03 2002	1593	265	Extensometer dropped into tube on elevator.			R673-009
07:08:18 Aug 03 2002	1592	141	Stowing EX-1 in its tube.			
07:08:19 Aug 03 2002	1592	141	Extensometer dropped into tube on elevator.			R673-010
07:08:42 Aug 03 2002	1594	163	Pulling the bungy on the elevator tube for EX-1.			
07:10:36 Aug 03 2002	1594	195	Pulling the bungy on the elevator tube for EX-2.			
07:11:24 Aug 03 2002	1594	262	ROPOS grabbing rope on elevator.			R673-011
07:11:33 Aug 03 2002	1594	264	Fixing bungy cord for tube holding EX-1.			
07:12:35 Aug 03 2002	1593	174	Moving the ship and heading out to find EX-5.			
07:14:27 Aug 03 2002	1573	165	Turned off SVHS at 0716.			
07:20:14 Aug 03 2002	1556	252	Transiting to the next location to find EX-5.			
07:42:29 Aug 03 2002	1589	256	Back on the bottom. Looking for elevator.			
07:48:13 Aug 03 2002	1596	275	Turning on SVHS video at 0748.			
07:48:38 Aug 03 2002	1596	268	Extensometer 4 in sight.			R673-012
07:50:36 Aug 03 2002	1596	257	Found EX-5.			
07:50:49 Aug 03 2002	1596	258	Recovering EX-5 in area of lobate lavas with some small collapsed pits. [NRZ 420590/5096865]	R673-EX-5-0005	Chadwick	
07:51:59 Aug 03 2002	1598	273	ROPOS grabbing EX-5.			R673-013
07:53:12 Aug 03 2002	1598	268	ROPOS grabbing EX-5.			R673-014
07:53:29 Aug 03 2002	1598	266	Picked up EX-5 and moving back to the cage.			
07:54:33 Aug 03 2002	1597	267	Turning off S-VHS video at 0754.			



Time (UTC)	Z (m)	Hdg	R673 2002 Comments	Samples	Investigator	FrGrab
07:56:36 Aug 03 2002	1568	137	Back at cage - moving ship back to elevator.			
08:22:10 Aug 03 2002	1591	309	Back on bottom and at the elevator.			
08:22:56 Aug 03 2002	1590	334	2 male skates.			R673-015
08:23:01 Aug 03 2002	1590	329	2 male skates.			R673-016
08:23:25 Aug 03 2002	1589	301	2 male skates realizing that they are both male.			R673-017
08:23:44 Aug 03 2002	1589	280	The other skate swims away.			R673-018
08:23:48 Aug 03 2002	1589	266	Skate swimming away.			R673-019
08:24:24 Aug 03 2002	1589	224	Found 2 male skates beneath the elevator - took digital pics.			
08:24:38 Aug 03 2002	1589	213	Elevator with 4 extensometers.			R673-020
08:24:59 Aug 03 2002	1590	279	Started S-VHS video at 0824.			
08:28:44 Aug 03 2002	1591	319	ROPOS putting in EX-4.			R673-021
08:29:03 Aug 03 2002	1592	327	Placed EX-5 into tube on elevator.			
08:29:27 Aug 03 2002	1593	290	Pulled bungy cord on tube where EX-5 was placed.			
08:31:21 Aug 03 2002	1592	225	Took 10 digital pics of the elevator with all extensometers placed inside. Last file number =1059.			
08:33:56 Aug 03 2002	1583	225	Turned S-VHS video off at 0833.			
08:35:54 Aug 03 2002	1581	206	Moving ship 2 km north to check out Bob vent.			
10:13:37 Aug 03 2002	1619	319	Heading to the bottom.			
10:14:49 Aug 03 2002	1636	314	On the bottom. Lots of jumbled sheet flows in area. Taking digital pics. [421629/5098870]			
10:15:32 Aug 03 2002	1636	320	Looking for Bob Vent.			
10:16:34 Aug 03 2002	1639	317	Lots of clams in area - also blue mats, sponges and crabs.			
10:20:52 Aug 03 2002	1638	312	That blue mat again at periphery of Bob's Vent.			R673-022
10:21:55 Aug 03 2002	1638	310	Blue and pink mats.			R673-023
10:25:04 Aug 03 2002	1639	238	Clams and blue mat.			R673-024
10:25:24 Aug 03 2002	1640	228	Clams and blue mat.			R673-025
10:26:37 Aug 03 2002	1640	226	Orange mat?			R673-026
10:26:53 Aug 03 2002	1640	225	Investigating area and taking lots of digital pics and frame grabs.			
10:27:51 Aug 03 2002	1640	225	Orange mat?			R673-027
10:28:51 Aug 03 2002	1640	225	Crab eating.			R673-028
10:30:18 Aug 03 2002	1640	224	Crab cracking open a clam.			R673-029
10:30:59 Aug 03 2002	1640	224	Clams.			R673-030
10:34:07 Aug 03 2002	1640	224	Crab's face.			R673-031
10:34:23 Aug 03 2002	1640	224	Crab. A face only a mother could love.			R673-032
10:35:52 Aug 03 2002	1640	218	Crabs noticing each other.			R673-033
10:36:26 Aug 03 2002	1640	210	Crabs fighting.			R673-034
10:38:43 Aug 03 2002	1637	304	Moving on to the NW to explore more of the area.			
10:40:04 Aug 03 2002	1640	306	Wide angle of gastropod city.			R673-035
10:41:40 Aug 03 2002	1641	348	Region has lots of areas of diffuse flow and lots of life associated with it.			
10:42:16 Aug 03 2002	1641	348	Gastropod city.			R673-036
10:46:22 Aug 03 2002	1641	350	Blue mat city.			R673-037

Time (UTC)	Z (m)	Hdg	R673 2002 Comments	Samples	Investigator	FrGrab
10:48:00 Aug 03 2002	1640	304	Close up of blue mats and gastropods.			R673-038
10:48:22 Aug 03 2002	1640	302	Taking digital pics of various parts of the area/biology.			
10:49:17 Aug 03 2002	1640	302	Close up of blue mats and gastropods.			R673-039
10:51:20 Aug 03 2002	1636	313	Shift change-Sheryl logging now. We are heading NW in an exploratory mode.			
10:55:58 Aug 03 2002	1636	128	We are about 50 meters from the cage and have left the venting area. We will turn back SE now to go back into it.			
10:59:26 Aug 03 2002	1634	120	Heading back to the cage for tether management.			
11:02:31 Aug 03 2002	1635	330	We are back on the bottom below the cage. Will head to the West a little. More evidence of venting here below the cage. We are back where we started. Will go NW again then will cut perpendicular to find the edges of the active area.			
11:05:01 Aug 03 2002	1636	294	Went 10m SW and will look around a bit here. Lots of clams and crabs here.			
11:07:41 Aug 03 2002	1640	233	Close up of crab.			R673-040
11:09:06 Aug 03 2002	1640	233	Close up of crab and biology.			R673-041
11:09:26 Aug 03 2002	1640	230	There are some patches of small tubeworms with reddish-brown bacterial mat.			
11:09:45 Aug 03 2002	1640	229	Close up of bacteria and gastropods.			R673-042
11:11:20 Aug 03 2002	1640	218	Dumping 30 digital pics to the hard drive. Numbers 1060-1089.			
11:15:33 Aug 03 2002	1640	217	Continue heading SW.			
11:18:26 Aug 03 2002	1639	195	Orange and blue bacterial mats.			R673-043
11:18:30 Aug 03 2002	1639	200	Still seeing evidence of venting.			
11:20:52 Aug 03 2002	1639	269	Close up of bacterial mats.			R673-044
11:21:42 Aug 03 2002	1637	241	Another patch of venting. Continuing SW.			
11:23:43 Aug 03 2002	1639	212	Close up of an interesting fish.			R673-045
11:24:28 Aug 03 2002	1639	213	Close up of an interesting fish.			R673-046
11:25:12 Aug 03 2002	1638	216	Odd looking fish. Looks somewhat flat and wide. Not sure what it is but it seems to be sitting down near a small diffuse venting area.			
11:26:05 Aug 03 2002	1639	293	Close up of interesting fish and bacterial mats.			R673-047
11:26:43 Aug 03 2002	1640	296	Close up of bacterial mats and possible scale fish.			R673-048
11:27:38 Aug 03 2002	1640	296	Close up of orange bacterial mat and gastropods.			R673-049
11:27:58 Aug 03 2002	1640	297	We don't know what kind of fish this is but Kim suggested the name "Uglyfish".			
11:30:10 Aug 03 2002	1640	290	Done exploring. Heading back to the cage and then to the elevator.			
11:46:35 Aug 03 2002	1544	240	Moved 5 digital pictures to the hard drive. LFN=1094.			
13:01:04 Aug 03 2002	1543	219	We are at the elevator site but will wait until it gets a little more light to release it.			
13:07:34 Aug 03 2002	1500	300	Bill is releasing the elevator.			
14:01:48 Aug 03 2002	1503	333	The elevator is on deck.			
14:18:36 Aug 03 2002	1503	356	We are not going to bother trying to recover transponders this time. Bringing ROPOS to the surface.			
15:11:49 Aug 03 2002	1	169	0810 Ropos is on the deck.			

## 5.11 R674 - 2002 Dive Log

Visited vents on the east side of the caldera. Started at Coquille vent field and ended at Cloud. **Vixen** Recovered 1 MTR, 2 GTB, 1 RK, 1 SS. Deployed 2 hobos. **Coquille diffuse flow** Recovered 1 MTR. **FeCity** 2 SS. **Castle** Recovered 2 SF, 1 with bacmat. Deployed 1 hobo. **Village** Recovered 1 MTR, 4 SS, 1 RK. Deployed 1 MTR. **Cloud** Recovered 1 MTR, 1 osmo, 2BT, 1 McLane, 1RK. Deployed 1 MTR. Digital images were recorded at all vents with new digital 5-megapixel camera.

Time (UTC)	Z (m)	Hdg	R674 2002 Comments	Samples	Investigator	FrGrab
20:57:03 Aug 03 2002	0	346	The sub is in the water.			
21:00:41 Aug 03 2002	57	230	The sub is out of the cage.			
22:04:50 Aug 03 2002	1536	251	The sub is on the bottom.			
22:05:27 Aug 03 2002	1536	255	This looks like Vixen Vent.			
22:05:27 Aug 03 2002	1536	255	Vixen vent.			R674-001
22:06:29 Aug 03 2002	1536	255	Vixen vent.			R674-002
22:11:11 Aug 03 2002	1536	248	Anhydrite chimney is being knocked over.			
22:11:57 Aug 03 2002	1536	250	Taking a temperature measurement in Vixen using the "Scott probe" on the gas tight intake probe. Tmax=324.			
22:14:09 Aug 03 2002	1536	249	High-temperature probe at Vixen vent.			R674-003
22:15:08 Aug 03 2002	1536	251	Firing Starboard gas tight bottle #12 at 22:15. [Vixen]	R674-GTB-stbd-000 1	Evans [ssmp: Butterfield / Lilley]	
22:16:51 Aug 03 2002	1536	253	Firing port gas tight bottle #6 at 22:17. [Vixen]	R674-GTB-port-000 2	Evans [ssmp: Butterfield / Lilley]	
22:21:09 Aug 03 2002	1536	269	Hobo-153 in Vixen vent.			R674-004
22:23:46 Aug 03 2002	1536	272	Hobo-153 deployed in Vixen.			
22:25:00 Aug 03 2002	1536	271	Above the vent has the appearance of white smoke. The base of the chimney appears to be partly mineralized, and not as fine grained as Virgin Mound.			
22:26:19 Aug 03 2002	1536	314	Hobo probes.			R674-005
22:27:20 Aug 03 2002	1536	312	Hobo probe 152 deployed at Vixen Vent. NOTE: Both of these probes (152 and 153) were at Vixen last year.			
22:29:41 Aug 03 2002	1536	305	A chunk of the base of Vixen was sampled. Placed in the starboard bio box. [Vixen]	R674-RK-0003	Embley	
22:35:09 Aug 03 2002	1536	311	Flock observed coming out of a nearby (~< 1 meter) hole in the ground. Some worms appear to surround the hole.			
22:36:14 Aug 03 2002	1536	317	Vent with abundant floc.			R674-006
22:39:04 Aug 03 2002	1536	314	The high temp probe measured a maximum of 27.9C in a brief appearance in the small hole next to Vixen.			
22:42:54 Aug 03 2002	1536	316	Heading is 314			
22:43:19 Aug 03 2002	1536	315	Suction sample of fluid and floc.			R674-007
22:44:29 Aug 03 2002	1536	318	Suction sample of fluid and floc into jar #4. 30C on the intake 20C on the output of the suction sampler. Start 22:44 Stop 22:46. [near Vixen]	R674-SS-J4-0004	Butterfield	
22:45:41 Aug 03 2002	1536	313	Suction sample with floc.			R674-008
22:52:18 Aug 03 2002	1535	356	Tube worms (?) among lava near Vixen.			R674-009
22:53:16 Aug 03 2002	1536	322	Bacteria-encrusted tubeworms (?) near Vixen.			R674-010
22:55:28 Aug 03 2002	1533	352	A small drained out area and a crab.			
22:58:38 Aug 03 2002	1536	54	A fix was received 3004 / 5373 while in search of an MTR.			

Time (UTC)	Z (m)	Hdg	R674 2002 Comments	Samples	Investigator	FrGrab
23:00:38 Aug 03 2002	1535	8	Digital sit cam of limpets in the periphery.			
23:00:48 Aug 03 2002	1534	24	Limpets on periphery of Vixen.			R674-011
23:02:12 Aug 03 2002	1535	189	Tubeworms and limpets on periphery of Vixen.			R674-012
23:06:38 Aug 03 2002	1536	169	A good fix was received 2985 / 5356			
23:12:24 Aug 03 2002	1536	155	MTR-4108 at greater Coquille area before recovery.			R674-013
23:15:04 Aug 03 2002	1536	155	One MTR has been found.			
23:16:03 Aug 03 2002	1536	172	MTR-4108 recovered to starboard bio box. [Coquille vent field]	R674-MTR-4108-0005	Embley	
23:24:03 Aug 03 2002	1536	53	Tubeworms and mats and limpets still in Coquille area.			R674-014
23:25:00 Aug 03 2002	1535	36	Collapse feature in Coquille area.			R674-015
23:25:23 Aug 03 2002	1536	44	Edge of collapse feature in Coquille area.			R674-016
23:25:23 Aug 03 2002	1536	44	Tubeworms and filamentous bacteria in Coquille area.			R674-017
23:25:23 Aug 03 2002	1536	44	We're still looking around for a second MTR.			
23:27:41 Aug 03 2002	1535	35	Tubeworms and clams and limpets in Coquille area.			R674-018
23:28:05 Aug 03 2002	1536	33	Clams in Coquille area (context shot).			R674-019
23:29:04 Aug 03 2002	1536	37	Live Clams in Coquille area (1).			R674-020
23:29:20 Aug 03 2002	1536	37	A live clam sighting.			
23:29:22 Aug 03 2002	1536	36	Live clams in Coquille area (2).			R674-021
23:31:40 Aug 03 2002	1535	39	Could not find the second MTR so we're moving on to Iron City.			
23:32:14 Aug 03 2002	1535	36	Shrimp among lava in Coquille area.			R674-022
23:32:40 Aug 03 2002	1536	37	Bearing 84 degrees distance 329 meters.			
23:34:36 Aug 03 2002	1533	85	Beginning move to FeCity from Coquille area.			
23:37:38 Aug 03 2002	1535	83	Collapse feature on way to Iron City.			R674-023
23:37:46 Aug 03 2002	1535	84	Surface of collapse feature on way to Iron City.			R674-024
23:41:09 Aug 03 2002	1536	79	Digital photos of lavas.			
23:42:48 Aug 03 2002	1535	84	Lavas between Coquille and FeCity (Iron City).			R674-025
23:43:06 Aug 03 2002	1534	83	Transferred 15 digital still photos the last of which was number 1150.			
23:44:52 Aug 03 2002	1535	84	Some more digital photos of lavas taken after the transfer.			
23:50:53 Aug 03 2002	1533	97	Iron staining between lavas on route to Iron City.			R674-026
00:01:59 Aug 04 2002	1529	37	The sub is coming off the bottom due to fire alarm.			
00:02:52 Aug 04 2002	1516	210	False alarm.			
00:08:12 Aug 04 2002	1533	193	Resuming transit to FeCity			
00:08:54 Aug 04 2002	1532	129	Collapse features near IFeCity.			R674-027
00:11:15 Aug 04 2002	1530	32	Driving along east side of rift looking for FeCity.			
00:13:01 Aug 04 2002	1533	290	Layered pillows near Iron City.			R674-028
00:13:17 Aug 04 2002	1534	296	Layered pillows near Iron City.			R674-029
00:13:29 Aug 04 2002	1534	306	Layered pillows near Iron City.			R674-030
00:14:38 Aug 04 2002	1532	1	Amazing Iron City.			R674-031
00:15:10 Aug 04 2002	1532	21	The skyscrapers of Iron City.			R674-032
00:15:18 Aug 04 2002	1533	33	Located active flow on East side of fissure - Fe City			
00:16:47 Aug 04 2002	1533	46	Iron flocs at Iron City.			R674-033

Time (UTC)	Z (m)	Hdg	R674 2002 Comments	Samples	Investigator	FrGrab
00:19:23 Aug 04 2002	1534	52	Transferred 15 digital pictures from camera. 1165 is the number of the last one.			
00:20:10 Aug 04 2002	1534	52	Close up of Iron City landscape.			R674-034
00:20:22 Aug 04 2002	1534	49	Close up of Iron City landscape.			R674-035
00:20:50 Aug 04 2002	1534	80	Microbial mats at Iron City.			R674-036
00:24:18 Aug 04 2002	1534	107	Suction sample of iron oxide started in jar J2. Tmax=4C. Start 00:18 End 00:42. fecity.log file on alien probe. [FeCity]	R674-SS-JJ2-0006	Moyer	
00:27:29 Aug 04 2002	1534	125	Yellow goo at Iron City.			R674-037
00:29:21 Aug 04 2002	1534	120	Suction sampling yellow goo at Iron City.			R674-038
00:35:41 Aug 04 2002	1534	114	Yellow goo entering Jar J3 at Iron City.			R674-039
00:42:13 Aug 04 2002	1534	89	Suction sample of iron oxide started into jar J2. Tmax=4. Start 00:42 End 00:50. note: scale worm covered in yellow-stained bacteria in sample. fecity.log file on alien probe. [FeCity]	R674-SS-JJ3-0007	Moyer	
00:45:11 Aug 04 2002	1534	101	7 digital photos were transferred the last of which was number 1172.			
00:46:18 Aug 04 2002	1534	99	Note scale worm covered in yellow-stained bacteria in Jar J3 at Iron City.			R674-040
00:53:08 Aug 04 2002	1534	108	Transit to Castle.			
00:53:41 Aug 04 2002	1534	105	Yellow oxidized iron containing microbial mats at Iron City.			R674-041
01:45:37 Aug 04 2002	1518	269	The bottom is back in sight.			
01:47:30 Aug 04 2002	1522	272	Lavas near Castle.			R674-042
01:50:30 Aug 04 2002	1515	13	Inactive chimney near Castle.			R674-043
01:50:52 Aug 04 2002	1513	46	The same inactive chimney Castle.			R674-044
01:51:37 Aug 04 2002	1510	6	Top of inactive chimney. Is this Castle?			R674-045
01:54:45 Aug 04 2002	1513	200	Mkr-N5 sighted.			
01:54:59 Aug 04 2002	1513	206	Blue material on inactive sulfide mound.			R674-046
01:55:39 Aug 04 2002	1514	168	Blue material on inactive sulfide mound.			R674-047
01:56:48 Aug 04 2002	1511	274	Possibly Castle.			R674-048
01:56:54 Aug 04 2002	1512	276	Possibly Castle.			R674-049
01:57:26 Aug 04 2002	1513	255	Possibly Castle.			R674-050
01:57:38 Aug 04 2002	1514	253	Possibly Castle.			R674-051
01:57:48 Aug 04 2002	1515	248	Animal life on possibly Castle.			R674-052
01:58:15 Aug 04 2002	1517	235	Possibly Castle.			R674-053
01:59:23 Aug 04 2002	1517	295	Dave's test tripod at Castle over anhydrite chimney.			R674-054
01:59:25 Aug 04 2002	1517	296	Discarded RAS tripod in view. This is Castle.			
02:00:28 Aug 04 2002	1519	298	BacTraps and Dave's test tripod at Castle.			R674-055
02:01:21 Aug 04 2002	1520	297	Dave's test tripod at Castle.			R674-056
02:01:49 Aug 04 2002	1520	340	Dave's test tripod at Castle.			R674-057
02:03:04 Aug 04 2002	1520	28	Dave's test tripod at Castle.			R674-058
02:03:45 Aug 04 2002	1520	27	Anhydrite below Dave's test tripod at Castle.			R674-059
02:06:10 Aug 04 2002	1520	34	GTB wand high T probe is to be inserted.			
02:06:58 Aug 04 2002	1520	34	Temperature measurement under what's left of anhydrite chimney under Dave's test tripod at Castle.			R674-060
02:07:08 Aug 04 2002	1520	35	Tmax=235C for Castle.			

Time (UTC)	Z (m)	Hdg	R674 2002 Comments	Samples	Investigator	FrGrab
02:16:14 Aug 04 2002	1520	36	Placing hobo at high temperature Castle vent.			R674-061
02:18:14 Aug 04 2002	1520	36	ROPOS finds Sputnik's last resting place at Castle vent.			R674-062
02:22:34 Aug 04 2002	1520	50	Tip of HOBO probe 128 in orifice.			R674-063
02:23:27 Aug 04 2002	1520	45	Deployed hobo-128 at Castle in the anhydrite vent.			
02:24:25 Aug 04 2002	1517	15	Looking down on Castle.			R674-064
02:25:28 Aug 04 2002	1515	51	Castle sulfide structure before sampling.			R674-065
02:26:31 Aug 04 2002	1515	57	Sampling sulfide from Castle.			R674-066
02:26:39 Aug 04 2002	1515	46	The merchandise.			R674-067
02:27:50 Aug 04 2002	1520	38	Large chunk of sulfide chimney from Castle placed in stbd biobox. Z=1516. [Castle]	R674-SF-0008	Lupton	
02:31:24 Aug 04 2002	1517	57	Tubeworms on side of Castle.			R674-068
02:33:01 Aug 04 2002	1516	54	28 digital photos transferred the last of which was number 1200.			
02:33:27 Aug 04 2002	1515	55	Close up of head of Castle.			R674-069
02:35:41 Aug 04 2002	1513	55	Head of Castle.			R674-070
02:35:53 Aug 04 2002	1513	54	Head of Castle.			R674-071
02:37:02 Aug 04 2002	1513	55	Reaching for Castle sulfide.			R674-072
02:37:58 Aug 04 2002	1513	78	Gargoyle on Castle before sampling.			R674-073
02:38:51 Aug 04 2002	1513	44	Gargoyle being sampled.			R674-074
02:39:03 Aug 04 2002	1513	40	Gargoyle severed by ROPOS.			R674-075
02:39:13 Aug 04 2002	1513	39	Another part of Castle's sulfide structure - covered with white filamentous bacteria. Into starboard biobox. Sample was supposed to be a sulfide for Embley - but turned into a bacteria sample for Moyer. [Castle]	R674-SF-bacmat-0009	Moyer	
02:43:17 Aug 04 2002	1513	89	15 digital still photos were transferred the last of which was 1215.			
02:43:33 Aug 04 2002	1513	88	The message: "ROPOS was here". The evidence: sampling scars.			R674-076
02:44:18 Aug 04 2002	1513	108	Top of Castle showing sampling scars.			R674-077
02:50:41 Aug 04 2002	1518	263	Arriving at Diffuse / Village vent 20 meters west of Castle.			
02:52:20 Aug 04 2002	1523	199	Very healthy looking red fur on tubeworms.			
02:52:20 Aug 04 2002	1523	199	Tubeworms.			R674-078
02:54:03 Aug 04 2002	1523	182	Active vent.			R674-079
02:56:57 Aug 04 2002	1523	183	Water sample into jar-5; T1=14 T2=7 Tmax=21. Start 3:00 Stop 3:02. [Diffuse/Village]	R674-SS-J5-0010	Butterfield	
03:02:33 Aug 04 2002	1523	186	Big fat limpets into the flush jar (jar 7). Tmax=7.7 Start 3:03:45 Stop 3:05:50. [Diffuse/Village]	R674-SS-J7-0011	Lee [ssmp: Bates]	
03:03:21 Aug 04 2002	1523	184	Active vent with tubeworms and limpets.			R674-080
03:07:15 Aug 04 2002	1523	185	Peripheral limpets on basalt into jar 2. Tmax=0.7C. alien stopped working. Two sites sampled - one not in the flow - another in slight flow. Start 0313 Stop 0320. alien temp log filename: villaman.log [Diffuse/Village]	R674-SS-J2-0012	Bates	
03:09:15 Aug 04 2002	1523	185	Active vent site.			R674-081
03:13:56 Aug 04 2002	1522	197	Suction sampling.			R674-082
03:14:30 Aug 04 2002	1522	199	Suction sampling.			R674-083
03:18:12 Aug 04 2002	1522	198	Suction sampling.			R674-084

Time (UTC)	Z (m)	Hdg	R674 2002 Comments	Samples	Investigator	FrGrab
03:19:31 Aug 04 2002	1522	200	Sampling area.			R674-085
03:24:31 Aug 04 2002	1522	176	Same site mats.			R674-086
03:28:35 Aug 04 2002	1523	139	Flock attacking ROPOS.			R674-087
03:30:26 Aug 04 2002	1523	136	Basalt sample collected in diffuse flow - part of new flow. [Diffuse/Village]	R674-RK-0013	Gillis / Channing	
03:33:12 Aug 04 2002	1523	140	Rock sample.			R674-088
03:33:58 Aug 04 2002	1523	137	Rock sample going into purse.			R674-089
03:34:11 Aug 04 2002	1523	136	Successfully stowed the basalt rock into the purse.			
03:35:15 Aug 04 2002	1523	139	In a pit 1-2m pit eastern edge of 98 flow 20m west of Castle vent.			
03:35:54 Aug 04 2002	1523	141	Deployed MTR-3087 at Diffuse/Village.			R674-090
03:39:18 Aug 04 2002	1523	215	MTR-3087 deployed in clump of tubeworms at Village vent. Heading 209S in a pit.			
03:41:59 Aug 04 2002	1523	208	Mtr-3087 at Village site.			R674-091
03:49:28 Aug 04 2002	1523	167	Suction sampling bacterial mats into jar 4. Start 0349-0356. [Diffuse/Village]	R674-SS-J4-0014	Moyer	
03:58:56 Aug 04 2002	1523	146	Dumping 18 digital photos. Last photo is 1233.			
04:00:51 Aug 04 2002	1523	244	Taking digital pictures of Village.			
04:04:13 Aug 04 2002	1522	6	Basalt seafloor.			R674-092
04:09:02 Aug 04 2002	1482	112	Transiting to Cloud start 0409. Back on bottom and searching for Cloud at 0530.			
05:41:07 Aug 04 2002	1519	90	Started pumping on starboard McLane pump. A few meters off the bottom while approaching Cloud. The pump is averaging 7.5 L/min.			
05:48:23 Aug 04 2002	1519	196	Cloud is in sight .			
05:49:30 Aug 04 2002	1522	231	Cloud.			R674-093
05:49:59 Aug 04 2002	1523	244	Settling arrays in sight.			
05:52:16 Aug 04 2002	1524	318	Bactrap.			R674-094
05:53:43 Aug 04 2002	1525	322	Still pumping McLane on bottom.			
05:55:41 Aug 04 2002	1525	314	Taking digital pictures of settling arrays.			
06:03:59 Aug 04 2002	1525	320	Still taking pictures of settling arrays.			
06:11:14 Aug 04 2002	1523	298	Moving to a second array 8 meters away from Cloud to take digital images of the vent.			
06:13:15 Aug 04 2002	1521	130	Stbd McLane pump - A few meters off the bottom while approaching Cloud. The pump is averaging 7.5 L/min. Vol=9240L 1914 seconds. Start 0541 End 0613. [Cloud]	R674-MP-0015	Leveille	
06:14:55 Aug 04 2002	1521	129	Crab attacking scientific instruments.			R674-095
06:19:50 Aug 04 2002	1523	328	Crab altering hydrothermal bacteria sample.			R674-096
06:20:59 Aug 04 2002	1523	302	Still taking digital pictures of second settling array.			
06:22:04 Aug 04 2002	1524	292	Jelly fish.			R674-097
06:24:11 Aug 04 2002	1523	290	Crab eating the antibacterial goo from the settling array.			R674-098
06:25:16 Aug 04 2002	1523	264	Claw caught in the cookie jar.			R674-099
06:32:43 Aug 04 2002	1523	260	Preparing to retrieve bactraps.			
06:36:29 Aug 04 2002	1522	319	Clouds.			R674-100
06:39:31 Aug 04 2002	1523	81	Trying to land ROPOS near the opening of Cloud vent to get the bactraps.			
06:52:10 Aug 04 2002	1524	295	Retrieving bactrap.			R674-101

Time (UTC)	Z (m)	Hdg	R674 2002 Comments	Samples	Investigator	FrGrab
06:52:56 Aug 04 2002	1524	292	Gotcha Bactrap!			R674-102
06:53:23 Aug 04 2002	1524	294	Recovering bacterial traps 65 and 66 together. Huge bacterial assemblage attached to them.			
06:55:13 Aug 04 2002	1522	301	Bacterial trap 66 placed in port biobox - deployed R659.[Cloud]	R674-BT-66-0016	Moyer	
06:56:00 Aug 04 2002	1522	300	TaDa!			R674-103
06:57:07 Aug 04 2002	1521	298	Bacterial trap 65 placed in port side bio box - deployed R629.[Cloud]	R674-BT-65-0017	Moyer	
06:58:28 Aug 04 2002	1521	298	4 digital pics moved - last file number 1306.			
06:58:53 Aug 04 2002	1521	297	2 bactraps at once.			R674-104
06:59:32 Aug 04 2002	1521	295	Bactraps being put in the biobox.			R674-105
06:59:40 Aug 04 2002	1521	296	Beautiful white filamentous bacteria on the bactraps.			R674-106
07:03:27 Aug 04 2002	1521	299	Bactraps secured in bio-box.			
07:08:22 Aug 04 2002	1519	298	Looking for a spot to anchor the MTR at Cloud without it falling into the hole.			
07:12:19 Aug 04 2002	1524	299	Attempting to get a sample of the rock around the orifice at Cloud.			
07:12:31 Aug 04 2002	1524	300	Flowing white filaments.			R674-107
07:13:50 Aug 04 2002	1524	281	A chunk of basalt from the orifice around Cloud placed in the purse. [Cloud]	R674-RK-0018	Channing / Gillis	
07:14:01 Aug 04 2002	1524	281	Grabbing a rock.			R674-108
07:15:12 Aug 04 2002	1524	281	Square rock chosen at Cloud vent.			R674-109
07:17:26 Aug 04 2002	1524	280	Putting rock in the purse.			R674-110
07:17:32 Aug 04 2002	1524	281	Basalt secured in purse.			
07:22:03 Aug 04 2002	1524	312	Picking up OSMO at Cloud N6.			R674-111
07:22:54 Aug 04 2002	1523	309	Retrieving the Osmo-sampler at Cloud - deployed R627. [Cloud]	R674-osmo-0019	Wheat	
07:24:52 Aug 04 2002	1524	302	OSMO so far placed off to the side of Cloud.			
07:25:45 Aug 04 2002	1524	309	Moving to deploy MTR-3173 at Cloud. Attempting to hang it off a rock so it doesn't disappear into the chasm.			
07:26:49 Aug 04 2002	1524	307	MTR 3173 deployed into the hole at Cloud N6. What is going on with the zip-ties?			R674-112
07:28:12 Aug 04 2002	1524	306	Trying to break the zip-tie.			R674-113
07:29:21 Aug 04 2002	1524	311	Label fell off line of MTR-3173.			
07:30:53 Aug 04 2002	1524	311	Trying to place line of MTR around a rock to weight it down.			
07:33:46 Aug 04 2002	1524	313	Grabbing a rock to weigh down the MTR line.			
07:35:22 Aug 04 2002	1524	313	Where rock was taken from.			R674-114
07:35:34 Aug 04 2002	1524	305	Line has sunk a foot into the hole. Leaving it - hopefully next year can grab it with a hook. Array was to the right when we tried to deploy the MTR-3173.			
07:36:11 Aug 04 2002	1524	309	Beautiful filamentous bacteria.			R674-115
07:37:04 Aug 04 2002	1523	307	Moving to N4 to recover another MTR.			
07:40:48 Aug 04 2002	1524	159	Really cool structure.			R674-116
07:47:46 Aug 04 2002	1522	333	Can't find the MTR - returning to N6 to pick up the OSMO.			
07:50:05 Aug 04 2002	1524	313	OSMO being recovered.			R674-117
07:50:07 Aug 04 2002	1524	317	Picked up OSMO and placed on top of bio-boxes on ROPOS.			



Time (UTC)	Z (m)	Hdg	R674 2002 Comments	Samples	Investigator	FrGrab
07:51:42 Aug 04 2002	1523	316	Locking down arm to secure the OSMO while heading back to look for the MTR for a few minutes before the dive ends.			
07:56:09 Aug 04 2002	1522	242	Spotted MTR-3045 at N4/Cloud.			
07:57:48 Aug 04 2002	1523	235	Recovered MTR-3045 at Mkr-N4 Cloud - Deployed R625. Placed in port biobox. MTR is covered in limpets. [Cloud N4]	R674-MTR-3045-00 20	Embley	
07:58:05 Aug 04 2002	1523	253	The MTR.			R674-118
08:06:36 Aug 04 2002	1523	256	ROPOS retrieving OSMO			R674-119
08:09:05 Aug 04 2002	1523	256	Moving out west by 20 m to take digital pics of the '98 lavas. 7 digitals taken - last file number 1313.			
08:13:38 Aug 04 2002	1517	280	ROPOS moving back to cage. Dive is over.			
08:20:01 Aug 04 2002	1369	235	ROPOS on the way to the surface.			
09:22:37 Aug 04 2002	1	95	ROPOS on deck and secure.			

## 6.0 NeMO 2003 SCIENCE SUMMARY

Bill Chadwick, Chief Scientist

Our NeMO 2003 expedition was a tremendous success. We came out with a long list of things we wanted to do at Axial this year but not much time. However, we were able to do almost everything we had planned, thanks to good weather and the hard work of the ship's crew, the ROPOS group, and the scientists on board. We completed 10 dives in 10 days and only were kept out of the water due to weather a half of a day near the end of the cruise. We kept ROPOS in the water an average of over 16 hours per day, or over two-thirds of the time we were at Axial, and collected 116 samples. During ROPOS dives we made pressure measurements, recovered settling arrays, deployed the RAS sampler, recovered and deployed HOBOS and MTRs, deployed extensometers, collected vent fluid samples, and conducted biological observation and experiments. The time between dives was also busy as usual, with the deployment and/or recovery of the NeMO Net buoy, the RAS sampler, an OBH instrument, elevator moorings, two BPR moorings, two MTR/current meter moorings, acoustic transponders, and we conducted five CTD casts.

It is now 5 years since the 1998 eruption at Axial Volcano. After the dramatic changes we saw right after the eruption (new lava on the seafloor, new hydrothermal vents becoming established and colonized, and warm water and microbial blooms almost everywhere), we have documented a slow decline in hydrothermal systems in the eruption area since then. Some vents gradually declined in temperature while others stopped venting altogether. So before this expedition, we did not know if more, or perhaps even all of the sites that we had been monitoring would now be completely dead – the heat and chemicals from the 1998 eruption now completely dissipated. But that is not what we found. Instead we found that the hydrothermal vents on the 1998 lava flow are still very much active and appear to have reached a kind of steady state. Many of the vents we visited this year appear very similar to the way they looked last year, or may even be more robust than before. For example, at Marker 33 (one of our main monitoring sites on the new lava flow) the temperature and extent of venting now seems steady after several years of decline and new tubeworm bushes have colonized nearby, suggesting that the site is now established and stable. From camera tows in the 1980's and 90's, we know that the southeast side the Axial Volcano's caldera (where the 1998 eruption occurred) was the site of extensive hydrothermal venting and biological communities before the 1998 eruption. Now 5 years later, this same area seems to again be a persistent site of deep hydrothermal circulation that taps heat from a bigger and more stable source than just the heat delivered to the surface from the 1998 lava flow.

So Axial seems to be returning to a steady state system after the perturbations caused by the 1998 eruption. Likewise, we are adapting our research strategies from documenting the rapid changes associated with the eruption, to a longer-term monitoring effort in anticipation of future events. NeMO Net is the cornerstone of this interactive monitoring effort. Much of our research is focused on trying to discover relationships between the volcanic, hydrothermal and biological systems at Axial. We suspect they are all profoundly interrelated and we are designing and deploying instrumentation that will reveal these relationships. In the meantime, we will keep our vigil at Axial until the next time that earthquakes begin to rumble, lava erupts, biological communities are destroyed, but then quickly reestablished all over again.

## 6.1 NeMO 2003 PARTICIPATING ORGANIZATIONS

NOAA Pacific Marine Environmental Lab (PMEL)  
 Oregon State University (OSU)  
 University of Washington (UW)  
 University of Victoria (UVic)  
 University of Quebec at Montreal (UQAM)  
 Dalhousie University (DU)  
 Canadian Scientific Submersible Facility (CSSF)  
 Washington State University (WSU)

## 6.2 NeMO 2003 SCIENTIFIC PERSONNEL

Scientist	Affiliation	Participation
Bill Chadwick	OSU / NOAA Vents Program	Chief Scientist/Geologist
Dave Butterfield	UW / NOAA Vents Program	Chemistry
Jean Marcus	University of Victoria	Biology
Ray Lee	Washington State University	Biology
Susan Merle	OSU / NOAA Vents Program	Data Manager/Outreach/Navigation
William Martin	UW / NOAA Vents Program	Chemistry
Geoffrey Lebon	UW / NOAA Vents Program	Chemistry
Shannon Ristau	NOAA Vents Program	Data Management/Mapping
Sheryl Bolton	University of Washington	Microbiology
Bill Hanshumaker	Oregon State University	Education/Outreach
Amanda Bates	University of Victoria	Biology GS
Gitai Yahel	University of Victoria	Biology GS
Noreen Kelly	Dalhousie University	Biology GS
Marie Morineaux	University of Quebec	Geochemistry GS
Warren Caldwell	Princeton University	Biogeochemistry Student
Jon Bumgardner	PMEL Engineering	Engineer
Nicholas Delich	PMEL Engineering	Engineer
John Shanley	PMEL Engineering	Engineer
Keith Shepherd	CSSF	ROPOS Team Leader
Bob Holland	CSSF	ROPOS Engineer
Keith Tamburri	CSSF	ROPOS Engineer
Kim Wallace	CSSF	ROPOS Engineer
Vincent Auger	CSSF	ROPOS Engineer
Sebastian Durand	CSSF	ROPOS Engineer
Rodger Adamson	CSSF	ROPOS Engineer
Ian Murdock	CSSF	ROPOS Engineer
Blee Williams	CSSF	ROPOS Engineer
Shane Lovelace	CSSF	ROPOS Engineer

(GS = Graduate Student)

### **6.3 2003 R/V THOMAS G. THOMPSON PERSONNEL**

Philip Smith	Captain
Jake Sowers	Chief Mate
Eric T. Haroldson	2nd Mate
Jay Stephens	3rd Mate
Anthony N. Monocandilos	AB
Erik C. Durnan	AB
Michael D. Durnan	AB
Terence Singerline	AB
Jeffrey R. Artingstall	AB
Frank L Spetla Jr.	AB
Charles E. Ormiston	Chief Engineer
Michael E. Merrill	1st Engineer
Richard D. Leonard	2nd Engineer
Mark H. Johnson	3rd Engineer
Nathan, S. Gardner	Oiler
Colin J. Street	Oiler
Mario S. Yordan	Oiler
Javier S. Smith	Wiper
Raymond E. Gideons	Chief Steward
Anthony T. Balbon	2nd Cook
Hasheem A. Bell	Steward Assistant
Bill Martin	Marine Technician
Robert Hagg	Marine Technician

## **7.0 2003 DISCIPLINE SUMMARIES**

### **7.1 GEOLOGY**

#### **7.1.1 NeMO 2003 Geology Summary**

**Bill Chadwick**

The geological work at Axial Volcano this year included, 1) ROV pressure measurements, 2) deploying extensometer instruments, and 3) collecting a lava pillar sample from near the rumbleometer site. The ROV pressure measurements continue our instrumental monitoring efforts to measure inflation and deflation of the volcano. Pressure measurements were made during ROPOS dive 734 at five seafloor benchmarks (Caldera Center, Magnesia, Marker 33, BagCity, and Southern Pillow Mound) during three ROPOS traverses in order to see if the points inside the caldera are moving vertically relative to the point well outside the caldera. This years survey was collected in almost the same way as last year's survey, so will be a good test of this monitoring method.

During ROPOS dive 742, five NOAA/PMEL prototype extensometer instruments were deployed on the north rim of Axial caldera, near where the north rift zone intersects the caldera rim. These instruments monitor for horizontal displacements on the seafloor. The instruments were deployed so they span the large fissure swarm on the north rim that was mapped with the Imagenex sonar during NeMO 2001. These extensometer instruments had previously been used in an area about 2 miles north of this location, but the refurbishment of the transponder nets this year offered the opportunity to relocate this experiment closer to the caldera. In this setting the instruments may be able to detect volcano inflation as well as any rift zone extension. For the first time, the prototype extensometers were deployed in tripod bases (similar to but smaller than the benchmarks currently deployed with the extensometer array at south Cleft). Pressure measurements were also made at each of these new benchmarks after the instruments were deployed so that vertical and horizontal deformation can be monitored from the same points.

During ROPOS dive 743, geologic mapping observations were made in the vicinity of the rumbleometer site, along the western edge of the collapse area of the 1998 lava flow. Digital camera images and a small pillar sample were collected to assist in planning for the possible recovery of a larger pillar sample in the future. This is of interest in order to relate physical features on the lava pillars in this area to the unique data recorded by the rumbleometer during the 1998 eruption.

Internally recording temperature probes were recovered and deployed at several high temperature and diffuse vents in our continuing effort to monitor the thermal output of Axial volcano. (See section 9.0 for details)

## **7.2 CHEMISTRY and MICROBIOLOGY**

### **7.2.1 Vent Fluid Chemistry and Microbiology Program**

**Dave Butterfield**

The main goals of this cruise were to install the NeMO-Net interactive sampler for time series sampling and to re-sample hot and warm vents with the Hydrothermal Fluid and Particle Sampler (HFPS). Both of these goals were met. Because of the limited duration of this cruise, the microbiological work was limited primarily to sampling low-temperature fluids on one HFPS dive (741).

Dave Butterfield and Bill Martin handled the setup of HFPS and shipboard chemical analysis, which included pH, alkalinity, hydrogen sulfide, and dissolved silica. Geoff Lebon and Sheryl Bolton assisted with HFPS setup. Sheryl Bolton, from John Baross's lab at the University of Washington, was responsible for all of the microbiological work on board. A team from PMEL's Engineering Development Division (Jon Bumgardner, Nick Delich, and John Shanley) was on board to handle many tasks including the preparation and deployment of the NeMO-Net interactive sampler.

#### **NeMO-Net Interactive Sampler**

This year we were able to assemble and deploy a single interactive sampler. The sampler consists of a McLane Remote Access Sampler (RAS), 3 platinum RTD temperature sensors, and a pH sensor (AMT GmbH, Rostock Germany, serial number 28) interfaced to a PMEL-designed acoustic modem-satellite link. The system is designed to collect 450ml water samples once per week by default schedule, send back daily temperature records (three sensors, once per hour), and collect and transmit pH data every 3 days. One temperature sensor (T1) is located inside the fluid collector directly next to the fluid intake tube, a second was placed directly in the hot vent (T2), and a third is located at the sensor block, (T3), which is at the exhaust end of the pump. All data are transmitted back to shore via the link from seafloor acoustic modem/transducer to NeMO-Net buoy to Iridium satellite. A new Iridium receiving system has been set up at PMEL this year. The interactive sampler was equipped with an omni-directional transducer this year, so that the buoy could be placed at a distance away from the vent field and not interfere with ROV or submersible operations.

We chose to monitor Virgin Mound high-temperature vent again this year for several reasons. First of all, it is in the class of vents that do not grow large sulfide structures because it has very low metal content. This makes it feasible to sample the hot fluid from this vent without the certainty of short-term clogging by sulfide mineral precipitation. This vent has a known history, with intermittent time-series sampling going back to 1986. It has consistently shown low salinity and gas content among the highest known for any hydrothermal vent. The extremely high CO<sub>2</sub> content of this vent implies that it has a strong connection to magmatic processes within the caldera. (Exsolution of magmatic CO<sub>2</sub> is the only mechanism capable of producing this high level of gas.) Therefore, this vent is likely to be affected by magmatic or tectonic activity at Axial Volcano. If any activity is detected by the SOSUS acoustic network, we will carefully examine the temperature and pH data to decide if increased sampling is warranted. If there are significant changes, we can send commands to take a vent fluid sample at any time.

We made several important modifications to the interactive sampler based on the experience from 2002-2003. The titanium tripod fluid collector placed over the vent was made taller by the addition of heavy stainless steel feet for additional height and stability. Syntactic foam was added to the top to decrease overall weight in the water and provide a righting moment for additional stability. A heat shield was added beneath the temperature

sensor and fluid line connectors, and flexible stainless steel tubing was added to protect the cable and fluid line near the vent. A long titanium tube was added to the temperature sensor placed directly in the vent to protect it from melting. The RAS setup was not significantly changed. Every sample is filtered with either glass fiber (pre-combusted and pre-weighed) or polycarbonate (every multiple of 4 on the RAS, acid-cleaned pre-weighed Millipore GTTP) filters. No preservatives are added to any of the samples in advance. Dead volumes (approximately 5ml) are filled with deep seawater filtered through a 0.2 micron filter. 5% hydrochloric acid is back flushed through the intake line after each sample. Volume of the intake line is 100 ml, and this is flushed with 750ml of sample prior to filling sample bags. Sample bags are all of laminate type to minimize gas exchange between the sample and the cylinder water. An optional preservative for DNA can be added to selected samples. The preservative is 2% by weight NaCl, 5 millimol/liter EDTA, 10 millimole/liter Tris, and 50% ethanol by volume, filtered through 0.2 micron filter, with a measured pH of 7.95.

Every aspect of the interactive sampler deployment went perfectly. The mooring was deployed with a 30-m long drop anchor (400 lb disc) in 3 segments to facilitate crane lifts. The mooring landed very close to the drop target SE of the ASHES vent field. ROPOS was able to remove the drop anchor and lift the package without difficulty. The sampler was placed on a flat area just south of Virgin and was very nearly level. The tripod was removed without trouble and placed directly over the vent with a level attitude and hot fluid filling the funnel. The T2 temperature probe was placed with the tip in hot flow beneath the tripod, and a small anhydrite chimney formed over the probe within 24 hours. The deployment could not have been better.

Temperature data transmitted back from the system show T1= 80 to 100 deg C, T2= 281 deg C, and ambient T3=2.5 deg C. We could not decode the other data transmitted by the system while at sea. Issues related to data transmission will have to be dealt with on shore. It appears that everything is correct with the seafloor system and the buoy.

### **Vent Fluid Sampling with HFPS**

We had two dives with HFPS, one for hot fluid sampling and one for low-T fluid sampling. It is best practice to separate hot and warm sampling because of potential cross-contamination that might affect the low-T sample chemistry. During dive 739, we compromised and sampled one low-T vent in the ASHES field first in order to save time and not return to ASHES on the second fluid sampling dive. We sampled the low-T vent (Dave's vent), where the interactive sampler (system B) for 2002-3 was deployed. Filters for DNA, RNA, and FISH were taken at this vent, but the fluid sample intended for culture had a serious leak and could not be used for microbiological culture work. During the rest of dive 739, we sampled key vents in the ASHES field, including Virgin Mound fluid taken out of the collection funnel for the interactive sampler, Inferno vent and Hell vent. Hell vent has been very difficult to sample in the past, but this year we obtained good quality samples. We also sampled Casper vent (next to Vixen vent in the Coquille area at the south end of the caldera) and Castle vent on the edge of the 1998 SE caldera lava flow. The vent at Castle looked very similar to past years, but an additional vent was found on the last dive of this cruise (743) at the top of a 10-m high chimney to the north of Castle and Flat Top vents. This new vent was named Top Gun. Unfortunately, the seawater-pressure mechanism for triggering gas-tight bottles on dive 739 was unreliable and only 2 of the 6 gas-tight samplers fired (one at Virgin and one at Inferno).

On the low-T sampling dive (R741), we sampled Bag City (two vents), Coquille, Marker 113, Village, Marker 33, Cloud N6, and Marker N3. In general, it appeared that venting was the same or somewhat more vigorous than in the previous two years. The fluid sampler worked very well on both dives. Good samples were obtained from all of the sites. On dive 741, we installed a pH and H<sub>2</sub>S sensor. The pH sensor worked well, but the H<sub>2</sub>S sensor not at all, giving highly erratic voltages throughout the dive. The in-situ

Shipboard analysis included pH, alkalinity, hydrogen sulfide and dissolved silica. On shore, samples will be analyzed for nutrients (nitrate/nitrite/ammonia/phosphate), major elements, dissolved organic carbon, and a large suite of trace elements. Unfortunately, there was no shipboard gas analysis this year, but the gas-tight samples collected will be analyzed for carbon dioxide, methane, hydrogen and helium.

### NeMO 2003 Vent Fluid Samples

Dive	HFS#	Sample Type	Date	Start Time	Stop Time	Max T (°C)	Avg T (°C)	Volume (ml)	Comments
R739	15	Sterivex filter	10:22 am	10:22:05	10:22:05	68.2	53.4	1018	Dave's vent sterivex
R739	10	RNA filter	10:22 am	10:22:05	10:22:05	70.3	56.5	920	Dave's vent RNA
R739	2	FISH filter	10:22 am	10:22:05	10:22:05	60.1	58.1	604	Dave's vent FISH
R739	4	Piston	10:22 am	10:22:05	10:22:05	60.7	57.2	626	Daves vent RAS2002 site
R739	11	Bag w gff filter	10:22 am	10:22:05	10:22:05	57.3	54.7	640	Dave's vent
R739	9	Bag	10:22 am	10:22:05	10:22:05	96.2	92.7	539	VM in RAS funnel
R739	14	Bag w gff filter	10:22 am	10:22:05	10:22:05	96.9	92.3	569	VM in RAS funnel
R739	GT	Gas-tight orange #11	10:22 am	10:22:05		92.1		150	VM in RAS funnel
R739	5	Piston	10:22 am	10:22:05	10:22:05	287	255.4	651	Inferno top N end
R739	16	Bag w gff filter	10:22 am	10:22:05	10:22:05	292.6	291.2	640	Inferno top N end
R739	GT	Gas-tight black #15	10:22 am	10:22:05		292		150	Inferno top N end
R739	23	Piston w gttf filter	10:22 am	10:22:05	10:22:05	270.5	263.5	599	Hell top
R739	20	Piston	10:22 am	10:22:05	10:22:05	270.4	260.4	633	Hell top
R739	8	Bag	10:22 am	10:22:05	10:22:05	254.7	214.6	503	Casper
R739	17	Bag w pc membrane filter	10:22 am	10:22:05	10:22:05	232.7	226.4	474	Casper
R739	18	Bag	10:22 am	10:22:05	10:22:05	262.4	240.9	466	Casper
R739	24	Piston w gff filter	10:22 am	10:22:05	10:22:05	224.6	223.9	473	Castle anhy
R739	22	Piston	10:22 am	10:22:05	10:22:05	224.3	223.3	513	Castle anhy
R739	19	Bag	10:22 am	10:22:05	10:22:05	223.9	221.3	495	Castle anhy.
R739	*	attempted Gas-tights							Tried gas-tights at Vixen and Castle. Only 2 of 6 worked.
R741	2	pH sensor (s/n 26)	10:22 am	10:22:05	10:22:05	31.4	4.2	21691	SENSORS
R741	4	Piston	10:22 am	10:22:05	10:22:05	12.9	12.8	704	bag city piston
R741	11	Bag w pc membrane filter	10:22 am	10:22:05	10:22:05	31.4	31.2	630	bag city filt bag
R741	5	Piston	10:22 am	10:22:05	10:22:05	31.3	31.1	706	bag city piston
R741	1	Sterivex filter	10:22 am	10:22:05	10:22:05	31.4	31.2	1003	bag city sterivex
R741	7	RNA filter	10:22 am	10:22:05	10:22:05	31.5	31.3	1001	bag city RNA filt
R741	8	Bag	10:22 am	10:22:05	10:22:05	29.3	25.9	626	coquille crevice vent w tube
R741	3	DNA filter	10:22 am	10:22:05	10:22:05	28.7	23.1	1096	coquille
R741	24	Piston w gff filter	10:22 am	10:22:05	10:22:05	29	25.1	666	coquille
R741	9	Bag	10:22 am	10:22:05	10:22:05	26.6	26.6	594	mkr 113
R741	13	Sterivex filter	10:22 am	10:22:05	10:22:05	26.6	26.6	1100	mkr 113
R741	23	Piston w gff filter	10:22 am	10:22:05	10:22:05	26.8	26.6	697	mkr 113
R741	22	Piston	10:22 am	10:22:05	10:22:05	28.1	27.4	674	village
R741	12	DNA filter	10:22 am	10:22:05	10:22:05	27.3	24.8	1045	village dna
R741	14	Bag w gff filter	10:22 am	10:22:05	10:22:05	24.7	24	636	village
R741	20	Piston	10:22 am	10:22:05	10:22:05	17.6	14.1	756	N3 piston tubeworms
R741	15	Sterivex filter	10:22 am	10:22:05	10:22:05	18.1	15.2	1229	N3 in tubeworms, same as p20
R741	16	Bag w pc membrane filter	10:22 am	10:22:05	10:22:05	20.6	17.2	500	N3, flow over vertical face white mat
R741	18	Bag	10:22 am	10:22:05	10:22:05	8.1	8	623	Cloud N6



Dive	HFS#	Sample Type	Date	Start Time	Stop Time	Max T (°C)	Avg T (°C)	Volume (ml)	Comments
R741	17	Bag w gff filter	10:22 am	10:22:05	10:22:05	13	12.4	571	mkr 33
R741	19	Bag	10:22 am	10:22:05	10:22:05	12.5	11.5	626	mkr 33
R741	21	Sterivex filter	10:22 am	10:22:05	10:22:05	12.6	10.9	1047	mkr 33
R741	10	RNA filter	10:22 am	10:22:05	10:22:05	12.6	12.6	1020	RNA-preserved
R743	GT#12	yellow tape	10:22 am	10:22:05		225?			Castle anhydrite, H2S in peek tube after sampling.
R743	GT#2	white tape	10:22 am	10:22:05		225?			Castle anhydrite, used peek tubes in titanium tube for intake

## 7.2.2 Hydrothermal Fluid Microbiology

### Sheryl Bolton

The primary goal of the study of hydrothermal fluid microbiology at Axial is to characterize and quantify the microbial populations associated with diffuse fluids using a combination of molecular, microscopic and culturing techniques and examine links to changes in fluid chemistry over both time and space. By characterizing the populations in diffuse fluids we are able to further constrain the hypothesized conditions of the subsurface biosphere at Axial Seamount.

This year provided several high quality samples that were useful in continuing the time-series of semi-quantitative culture enrichments (MPNs, Most-Probable Number technique) at several vent locations, some of which have been sampled annually since the 1998 eruption. Samples were also taken at two sites at which MPNs had not been performed previously (Coquille and Marker N3). A table showing the results of these MPNs is shown below.

#### Results of Most-Probable Number Technique

Location	Sample T (C)	Culture T (C)	Type of Microbe	Microbes/L
Bag City	31	90	Hyperthermophilic heterotroph	20-720
		90	Hyperthermophilic autotroph	0
Coquille	29	90	Hyperthermophilic heterotroph	500-8800
		70	Thermophilic autotroph	60-880
Marker 113	27	90	Hyperthermophilic heterotroph	500-8800
Village	28	90	Hyperthermophilic heterotroph	140-4200
Marker N3	18	90	Hyperthermophilic heterotroph	20-460
		90	Hyperthermophilic autotroph	<10-260
Cloud	8	70	Thermophilic heterotroph	3000-96,000
Marker 33	12	90	Hyperthermophilic heterotroph	60-880
		90	Hyperthermophilic autotroph	0

The Marker 33 sample was the lowest temperature sample at that site and also showed the lowest numbers of hyperthermophiles since the 1998 eruption. Marker 113 and Village vents also showed decreased numbers of hyperthermophiles from previous years, while the density of thermophiles increased at Cloud vent, although the temperature has remained fairly stable since last year. Both Coquille and Marker N3 appear to have established populations of both hyperthermophilic heterotrophs and thermophilic and hyperthermophilic autotrophs.

The most commonly cultured and most thoroughly studied group of organisms from geothermal habitats belong to the hyperthermophilic order Thermococcales (*Pyrococcus*, *Thermococcus*, and *Palaeococcus* spp.). The isolation of these organisms from low-temperature fluids well below their optimal growth temperature indicates a warm, stable, anaerobic environment within the seafloor where they can thrive. However, the few phylogenetic analyses of deep-sea hydrothermal vent fluids without prior enrichment on mineral or organic surfaces have not detected the Thermococcales, and little is known about their *in-situ* diversity, abundance, and distribution. Fluids filtered for DNA extraction and FISH (Fluorescent In-Situ Hybridization) from geographically and chemically different vents will be used to determine the diversity and abundance of the Thermococcales using 16S rRNA primers specifically targeting this group of organisms. The molecular and microscopic data will then be compared to culture data from isolated Thermococcales species and MPNs to determine if the isolated organisms are representative of the *in-situ* diversity and abundance.

The long-term RAS sampler placed at Virgin vent contains several filters for both DNA/RNA extraction and FISH. A DNA preservative will be added to filters to increase the yield of DNA/RNA during extraction and decrease degradation during the year-long deployment. An RNA preservative shown to increase yield during extraction was also successfully added in-situ to an RNA filter taken at Marker 33 using the hot fluid sampler. This sample will be used to look for the expression of metabolic functional genes such as the *nif* genes that encode enzymes responsible for nitrogen fixation. Previous DNA studies at Marker 33 have identified a diverse community of potential nitrogen-fixing Archaea and Bacteria that may be expressing *nif* genes when nitrogen is limiting. This method can also be used to look for expression of genes involved in other potentially relevant metabolic pathways to help further understand the microbial communities in the subsurface biosphere at Axial Seamount.

### **7.2.3 A Preliminary Study of the Lability (Bioavailability) of Dissolved Organic Carbon (DOC) in Hydrothermal Vents.** **Gitai Yahel and Verena Tunnicliffe**

The total organic carbon (TOC) in the ocean is divided into two major compartments: particulate (POC) and dissolved (DOC). The dissolved pool is operationally defined as the organic carbon passing through a fine filter, typically GF/F (~0.5  $\mu\text{m}$ ). The particulate fraction consists of larger living organisms and detrital particles. The vast majority of the organic carbon pool in the ocean is dissolved; about 90% in surface waters and often 99% in deep waters. Only a small fraction of the dissolved pool is labile, the rest is thought to be refractory and unavailable for use by marine organisms.

Our current knowledge of the concentrations, fluxes, and lability of DOC in the hydrothermal vent system is limited. Preliminary results suggest that DOC may undergo severe transformation during its passage through the hydrothermal system (S. Lang and D. Butterfield, University of Washington, unpublished data). The hydrothermal system is believed to be a source of organic carbon, either by direct formation of small organic molecules and/or via CO<sub>2</sub> fixation (primary production) by the sub-seafloor microbial community. Our goal was to test if vent water DOC is a potential source for heterotrophic consumption by vent organisms at Axial (i.e. if and to what extent is vent water DOC bioavailable). To that end, clean water samples were collected at various locations (background seawater and multiple diffuse flow vent sites). Water samples were aliquoted for analysis of TOC, DOC, POC, and for bacterial counts and incubated on deck for 24-48 hr. This sampling scheme was repeated at the middle and the end of the incubation period to test for potential bacterial consumption of DOC and/or for bacteria growth.

## Water Samples:

Diffused vents X 13 (Hell, Village, Marker 33)

Ambient deep seawater X 11 (to ground-truth and calibrate the system, 1000 m depth)

## 7.3 MACROBIOLOGY

### 7.3.1 Larval Recruitment Dynamics

Noreen Kelly and Anna Metaxas

This year marked the end of a 3-year experiment to describe patterns in larval colonization and understand the factors that affect larval settlement and subsequent recruitment. We collected arrays of settlement plates that had been deployed at various vent sites at Axial Volcano in 2001 and 2002. Each array included plates with two different substrates (basalt and scour pads) and, for each substrate, two levels of accessibility by grazers (low and high). The arrays were deployed in sets, with one set having already been recovered and replaced in 2002. This year, we were able to recover three arrays at Cloud (two near venting and the third ~8 m away), two arrays from ROPOS, one from Virgin's Daughter, and one from Marshmallow, for a total of 7 settlement arrays. cursory examinations of settlement arrays and digital photographs showed distinct size classes of gastropods, indicating episodic recruitment over time. Analysis of arrays collected in 2002 showed spatial variability in settlement and recruitment of invertebrate larvae to vents at Axial Volcano. With the collection of these remaining arrays in 2003, we will also be able to determine if there exists temporal variability in settlement and recruitment at these sites as well.

This year we were also able to measure growth rates of the limpet, *Lepetodrilus fucensis*, over two different time scales. Both methods involved the use of the fluorochrome Calcein (2,4-bis-[N,N'-di(carbomethyl)-aminomethyl]-fluorescein), which binds to calcium. Immersion of limpets in a calcein solution results in the deposition of a fluorescent mark along the growing edge of the shell. Growth (shell length increase) is then measured as the distance between the bright green fluorescent calcein mark and the growing tip of the shell from time of exposure. For the short-term experiment (days to weeks), a sub-sample of 100 limpets (representing various size classes) were taken from a collection from Marker 33, and using two on-board pressure chambers, were divided into two groups of 50 individuals, and kept under pressure at two different temperatures, 17 and 8 °C. For the first 12 hours, limpets were exposed to a 100 mg/L calcein solution and then immersed in unfiltered seawater for the remainder of the experiment. For the long-term experiment (months to year), a sub-sample of 500 limpets (representing 3 distinct size-classes) from ROPOS vent were exposed to a calcein solution on-board ship, then returned to the sea-floor and placed in diffuse venting at Marker 33. These limpets were placed in a cage, lined with 1 mm mesh, which will remain on the sea-floor for one year. It is hoped that this data will identify if growth rates are variable, and clarify the role of growth variability in affecting patterns of recruitment.

#### NeMO 2003 Sample List

<b>Sample Number</b>	<b>Vent/Site</b>	<b>Description</b>
R734-SS-J5-0009	Marker 33	Sub-sampled 100 limpets for growth experiment
R735-LA-0003	Cloud	Array F recovery
R735-LA-0004	Cloud	Array P recovery
R735-LA-0005	Cloud	Array H recovery
R737-LA-0001	ROPOS	Array Z recovery
R737-LA-0002	ROPOS	Array I recovery
R739-SS-J4-0017	ROPOS	Background community sample for Array I
R739-SS-J5-0018	ROPOS	Background community sample for Array Z

R740-LA-N-0001	Virgin's Daughter	Array N recovery
R740-SS-J4-0002	Virgin's Daughter	Background community sample for Array N
R740-LA-K-0003	Marshmallow	Array K recovery
R740-SS-J5-0004	Marshmallow	Background community sample for Array K
R741-SS-J7-0025	Cloud	Background community sample for Arrays F&P

### 7.3.2 Gastropod Species Distributions and Limpet-Bacterial Symbiosis

Amanda Bates

#### Gastropod Species Distributions

On the Axial 2003 cruise, I replicated the behavioural experiments first conducted at Endeavour Seamount and found corroborating results. I also conducted similar experiments in on-ship pressure vessel experiments and found that temperature is an important habitat cue. We now understand that vent fluid chemistry is not the only control on the distribution of these three species. Biological factors, such as competition, may also play a role in determining gastropod species distributions. These behavioral in situ and on-board experiments represent a new direction in vent research.

#### The Nature of a Limpet-Bacterial Symbiosis

Limpets were collected for molecular work to determine 1) the identity of the gill bacteria and 2) the life stage at which the bacteria are acquired. These collections are critical to our understanding of what may be a unique symbiosis between a dominant community player, the limpet, and its gill bacteria.

### 7.3.3 NeMO 2003 Report from Juniper's Lab

Marie Morineaux

Marie Morineaux from the Kim Juniper's lab (UQÀM, Montréal, Québec, Canada) participated in the NeMO 2003 cruise to Axial Volcano (North East Pacific). Samples of fauna and organic detritus were collected for different projects, along with video recordings.

#### 1- Ecology of alvinellid worms at hydrothermal vents

Overall goal : Understand feeding behavior of the sulfide worm *Paralvinella sulfincola* and palm worm *Paralvinella palmiformis*

Our first objective was to conclude ecological studies of the sulfide worm, *Paralvinella sulfincola* polychaete by our lab. This pioneering species colonizes the hottest colonized parts of the black smokers in NEP vent fields. Worm density, biomass, and territorial behavior have been previously studied, and we have also made preliminary observations of the capture of the particulate matter as food. Some data were missing to conclude description of the animal's deposit feeding behavior. Six hours of close-up videos of *P. sulfincola* were taken during the NeMO 2003 cruise, essentially at the Hell and Pork Chop (base of Hell) vents. This will allow us to examine feeding behavior under different environments conditions.

During the close-up videos observations, one digital photo was taken every 20 seconds. This let us document the presence of *P. sulfincola* juvenile's as well as the adult worm's general behavior.

About two hours of close-up video of the *Paralvinella palmiformis* polychaete has also been taken for to begin a study of feeding behavior of this worm. Those videos were collected at the Marker 33 and Phoenix vents.

## 2- Meiofauna and microbes at deep-sea hydrothermal vent

Meiofaunal organisms share the same habitat of the sulfide worm and other hydrothermal vent macro faunal assemblages. Digital photos and suction samples were collected from the two close-up *P. sulfincola* habitats. To continue this meiofauna study, other samples were collected in different habitats at other hydrothermal vent sites, including blue mats at Village and two low flow sites at Coquille and Village. Five suction samples in all were collected for the meiofauna study.

Samples were also collected for a study of the microbial weathering of sulphide minerals. These samples included:

### Four arrays containing weathering sulphide blocks:

One suction sample of iron oxide on the road between Coquille and Village

One suction sample of sediment at the base of Hell chimney

One piece of rock in Castle chimney

### List of the samples collected during the NeMO cruise 2003 :

R737-LA-I	Ropos vent	Recovery of the array I
R737-LA-F R737-LA-H	Cloud	Recovery of the array F and H
R740-LA-N		Recovery of the array N
R740-SS-J6	Pork Chop	115 digital photos 2 hours videos observations of <i>P. sulfincola</i> Suction sample of <i>P. sulfincola</i> habitat
R740-SS-J7	Hell	One hour videos of <i>P. sulfincola</i>
R740-SS-J7	Hell	One hour videos of <i>P. sulfincola</i>
R741-SS-J4	Bag City	Suction sample of a low flow site
R741-SS-J5	Coquille	Suction sample of a low flow site
R743-RK	Castle	One piece of rock
R743-SS-J6	Base of Hell	Sediment
R743-SS-J5	Hell	80 digital photos Half an hour of videos of <i>P. sulfincola</i> Suction sample of <i>P. sulfincola</i> habitat
R743	Phoenix	Two hours videos of <i>P. sulfincola</i> , <i>P. palmiformis</i> and <i>P. pandorea</i> at Phoenix vent
R743-SS-J4	Village	Suction sample of blue mats

## **7.4 PMEL ENGINEERING**

### **7.4.1 NeMO 2003 Engineering Summary**

**Jon Bumgardner**

This document is to serve as a short summary of the Pacific Marine Environmental Laboratory Engineering Development Division's (PMEL EDD) operations during the 2003 NeMO cruise at Axial. These tasks include: deploying and placing the RAS Sampler, deploying the communications buoy, recovering and deploying two subsurface moorings, recovering and servicing the transponder network, deploying two bottom pressure recording units, deploying and recovering an ocean bottom hydrophone unit (OBH), and deploying five extensometers. All bottom placement of engineering equipment was completed by the ROPOS team. All deck operations were carried out under the supervision and with the assistance of the R.V. Thompson deck crew.

The RAS sampler was prepared and deployed from the starboard side of the Thompson using the aft crane. The RAS lander was deployed with a releasable sink anchor that guided it to the bottom in about one hour. The lander was placed by the ROPOS team with assistance from engineering personnel. This included installing the intake funnel over the vent and placing a secondary temperature probe in the vent.

The communications buoy serves as the surface node for the NeMO net observatory. The buoy relays signals sent to it from the RAS lander and from the bottom pressure recorder (BPR) left from last year. The buoy was deployed amidship, from the starboard side, buoy first.

The two subsurface moorings were recovered and deployed on the starboard side of the fantail. This operation required the use of EDD portable capstan. These moorings were deployed anchor last.

BPR's, OBH, and transponders were quick and relatively easy to deploy due to their relatively small size. The BPR's and OBH were deployed using the aft crane and the transponders were deployed by hand from the port side.

The extensometers were sent to the bottom in a PMEL elevator mooring deployed and recovered amidship with the aft crane. The ROPOS team installed the extensometers once they reached the bottom.

From engineering's perspective this cruise was a success. All operations were completed on schedule, without injuries, equipment loss, and or damage.

## **7.5 PUBLIC OUTREACH**

### **7.5.1 NeMO 2003 Public Outreach**

**Susan Merle, Bill Hanshumaker, Bill Chadwick, Andra Bobbitt, Shannon Ristau**

The NeMO 2003 web site (<http://www.pmel.noaa.gov/vents/nemo/expeditions.html>) offered daily updates on the cruise and allowed interested individuals to follow progress of the scientific expedition at the NeMO Observatory, Axial Volcano. The updates included a daily science report written by Susan Merle and a science summary by Chief Scientist Bill Chadwick. The web site featured a daily log by "Educator At Sea" participant Bill Hanshumaker. Bill Hanshumaker is a Public Marine Education Specialist with the Sea Grant facility at Hatfield Marine Science Center (HMSC). Bill acted as the liaison between scientists on the NeMO expedition and the public. Andra Bobbitt and Susan Merle (NOAA Vents Program / OSU), and Bill Hanshumaker coordinated their efforts (Susan and Bill on

the ship, Andra on shore) to produce a daily NeMO web page. The updated information and pictures were also included in daily presentations for the general public at HMSC, twice daily, presented by interns at the HMSC Interpretive Center. The four summer interns were: Danielle Gabriel, Mary Conser, Rebecca (Becca) Schiewe, and Diana Boro,

### **7.5.2 NeMO 2003 Public Outreach: Marine Research and Education** **William Hanshumaker, Public Marine Education Specialist**

"OceanQuest" is the title of our summer educational theme at Hatfield Marine Science Visitors Center (HMSVC). We focus on delivering the results of current marine research through a variety of venues; auditorium presentations, public demonstrations, research posters, and scientific apparatus. The OceanQuest program was successful at communicating the process and results of recent marine research to over 1200 people this summer. The evolving PowerPoint program was presented in our auditorium on 84 opportunities between June 27th and September 6th. Summer interns were responsible for developing a new presentation based on NOAA's Ocean Exploration program. This was incorporated midway through the summer and covered oceanographic research from the Marianas Arc volcanoes, to Astoria Canyon and Heceta Bank. During the final weeks of the summer, OceanQuest focused on the New Millennium Observatory (NeMO) at Axial Volcano. This version utilized text and images sent directly from sea, providing our visitors at Hatfield Marine Science Center (HMSC) with an opportunity to experience the excitement of near-real time marine research.

NeMO was conceived in 1998 as a long-term study of the interactions between physical oceanography, geology, chemistry, and biology on a dynamic part of the mid-ocean ridge system. Using state of the art technology and continuing to evolve, NeMO has been wildly successful, not only with its scientific endeavors, but also in its educational outreach efforts.

NeMO has touched the lives of educators, students and the general public. Each year, educators are sent to sea with scientists on a research vessel to investigate Axial Volcano. Educators come from across the country, from New York to Oregon, and return to their hometowns with new knowledge and enthusiasm for ocean exploration. The classroom teachers develop curriculum based on their NeMO experience, multiplying the educational impact of their personal experience. Through a National Science Foundation grant, additional curriculum based on NeMO has been developed and has been distributed by CD to educators around the globe.

Many educators use the nationally recognized NeMO web site and associated links in their classrooms. Their students can be directly involved in the NeMO experience, as well. Students send questions to the educator at sea, who consults with the scientists to answer their questions in near real time via the NeMO web site. The NeMO web site is also useful for students exploring potential careers in oceanography. Interviews of research scientists and marine technicians are posted on the web, complete with information on what their job entails and how they acquired their positions.

The NeMO program has had tremendous impact in nonformal venues as well. Information and digital images posted on NeMO's web site has been used at the HMSC and the Oregon Museum of Science and Industry to develop auditorium presentations for the general public. At the Hatfield Marine Science Visitor Center, PowerPoint presentations are updated daily during the summer, providing the visiting public with near real time information of research being conducted on the Axial Volcano. College interns are responsible for the development and delivery of these programs. They gain valuable professional experience that has enhanced their career opportunities. These presentations cover fundamental science concepts, such as plate tectonics, as well as the social

implications of the marine research being conducted. Evaluation of the audiences has indicated that regardless of age or educational level, significant short-term cognitive gain was demonstrated.

Each year, over 130,000 people have the opportunity to see exhibits about NeMO at Hatfield Marine Science Visitor Center. Specimens from the Axial Volcano are on public display. A computer exhibit simulates an underwater fly-by of the volcano where the participant can cue up videos of different NeMO sites. Deep-sea research equipment, such as a rumbleometer and extensometer, are on display. The most popular exhibit at the Center is the ROPOS (remotely operated platform for ocean science) simulator. Combining computer animation and authentic video captured at NeMO, participants can choose one of three dive experiences. Using a joystick in a simulated ship board environment, they can navigate ROPOS to dive and explore at NeMO.

NeMO continues to have a profound effect on both deep-sea research and education. The New Millennium Observatory serves as a model that should be emulated in our current national efforts to connect ocean research to the American public.



## 8.0 NAVIGATION

### 8.1 NeMO 2003 Navigation

Bill Chadwick

Since 1998, we have had 2 transponder nets for acoustic navigation at Axial Volcano (the ASHES and the North Rift nets), each consisting of four expendable Benthos XT-6000 transponders with 5-year battery lifetimes. This year we recovered all the Axial transponders to replace their batteries, change some reply frequencies, and relocated the nets slightly. During several ROPOS dives, the parachute chord mooring lines were cut and ROPOS either held onto the transponders or clipped them together before letting them float to the surface as a bunch (to minimize the recovery time with the ship at the surface). This operation went very smoothly because ROPOS was able to find the transponders very easily and quickly (since their positions and depths were known very accurately) and the ship had no trouble maneuvering to recover them with ROPOS still in the water. The only surprise was that the 11.0 kHz transponder in the ASHES net, which had not been heard from for several years, was never found, presumably due to implosion or being dragged off by someone else. So we recovered a total of seven transponders. Two of the reply frequencies were changed so that there would be no redundant frequencies between the nets. The ASHES net was replaced close to its previous position, but the North Rift net now covers both the CASM vent site and the north rim of the caldera, where the extensometer instruments were deployed. ROPOS dives were made in both new nets and the navigation was good (perhaps improved?), as long as the cage motor was off.

The table below lists the calibrated locations and depths of the new transponder nets (calibrations were performed by ROPOS navigators using SeaScape software).

### 8.2 NeMO 2003 Transponder Positions Transponders deployed Summer 2003

Reply Frequency (kHz)	UTM X	UTM Y	Long (decimal degrees)	Lat (decimal degrees)	Long (deg)	Long (min)	Lat (deg)	Lat (min)	Depth
<b>Lava Net</b>									
lava10.5	424368	5088261	129.975763	45.943750	129	58.5458	45	56.6250	1308.21
lava8.5	424349	5086129	129.975673	45.924567	129	58.5404	45	55.4740	1320.87
lava11.5	422407	5086195	130.000728	45.924940	130	0.0437	45	55.4964	1326.71
lava7.5	421926	5087976	130.007223	45.940918	130	0.4334	45	56.4551	1336.26
<b>CASM Net</b>									
casm8.0	421279	5093140	130.016412	45.987312	130	0.9847	45	59.2387	1363.79
casm10.0	420510	5094426	130.026552	45.998798	130	1.5931	45	59.9279	1306.48
casm9.5	419661	5093074	130.037288	45.986528	130	2.2373	45	59.1917	1277.21

## 9.0 ROPOS SAMPLES/EXPERIMENTS - 2003

### 9.1 R734 - 2003 Samples

Sample	Location	Mkr	Z	Hdg	Time	R734 2003 Sample Descriptions	Investigator
R734-SS-J8-0001	Vixen		1536	294	04:54:20 Aug 30 2003	Suction sample of sulfide worms into jar-8. Start 0454 Stop 0457.	Lee
R734-hobo-153-0002	Vixen		1536	294	05:07:32 Aug 30 2003	Recovered hobo-153 (deployed in 2002).	Embley
R734-hobo-152-0003	Vixen		1536	295	05:11:20 Aug 30 2003	Recovered hobo-152 (deployed in 2002).	Embley
R734-MTR-3087-0004	Village		1522	197	07:17:14 Aug 30 2003	MTR-3087 recovered from Village (Diffuse) vent. The number recorded at deployment was 3987 - it's actually 3087.	Embley
R734-hobo-128-0005	Castle		1521	13	07:28:13 Aug 30 2003	Hobo-128 recovered successfully. It was deployed in R674 in the anhydrite spire.	Embley
R734-MTR-3213-0006	Mkr-33		1525	315	08:45:05 Aug 30 2003	MTR-3213 retrieved.	Embley
R734-MTR-4127-0007	Mkr-33		1524	207	08:56:39 Aug 30 2003	MTR-4127 retrieved. The label was covered with limpets - it is confirmed to be 4127.	Embley
R734-MTR-3185-0008	Mkr-33		1524	201	09:02:45 Aug 30 2003	Retrieval of MTR-3185. The number is very clearly read as 3185 - but this MTR number is not listed among those deployed in R661 (we thought it was 3039). We are taking it anyway. The MTR was surrounded thickly with tubeworms.	Embley
R734-SS-J5-0009	Mkr-33	Bmrk-5	1524	213	09:45:40 Aug 30 2003	Suction sample of limpets and other critters for Amanda in a new tubeworm bush near Mkr-33 in the area of the Bmrk-5 (into jar-5). Start=0944 End=0949. Start2=0952 End2=0953. Start3=0955 End3=0958. Third suction is at slightly different area.	Bates [ssmp: Kelly / Lee]
R734-SS-J6-0010	Mkr-33		1524	200	10:17:49 Aug 30 2003	High flow suction sample of limpets at the far side of Mkr-33 crack (into jar-6). Start=1021 End=1025.	Bates [ssmp: Kelly / Lee]
R734-SS-J4-0011	Mkr-33		1524	178	10:28:34 Aug 30 2003	Low flux suction sample of baby limpets at periphery of Mkr-33 into jar-4 with 180 micron mesh.	Bates [ssmp: Kelly / Lee]
R734-RK-bio-0012	Cloud		1526	291	11:22:07 Aug 30 2003	Picked up rock with unidentified worms living on it.	Marcus [ssmp: Bates]
R734-MP-port-0013	Caldera center		997	285	16:02:52 Aug 30 2003	Running the McLane pump on the port side with a GFF filter for DOC. 2 minute sample 1000m depth 500 meters above the center of the caldera.	Yahel
R734-MP-stbd-0014	Caldera center		999	310	16:06:47 Aug 30 2003	Running the McLane pump with no filter on the starboard side 1000 m depth 500 meters above the center of the Caldera for DOC. Start 1607 Stop 1608.	Yahel

### 9.2 R735 - 2003 Samples

Sample	Location	Mkr	Z	Hdg	Time	R735 2003 Sample Descriptions	Investigator
R735-McLane-stbd-0001	Mkr-33	Bmrk-6	1523	255	06:33:06 Aug 31 2003	McLane pump (stbd) with GFF filter for fluids to sample DOC in the tubeworm bush north of Mkr-33 near the benchmark. 6 liters total at 5 liters per minute. Start 0637 Stop 0639. Talien-max=7.5.	Yahel
R735-McLane-port-0002	Mkr-33	Bmrk-6	1523	255	06:39:20 Aug 31 2003	McLane port sample - No filter (sucks the fluid into a bag) - for fluids to sample DOC in the tubeworm bush north of Mkr-33 near the benchmark. 6 liters total at 5 liters per minute. Start 0641 Stop 0642. Talien-max=7.5	Yahel
R735-LA-F-0003	Cloud		1525	276	07:43:47 Aug 31 2003	Larval array F collected then stowed and secured in transport box. This is a near array - close to the vent. (Deployed in 2001).	Kelly
R735-LA-P-0004	Cloud		1523	311	09:00:56 Aug 31 2003	Larval array P recovered. This is a near array - close to the vent. (Deployed 2002).	Kelly

Sample	Location	Mkr	Z	Hdg	Time	R735 2003 Sample Descriptions	Investigator
R735-LA-H-0005	Cloud area		1525	350	09:57:17 Aug 31 2003	Larval array H secured in portabox to be placed at base of elevator. This is a "far" - periphery - array which was located about 8 meters S/SW of the vent. (Deployed 2001)	Kelly
R735-RK-0006	Cloud area		1520	342	13:18:52 Aug 31 2003	Rock sample is in the elevator; ready to be brought to the surface. [Collected 35m S of Cloud]	Chadwick
R735-RK/Bio-0007	Cloud area		1525	329	13:32:51 Aug 31 2003	Rock collected with unidentified worms on it.	Marcus

## R736 - 2003 Dive Aborted. No samples

### 9.3 R737 - 2003 Samples

Sample	Location	Mkr	Z	Hdg	Time	R737 2003 Sample Descriptions	Investigator
R737-LA-Z-0001	ROPOS		1546	168	11:51:33 Sep 01 2003	Larval array Z recovered. (Deployed in 2002).	Kelly
R737-LA-I-0002	ROPOS		1546	195	13:38:16 Sep 01 2003	Larval array I picked up and put into the sample box. (Deployed in 2001).	Kelly
R737-cage-0008	Hell		1540	335	14:38:31 Sep 01 2003	Transplant cage retrieved. Left side of cage with many limpets was in flow. This sample number is out of order because it had not been recorded originally. (Deployed in 2001).	Bates
R737-MP-stbd-0003	ASHES		1007	255	16:23:02 Sep 01 2003	Pumping with the McLane on the starboard side. Start 1623 Stop 1624. GFF filter cracked so not successful. 6 liters at 5 L/min. [1000 meters depth about 500 meters above ASHES]	Yahel
R737-MP-port-0004	ASHES		1004	266	16:25:05 Sep 01 2003	Pumping with the McLane on the port side. Start 1627. Stop 1628. Bag - no filter. 6 liters at 5L/min. [1000 meters depth about 500 meters above ASHES]	Yahel
R737-SS-J1-0005	ASHES		1004	275	16:25:42 Sep 01 2003	Suction sampling into jar 1. Start 1624 Stop 1627. Ambient water for comparison. [1000 meters depth about 500 meters above ASHES].	Yahel
R737-SS-J2-0006	ASHES		1004	286	16:29:11 Sep 01 2003	Suction sampling Jar 2. Start 1628. Stop 1630. Ambient water for comparison. [1000 meters depth about 500 meters above ASHES]	Yahel
R737-SS-J3-0007	ASHES		1004	279	16:30:48 Sep 01 2003	Suction sampling into jar 3. Start 1630 Stop 1634. Ambient water for comparison. [1000 meters depth about 500 meters above ASHES].	Yahel

### 9.4 R738 - 2003 Samples

Sample	Location	Mkr	Z	Hdg	Time	R738 2003 Sample Descriptions	Investigator
R738-MP-0001	NRZ		1000	302	04:59:42 Sep 02 2003	Start port side McLane pump (unfiltered) at 4:59 for 2 minutes. Volume pumped: 6L at 5L/minute. [1000 meter depth over the NRZ]	Yahel
R738-MP-0002	NRZ		1000	229	05:01:09 Sep 02 2003	Start starboard side McLane pump (filtered) at 5:04; pump for 2 minutes. Volume pumped: 6.37L at 5L/minute. Note: pumping rate dropped during sampling. [1000 meter depth over the NRZ]	Yahel

### 9.5 R739 - 2003 Samples

Sample	Location	Mkr	Z	Hdg	Time	R739 2003 Sample Descriptions	Investigator
R739-HFS-10-0002	Dave's		1546	206	14:20:02 Sep 02 2003	HFS RNA filter-10. Start 14:19 Stop 14:30 - shifted out of vent but decided to let that be end of sample. Tmax=70 Tavg=54 T2=26. Vol=920ml.	Butterfield [ssmp: Bolton]
R739-HFS-15-0001	Dave's		1546	206	14:05:28 Sep 02 2003	HFS Sterivex filter-15. Start 1404 Stop 1417. Tmax=68 Tavg=53 T2=26. Vol=1018 ml.	Butterfield [ssmp: Bolton]

Sample	Location	Mkr	Z	Hdg	Time	R739 2003 Sample Descriptions	Investigator
R739-HFS-2-0003	Dave's		1546	218	14:41:31 Sep 02 2003	Begin HFS-2 with FISH filter. Start 1441 Stop 1444. Start2 1454 Stop2 1458. Tmax=60.1 Tave=58.1 T2=28 Vol=604mls. Stopped sampling when intake pulled out of flow.	Butterfield [ssmp: Bolton]
R739-HFS-11-0005	Dave's		1546	209	15:06:26 Sep 02 2003	HFS filtered bag-11. Start 1507 Stop 1510. Tmax=57.3 Tave=54.7 T2=26 Vol=640mls.	Butterfield
R739-HFS-4-0004	Dave's		1546	209	14:59:23 Sep 02 2003	HFS piston-4. Start 1458 Stop 1505. Tmax=60.7 Tave=57.2 T2=26 Vol=626ml.	Butterfield [ssmp: Bolton]
R739-HFS-9-0006	Virgin		1546	51.4	15:39:33 Sep 02 2003	HFS unfiltered bag-9. Start 1540 Stop 1546. Tmax=96.2 Tave=92.7 T2=41 Vol=539ml. Sample in the RAS funnel.	Butterfield [ssmp: Bolton]
R739-GTB-orange-0007	Virgin		1546	49.2	15:41:55 Sep 02 2003	Sampling with orange gas tight bottle in the RAS funnel. Fired at 1542. Temp when fired=92 T2=39. Temperature seems stable in the funnel.	Butterfield
R739-HFS-14-0008	Virgin		1546	51.5	15:47:16 Sep 02 2003	HFS filtered bag-14. Start 1547 Stop 1552. Tmax=96.9 Tave=92.3 T2=38. Vol=569ml. In the RAS funnel.	Butterfield
R739-SS-J6-0013	Inferno		1543	235	17:08:24 Sep 02 2003	Suctioning sulfide worms into jar-6. Start 1708 Stop 1711. Tmax=7.	Lee
R739-HFS-23-0014	Hell		1543	179	17:29:58 Sep 02 2003	HFS filtered piston-23. Start 1730 Stop1733. Start2 1734 Stop2 1738. Tmax=270.5 Tavg=263.5 T2=114. Vol1=260ml Total Vol=600ml. Pump stopped itself during sampling.	Butterfield
R739-GTB-blue-0015	Hell		1543	178	17:31:40 Sep 02 2003	Firing blue gas tight bottle. Fired at 1734. Pulled pin but it didn't fire.	Butterfield
R739-HFS-20-0016	Hell		1543	179	17:38:34 Sep 02 2003	HFS unfiltered piston-20. Start 1739 Stop 1746. Tmax=270.4 Tave=260.4 T2=116. Vol=633mls.	Butterfield
R739-SS-J4-0017	ROPOS		1545	76.8	17:53:40 Sep 02 2003	Suctioning biota into jar-4. Start 1755 Stop 1800 Taking temperature reading as well. Talien=1. Tmax at surface of biota=5.4. Tmax down in the biota=8.5. SS at LA-Z location.	Kelly
R739-SS-J5-0018	ROPOS		1545	202	18:06:01 Sep 02 2003	Suctioning biota into jar-5. Start 1806 Stop 1808. Start2 1809 Stop2 1811. Tmax at surface of biota=5.4. Tmax down in the biota=8.5. SS at LA-Z location.	Kelly
R739-HFS-8-0019	Casper		1537	3	20:29:49 Sep 02 2003	HFS unfiltered bag-8. Start 20:27 Stop=20:31. Tmax=254.7 Tave=214 T2=80. Vol=503ml. Current is running west-southwest.	Butterfield
R739-GTB-yellow-0021	Casper		1537	5.6	20:56:21 Sep 02 2003	Firing gas tight bottle with yellow loop. Fired at 20:55. May not have worked so we are firing another bottle.	Evans [ssmp: Butterfield / Lilley]
R739-HFS-17-0020	Casper		1537	7	20:54:00 Sep 02 2003	HFS unfiltered bag-17. Start=20:49 Stop=20:53. Tmax=232.7 Tave=226 T2=55. Vol=475ml.	Butterfield
R739-GTB-red-0022	Casper		1538	4.9	20:58:18 Sep 02 2003	Firing the red gas tight bottle at 20:58. No movement in the bottle detected. (same position as GTB-red-0021)	Evans [ssmp: Butterfield / Lilley]
R739-HFS-18-0023	Casper		1538	0.6	21:00:03 Sep 02 2003	HFS unfiltered bag-18. Start 21:00 Stop=21:04. Tmax=262.4 Tave=247.5 T2=90. Vol=466ml.	Butterfield
R739-HFS-24-0024	Castle		1521	45.2	22:36:21 Sep 02 2003	HFS with filtered gas piston-24 in clear smoker. Start 22:36 Stop=22:41. Tmax=224.6 Tave=223.9 T2=100. Vol=473ml.	Butterfield
R739-HFS-22-0025	Castle		1521	45.2	22:43:03 Sep 02 2003	Sampling HFS unfiltered gas piston-22. Start 22:43 Stop=22:49 Tmax=224.3 Tave=223.3 T2=93 Vol=513ml.	Butterfield
R739-HFS-19-0026	Castle		1521	46	22:50:19 Sep 02 2003	HFS unfiltered bag-19. Start 22:51 Stop=22:56. Tmax=223.9 Tave=221.3 T2=90. Vol=495ml. Current is running west-southwest.	Butterfield
R739-SS-J3-0027	Castle		1522	325	23:08:01 Sep 02 2003	Begin suction into jar-3 for limpets.	Bates
R739-SS-J7-0028	Castle		1522	352	23:19:47 Sep 02 2003	Suction sample of sulfide worms. We did two separate suction samples of the same area and put them into the same jar (#7).	Lee
R739-HFS-5-0009	Inferno		1543	286	16:22:07 Sep 02 2003	HFS piston-5. Start 1622 Stop 1624. Start2 1635 Stop2 1639. Tmax=287 Tavg=255 T2=120. Vol=650ml. Sample pump is slowing down and may be clogging. Stopped to reposition.	Butterfield

Sample	Location	Mkr	Z	Hdg	Time	R739 2003 Sample Descriptions	Investigator
R739-HFS-16-0010	Inferno		1543	289	16:40:47 Sep 02 2003	Sampling HFS filtered bag-16. Start 1641 Stop 1648 Tmax=292.6 Tave=291.2 T2=130 Vol=640mls. Stable temp at start of pumping at 286 degrees.	Butterfield
R739-GTB-white-0011	Inferno		1543	289	16:50:27 Sep 02 2003	Firing white gas tight bottle. Fired at 1651. Pulled pin but it didn't fire.	Evans [ssmp: Butterfield / Lilley]
R739-GTB-black-0012	Inferno		1543	288	16:52:06 Sep 02 2003	Firing black gas tight bottle. Fired at 1652. Temperature at firing was 291. T2=134.	Evans [ssmp: Butterfield / Lilley]

## 9.6 R740 - 2003 Samples

Sample	Location	Mkr	Z	Hdg	Time	R740 2003 Sample Descriptions	Investigator
R740-wood-0014	NW of Mkr-33		1524	310	13:15:21 Sep 03 2003	Voight and Tunncliffe's wood blocks . Wood was deployed last year. Lots of worm siphons visible. One bag containing oak (green) and one containing fir (white). [60 m NW of Mkr-33]	Voight / Tunncliffe
R740-LA-N-0001	Virgin's Daughter		1545	42.7	16:11:36 Sep 03 2003	Recovered larval array N from Virgin's Daughter. (Deployed in 2001).	Kelly
R740-SS-J4-0002	Virgin's Daughter		1546	99	16:30:27 Sep 03 2003	Suction sample where Noreen's LA-N was sitting. Start 1631 Stop 1633. Start2 1634 Stop2 1637. Talien=28 max. Stopped to reposition the sub.	Kelly
R740-LA-K-0003	Marshmallow		1545	322	17:59:00 Sep 03 2003	Recovering Noreen's larval array K from Marshmallow. (Deployed in 2002).	Kelly
R740-SS-J5-0004	Marshmallow		1545	12.8	18:15:15 Sep 03 2003	Suction into jar-5 at Marshmallow where LA-K was positioned. Start 1815 Stop 1817. Start2 1819 Stop2 1821. Talien max=31.	Kelly
R740-MTR-0005	Dave's		1546	336	18:41:11 Sep 03 2003	Recovered MTR from near the RAS that was taken out of Dave's vent on an earlier dive (R739). We believe this was placed next to last years RAS at Dave's. Can't see the number.	Butterfield
R740-SS-J6-0006	Hell		1547	284	21:35:05 Sep 03 2003	Suction sample of worms imaged from high and low particulate site at Porkchop. Tmax measured with alien 10cm above the worms is 10C. [Porkchop]	Morineaux
R740-SS-J7-0007	Hell		1546	68.3	23:10:17 Sep 03 2003	Suction sample of sulfide worms and associated biota into jar-7. Temperature reading at the same time. Start=2310 Stop=2312. Tmax=41.	Morineaux
R740-SS-J8-0008	Hell		1546	36.7	23:21:18 Sep 03 2003	Suction of sulfide worms into jar-8 for Ray Lee. Start=2321 Stop=2326.	Lee
R740-SS-J1-0009	Unnamed Diffuse Vent		1548	124	23:48:50 Sep 03 2003	Suction into jar-1. Start=2348 Stop=2352. Sampling on low flow for bacteria; particulates and DOC.	Yahel
R740-SS-J2-0010	Unnamed Diffuse Vent		1548	128	23:52:15 Sep 03 2003	Suction into jar-2. Start=2352 Stop=2354. We haven't moved the arm; still sampling in the same area for bacteria; particulates and DOC.	Yahel
R740-SS-J3-0011	Unnamed Diffuse Vent		1548	128	23:54:19 Sep 03 2003	Suction into jar-3. Start=2354 Stop=2356. Still in same location for bacteria; particulates and DOC.	Yahel
R740-MP-red-0012	Unnamed Diffuse Vent		1548	125	00:15:18 Sep 04 2003	Starting red side McLane Pump for bacteria, particulates and DOC. Pumping at 5 liters/min for a total of 6 liters. Start=0016 Stop=0017.	Yahel
R740-MP-green-0013	Unnamed Diffuse Vent		1548	127	00:19:52 Sep 04 2003	Begin McLane pump into green intake for bacteria; particulates and DOC. Pumping at 5 liters/min for a total of 6 liters. This pump has a filter on it. Start=0019 Stop=0021.	Yahel

## 9.7 R741 - 2003 Samples

Sample	Location	Mkr	Z	Hdg	Time	R741 2003 Sample Descriptions	Investigator
R741-HFS-4-0001	BagCity	Mkr-36	1534	322	10:23:40 Sep 04 2003	HFS piston-4 in tubeworm bush SE of Mkr-36. Start 1023 Stop 1030. T1=12.9 T2=8 T1max=12.9 T1avg=12.8. pH=7.4. Vol=704ml.	Butterfield
R741-HFS-11-0002	BagCity		1535	300	10:59:18 Sep 04 2003	HFS filtered bag-11 at BagCity. Start=1058 Stop=1106.T2=19.5 T1max=31.4 T1avg=31.2. pH=6.3. Vol=630ml. [5m S of Mkr-36 near 2001 RAS frame]	Butterfield
R741-HFS-5-0003	BagCity		1534	299	11:08:43 Sep 04 2003	HFS piston-5 at BagCity. Start=1107 Stop=1115. T1=31.1 T2=18.6 T1max=31.3 T1avg=31.1. pH=6.3. Vol=706ml. [5m S of Mkr-36 near 2001 RAS frame]	Butterfield [ssmp: Bolton]
R741-HFS-1-0004	BagCity		1535	303	11:16:54 Sep 04 2003	HFS Sterivex filter-1 at Bag City. Start=1116 Stop=1128. T1=30.9 T2=18.9 T1max=31.4 T1avg=31.2. pH=6.3. Vol=1003ml. [5m S of Mkr-36 near 2001 RAS frame]	Butterfield
R741-HFS-7-0005	BagCity		1535	303	11:30:08 Sep 04 2003	HFS with RNA filter-7 at Bag City. Start=1129 Stop=1141. T1=31.3 T2=18.9 T1max=31.5 T1avg=31.3. Vol=1001ml. Location is 5m S of mkr-36 near 2001 RAS frame.	Butterfield
R741-SS-J4-0006	BagCity		1535	293	11:49:40 Sep 04 2003	SS into jar-4 of sulfide worms and limpets at BagCity. Start=1150 Stop=1154. Turning suction tube in worm bush to stir up contents. [5m S of Mkr-36 near 2001 RAS frame]	Morineaux
R741-SS-J6-0007	Between BagCity and Coquille		1535	28	12:19:44 Sep 04 2003	SS into Jar-6 of all biota in FeO area of old lava flow on way to Coquille from Bag City. Start=1219 Stop=1224. [FeO area between BagCity and Coquille]	Morineaux
R741-HFS-8-0008	Coquille		1537	4	12:55:15 Sep 04 2003	HFS unfiltered bag-8 at Coquille. Start=1255 Stop=1302. T2=17.4 Tmax=29.3 Tavg=26. Vol=626ml. Sample taken in a typical vent in a crevice of lobate flow with the following biota: small tubeworms, palmworms and limpets.	Butterfield [ssmp: Bolton]
R741-HFS-3-0009	Coquille		1538	2	13:06:14 Sep 04 2003	HFS flat DNA filter-3 at Coquille. Same location as last sample. Start=1306 Stop=1319. T2=16 Tmax=28.7 Tavg=23.1. Vol=1096ml.	Butterfield [ssmp: Bolton]
R741-HFS-24-0010	Coquille		1537	1	13:21:16 Sep 04 2003	HFS filtered piston-24 at Coquille in same tubeworm bush area. Start=1321 Stop=1328. T2=16 Tmax=29 Tavg=25.1. pH=5.8. Vol=670ml.	Butterfield
R741-SS-J5-0011	Coquille		1537	15	13:44:19 Sep 04 2003	Suction of fauna in Coquille vent area into jar-5. Start=1346 Stop=1350. Talien=1.1 Tmax=7.	Morineaux
R741-HFS-9-0012	Mkr-113		1525	34	15:16:37 Sep 04 2003	Sampling HFS unfiltered bag-9. Start 1516 Stop 1523. Tmax=26.6 Tave=26.6 T2=16.5. pH=5.8. Vol=594mls.	Butterfield [ssmp: Bolton]
R741-HFS-13-0013	Mkr-113		1525	34	15:29:13 Sep 04 2003	Sampling HFS Sterivex DNA filter-13. Start 1528 Stop 1542. Tmax=26.6 Tave=26.6 T2=16.9. pH=5.8. Vol=1100mls.	Butterfield [ssmp: Bolton]
R741-HFS-23-0014	Mkr-113		1525	34	15:43:47 Sep 04 2003	Sampling HFS filtered piston#23. Start1 1544 Stop1 1548 Start2 1548 Stop2 1551 Start3 1551 Stop3 1553. Tmax=26.8 Tave=26.6 T2=16.9. pH=5.8. Vol1=255mls Vol2=510mls Total Vol=697mls. Pump stopped itself and was restarted twice.	Butterfield
R741-HFS-22-0015	Village		1523	64	17:43:20 Sep 04 2003	Sampling HFS unfiltered piston-22. Start 1743 Stop 1750. Tmax=28.1 Tave=27.4 T2=14. pH=5.6. Vol=675mls.	Butterfield [ssmp: Bolton]
R741-HFS-12-0016	Village		1523	63	17:52:04 Sep 04 2003	Sampling HFS DNA flat filter-12. Start 1752 Stop 1804. Tmax=27.3 Tave=24.8 T2=13. pH=5.6. Vol=1045mls.	Butterfield [ssmp: Bolton]
R741-HFS-14-0017	Village		1523	61	18:06:15 Sep 04 2003	HFS filtered bag-14. Start 1805 Stop 1812. Tmax=24.7 Tave=24.0 T2=13. pH=5.6. Vol=636mls.	Butterfield
R741-SS-J1-0018	Village		1523	63	18:30:54 Sep 04 2003	Suctioning into jar-1 for DOC. Start 1831 Stop 1834.	Yahel
R741-SS-J2-0019	Village		1523	60	18:37:08 Sep 04 2003	Suctioning a duplicate DOC sample into jar-2. Start 1837 Stop 1840. Talien=5 average.	Yahel
R741-SS-J3-0020	Village		1523	61	18:43:07 Sep 04 2003	Suctioning a third duplicate sample for DOC into jar-3. Start 1844 Stop 1845.	Yahel
R741-HFS-20-0021	Mkr-N3		1529	141	00:38:02 Sep 05 2003	HFS piston-20. Start=0037 Stop=0045. T1=16 T2=9.2 Tmax=17.6 Tavg=14.1. pH=5.38. Vol=756ml. Location is in large tubeworm bush surrounded by blue mats.	Butterfield

Sample	Location	Mkr	Z	Hdg	Time	R741 2003 Sample Descriptions	Investigator
R741-HFS-1 5-0022	Mkr-N3		1529	141	00:46:58 Sep 05 2003	HFS with DNA/Sterivex filter-15. Start=0047 Stop=0103. T2=9.6 Tmax=18.1 Tavg=15.2. pH=5.38. Vol=1229ml. Location is in large tubeworm bush surrounded by blue mats.	Butterfield [ssmp: Bolton]
R741-HFS-1 6-0023	Mkr-N3		1530	351	01:41:20 Sep 05 2003	HFS with bag filter-16. Start=0143 Stop=0146 Start2=0146 Stop2=0148. T2=12.5 Tmax=20.6 Tavg=17.2. pH=5.38. Vol=500ml. The sample is in an area of high flow/high flock. Filter has clogged twice.	Butterfield
R741-HFS-1 8-0024	Cloud		1526	332	03:04:21 Sep 05 2003	HFS unfiltered bag-18. pH=6.72. Start 0305:30 Stop 0311. Tmax=8.1 Tavg=8.0 T2=6.1 Standard dev 0.03. pH=6.72. Vol=623ml. In the hole at Cloud.	Butterfield [ssmp: Bolton]
R741-SS-J7- 0025	Cloud		1526	331	03:16:44 Sep 05 2003	SS where LA-F (a near array) was placed for the last 2 years. Background collection of the community to compare it with what settled on the array. Start 0320 Stop 0328.	Kelly
R741-HFS-1 7-0026	Mkr-33		1524	124	03:58:35 Sep 05 2003	HFS filtered bag-17. Start 0400 Stop 0406. Tmax=13.0 Tavg=12.4 T2=6.5. pH=6.2. Vol=570ml.	Butterfield
R741-HFS-1 9-0027	Mkr-33		1524	124	04:07:52 Sep 05 2003	Start unfiltered bag-19. Start 0408 Stop 0414. Tmax= 12.5 Tavg=11.5+/-0.5 T2= 6.2. Vol=625ml. pH=6.2.	Butterfield [ssmp: Bolton]
R741-HFS-2 1-0028	Mkr-33		1524	121	04:15:38 Sep 05 2003	Start sterivex filter-21 for DNA. Start 0415 Stop 0428. Tmax=12.6 Tave=10.9 T2=6.1. Vol=1047ml. pH=6.2.	Butterfield [ssmp: Bolton]
R741-HFS-1 0-0029	Mkr-33		1524	121	04:31:06 Sep 05 2003	HFS RNA-10. Start 0431 Stop 0444. Tmax=12.4 Tave=11.2+/-0.5 T2=7.0. Vol=1002 ml. pH=6.2. This will have an in situ RNA later preservative pumped into the sample afterwards.	Butterfield [ssmp: Bolton]
R741-SS-J8- 0030	Mkr-33		1524	127	04:59:02 Sep 05 2003	Suction for palm worms into jar-8. Start1 0459 Stop1 0450. Repositioning. Start2 050; Stop2 0506. Moving to do other tasks (see below). We will reposition along crack to sample more palm worms later. Start3 0525 Stop3 0528.	Lee

## R742 - 2003 Extensometers deployed on NRZ. No samples

### 9.8 R743 - 2003 Samples

Sample	Location	Mkr	Z	Hdg	Time	R743 2003 Sample Descriptions	Investigator
R743-RT-00 01	Mkr-33		1524	192	01:34:16 Sep 07 2003	Racetrack is securely placed in the biobox.	Bates
R743-SS-J7- 0002	Mkr-33		1524	202	01:39:07 Sep 07 2003	Suction jar-7 of all biota near crack at Mkr-33. Start=0139 Stop=0142. Start2=0143 Stop2=0144. Additional sampling in attempt to collect active palm worms.	Lee
R743-GTB-0 003	Castle		1521	360	03:02:20 Sep 07 2003	Gastight sample in the anhydrite. (We're do 2 samples here in the same spot).	Evans [ssmp: Butterfield / Lilley]
R743-GTB-0 004	Castle		1521	356	03:03:15 Sep 07 2003	Gastight sample in the anhydrite at Castle. (We're do 2 samples here in the same spot).	Evans [ssmp: Butterfield / Lilley]
R743-SS-J4- 0005	Village		1523	113	03:24:45 Sep 07 2003	Suction for blue ciliate mat in jar-4. Poking around in several spots to get enough mat. Start 0325 Stop 0331.	Morineaux
R743-SF-00 06	Castle		1515	46	03:40:37 Sep 07 2003	Sulfide from Castle. Broke a piece off the top side of the structure. (For the Juniper lab).	Leveille
R743-RK-00 07	Rumbleom eter area		1523	231	05:27:14 Sep 07 2003	Piece of lava pillar with hole in the middle. It's fragile. Putting it in the boot. The piece broke up into a couple pieces. Sample from area of '98 rumbleometer stuck in the lava. [423679/5086745]	Chadwick
R743-SS-J5- 0008	Hell		1544	175	09:54:53 Sep 07 2003	Suction into jar-5 at Hell. Sample of sulphide worms at site of Marie's filming. Temperature 0.5 to 3 degrees above ambient. Stop=0959.	Morineaux
R743-SS-J6- 0009	Hell		1545	247	10:08:02 Sep 07 2003	Suction of sediment at the base of Hell into jar-6, below the site of Marie's filming of sulphide worms. Stop=1010.	Morineaux
R743-SS-J8- 0010	Hell		1544	159	10:29:31 Sep 07 2003	Suction of palm worms and limpets into jar-8.	Lee

Sample	Location	Mkr	Z	Hdg	Time	R743 2003 Sample Descriptions	Investigator
R743-SS-J1-0011	near ROPOS		1546	149	13:02:47 Sep 07 2003	Suction jar-1 for DOC and bacteria. [diffuse area near ROPOS Vent]	Yahel
R743-SS-J2-0012	ROPOS		1546	149	13:04:16 Sep 07 2003	Suction into jar-2 at diffuse area near ROPOS for DOC; dissolved organics and bacteria. Start=1304 Stop=1307.	Yahel
R743-SS-J3-0013	ROPOS		1546	151	13:08:04 Sep 07 2003	Suction into jar-3 in same area as last two samples in diffuse area near ROPOS. Suctioning for DOC and bacteria. Start=1309 Stop=1313.	Yahel



## 10.0 ROPOS DIVES - 2003

### 10.1 ROPOS 2003 DIVE STATISTICS

10 ROPOS Dives at Axial	R734 - R743
Total Wet Time	169.3 hours
Total Bottom Time	140.4 hours
Total Number of ROPOS Samples	114

### 10.2 ROPOS 2003 DIVE SUMMARIES

Dive	Area	wet time (UTC)	Julian Day(s)	wet time (hrs)	btm time (UTC)	Julian Day(s)	btm time (hrs)	smp #	NeMO 2003 ROPOS Dive Summary
R734	Southern pillow mound to caldera center (S. Pillow Mound, BagCity, Mkr-33, Magnesia, Caldera center, Vixen, Village, Castle, Cloud)	8/28 1958 - 8/30 1644	240 241 242	44.77	8/28 2058 - 8/30 1546	240 241 242	42.3	12	Pressure sensor measurement dive. Three traverses of the caldera taking pressure measurements at all 5 benchmarks ( <b>Bmrk-66 - S. Pillow Mound, Bmrk-4 - BagCity, Bmrk-5 - Mkr-33, Bmrk-1- Magnesia, Bmrk-63 - Caldera center</b> ). Observed the OBH on the bottom near Bmrk-5. Tried to cut loose 2 transponders from the ASHES net but could only find 1 (the 9.5). The 11.0 could not be located. On the third traverse north samples were taken. <b>Vixen</b> Recovered 2 hobos, 1SS. Deployed 2 hobos. <b>Village</b> Recovered 1 MTR. <b>Castle</b> Recovered 1 hobo. <b>Mkr-33</b> Recovered 3 MTR, 3 SS. Deployed 3 MTR. Also deployed a marker (Mkr-77) at the vent site. <b>Cloud</b> Recovered 1 RK/bio. Deployed 2 MTR in the hole at Cloud. Could not find the 2 that were deployed last year in the pit. <b>Caldera center</b> 2 McLane samples about 500 meters above the bottom at 1000 meters depth. The longest dive for ROPOS so far!!
R735	nSRZ (Cloud, Mkr-33)	8/31 0322 - 8/31 1644	243	13.37	8/31 0447 - 8/31 1536	243	10.8	7	The elevator was placed on the bottom after it was released from the cage. <b>Mkr-33</b> 2 McLane samples in the tubeworm bush north of Mkr-33. Deployed Amanda's racetrack near the crack. <b>Cloud</b> Recovered 3 LA (2 near and 1 periphery) which were deployed in 2002. Digital video and DSC survey. Found wood samples deployed by Voight/Tunncliffe about 50 meters NW of Mkr-33. Proceeded on to look at pillars and collect 2 rock sample, one with unidentified worms (collected 35 meters south of Cloud). ROPOS released the elevator.

Dive	Area	wet time (UTC)	Julian Day(s)	wet time (hrs)	btm time (UTC)	Julian Day(s)	btm time (hrs)	smp #	NeMO 2003 ROPOS Dive Summary
R736	ASHES (Virgin)	8/31 2344 - 9/1 0328	243 244	3.73	9/1 0102 - 9/1 0253	244	1.85	0	Arrived on the bottom at ASHES. Saw the weights and RAS. <b>Virgin</b> One weight was moved away from the vent, then there was a problem with the line that was spooled to move the weights. The line had loosened and was flapping around. The dive was aborted to fix it.
R737	ASHES (Virgin, Hell, Dave's)	9/1 0413 - 9/1 1718	244	13.08	9/1 0530 - 9/1 1609	244	10.7	8	Moved last year's RAS weights near Dave's vent. <b>Virgin</b> Moved the RAS to Virgin vent and positioned the RAS, tripod and temperature probes. <b>ROPOS</b> Recovered 2 LA (LA-Z deployed '02, LA-I deployed '01). <b>Hell</b> Recovered Amanda's transplant cage (deployed '02). Also performed a video reconnaissance survey for Morineaux at Hell. <b>Above Ashes</b> 2 McLane and 3SS of ambient water at 1000 meters depth. The elevator was released acoustically.
R738	NRZ	9/1 2138 - 9/2 0555	244 245	8.28	9/1 2232 - 9/2 0444	244 245	6.2	2	<b>NRZ</b> Recovered the 4 transponders in the NRZ net. Three of the transponders were hooked together and sent to the surface where the ship recovered them. The forth was brought up in the ROPOS claw. Two McLane pump samples were taken at 1000 meters depth above the NRZ.
R739	ASHES (Virgin, Marshmallow, Inferno, Hell, Dave's) and nSRZ (Casper, Castle)	9/2 1117 - 9/3 0044	245 246	13.45	9/2 1230 - 9/2 2339	245	11.2	28	Fluid sampling dive at ASHES. <b>Dave's</b> 5 HFS. <b>Virgin</b> 2 HFS, 1 GTB. <b>Marshmallow</b> Deployed 1 hobo. <b>Inferno</b> 2 HFS, 2 GTB, 1 SS. <b>Hell</b> 2 HFS, 1GTB. <b>ROPOS</b> 2 SS. <b>Casper</b> 3 HFS, 2 GTB. <b>Castle</b> 3 HFS, 2SS. Deployed 1 hobo.
R740	Mkr-33 area and ASHES (Marshmallow, Virgin's Daughter, Porkchop, Hell, and Dave's Vent)	9/3 1110 - 9/4 0206	246 247	14.93	9/3 1212 - 9/4 0102	246 247	12.8	14	<b>60 m NW of Mkr-33</b> Recovered 2 wood blocks for Voight/Tunncliffe (recorded as one sample). One block was oak, the other fir. Lots of worm siphons were visible protruding from the wood. <b>Mkr-33</b> Deployed one cage-growth experiment. <b>Virgin's Daughter</b> Recovered LA-N (deployed '01), 1 SS in area of array. <b>Marshmallow</b> Recovered LA-K (deployed '02), 1 SS in area of array, 1 temp reading. <b>Dave's</b> Recovered 1 MTR that had been deployed with the 2002 RAS. <b>Hell</b> 3 SS, 5 temp readings. Worm Video and DSC Survey at Porkchop flange and Hell chimney. <b>Unnamed Diffuse Vent</b> 3 SS, 2 MP.

Dive	Area	wet time (UTC)	Julian Day(s)	wet time (hrs)	btm time (UTC)	Julian Day(s)	btm time (hrs)	smp #	NeMO 2003 ROPOS Dive Summary
R741	nSRZ (BagCity, Coquille, Mkr-113, Village, Mkr-N3, Cloud, Mkr-33)	9/4 0752 - 9/5 0624	247 248	22.53	9/4 0959 - 9/5 0540	247 248	19.7	30	Fluid sampling dive on the nSRZ. <b>BagCity</b> (Mkr-36) 5 HFS, 1 SS. " <b>FeO Field</b> " (iron oxide area between BagCity and Coquille) 1SS. <b>Coquille</b> 3 HFS, 1SS. <b>Mkr-113</b> 3 HFS, 4 temp probes. <b>Village</b> 3 HFS; 3 SS, 4 temp probes. <b>Mkr-N3</b> 3 HFS, 3 temp probes. <b>Cloud</b> 1 HFS, 1 SS. <b>Mkr-33</b> 4 HFS; 1 SS. Recovered Ashes net transponders 10.5 and 11.5.
R742	NRZ	9/5 1714 - 9/6 0708	248 249	13.9	9/5 1818 - 9/6 0603	248 249	11.8	0	<b>North Caldera Rim</b> Five extensometers were deployed on the north rim of the caldera. Pressure sensor measurements were performed at <b>EXT#1-5</b> then back again to EXT#1 to close the loop. Ray's plunger was tested. The dive finished early due to high winds. Due to the weather we were not able to go to CASM and finish with the dive tasks.
R743	nSRZ and ASHES ( Mkr-33, Village, Castle, Rumbleometer area, Phoenix, Hell, Mushroom, ROPOS, Inferno )	9/6 1723 - 9/7 1440	249 250	21.28	9/7 0022 - 9/7 1330	250 250	13.1	13	Last dive of Cruise TN160 - finished up any high priority tasks. <b>Mkr-33</b> Deployed Mkr-77 and 1 MTR. Retrieved Amanda's racetrack experiment, 1 SS. Performed digital video and Ray's Plunger experiment. <b>Castle</b> 2 GTB, 1SF <b>Village</b> 1 SS. <b>Rumbleometer Area</b> 1 pillar lava RK sample, digital video tour of pillars. <b>Hell</b> digital video survey, sulfide worm video, digital mosaic, 3 SS. <b>Phoenix</b> digital video survey; digital mosaic. <b>Inferno</b> digital video survey, digital mosaic. <b>Mushroom</b> digital video survey, digital mosaic. Diffuse area <b>near Ropos</b> 3 SS.
	Totals	8/28 - 9/7	240 - 250	169.32	8/28 - 9/7	240 - 250	140.4	114	

## 10.3 NeMO 2003 - DIVE PLAN (post-cruise summary for cruise report)

Bill Chadwick

DIVE NUMBERS AND TIMES ARE APPROXIMATE

### BEFORE DIVE

8/28, 05:00 - EM300 multibeam of CoAxial segment  
10:00 - arrive Axial, Deploy OBH mooring near M33 - 45°55.993'/-129°58.945'  
12:00 - transit to dive site at pillow mound - 45°51.789'/-130°00.223'

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### 1) ROPOS DIVE 734 - LAVA FLOW - PRESSURE TRANSECTS

#### EQUIPMENT

Biobox  
Suction sampler  
McLane Pump  
Pressure sensor  
Line cutter  
2 HOBOS  
5 MTRs  
double-hook line for joining 2 transponders together

#### TASKS

pressure sensor measurements at benchmarks - 3 transects  
cut loose 11.0 XP and 9.5 XP (in daylight)  
recover & deploy HOBO and MTR temperature probes @ Cloud, M33, Vixen, Castle  
suction limpets @ M33 for Amanda  
suction sulfide worms @ Vixen or Castle for Ray

NOTE: PMEL mooring 02T60 is located between M33 and Bag City and rises 300 m above bottom

#### SEQUENCE

8/28 13:00 - Deploy ROPOS @ 45°51.789'/-130°00.223'  
15:00 - P at pillow mound (1<sup>st</sup>)  
19:00 - P at BagCity (1<sup>st</sup>)  
22:00 - P at M33 (1<sup>st</sup>)  
8/29 00:00 - P at Magnesia (1<sup>st</sup>)  
02:00 - P at Center (1<sup>st</sup>)  
04:00 - P at Magnesia (2<sup>nd</sup>)  
06:00 - P at M33 (2<sup>nd</sup>)  
08:00 - cut and recover 11.0 XP  
11:00 - cut and recover 9.5 XP  
13:00 - P at BagCity (2<sup>nd</sup>)  
17:00 - P at pillow mound (2<sup>nd</sup>)  
21:00 - P at BagCity (3<sup>rd</sup>)  
22:00 - recover and deploy 2 HOBOS at Vixen (suction sulfide worms?)  
23:00 - recover 1 MTR at Diffuse/Village vent & 1 HOBO at Castle (suction sulfide worms?)  
8/30 00:00 - recover and deploy 2 MTRs at Cloud  
01:00 - recover and deploy 3 MTRs at M33  
02:00 - suction limpets at M33 for Amanda  
03:00 - find OBH on bottom (digital camera pics & frame grabs)  
04:00 - P at M33 (3<sup>rd</sup>)  
06:00 - P at Magnesia (3<sup>rd</sup>)  
08:00 - P at Center (2<sup>nd</sup>)  
10:00 - end of dive, recover ROPOS

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## **BETWEEN DIVES**

11:00 - Deploy NeMO Net Buoy @ 45°56.75'/-130°00.0'  
15:00 – Recover MTR mooring(s)  
02T60 @ 45°55.6'/-129°59.2'  
02V120 @ 45°54.8'/-129°54.8'  
18:00 – transit to dive site at Cloud – 45°56.004'/-129°58.896'

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## **2) ROPOS DIVE 735 - LAVA FLOW – ARRAY RECOVERY (~15 hrs)**

### **EQUIPMENT**

Noreen's Portabox with frame (instead of biobox)  
McLane Pump  
Suction sampler  
Deploy ROPOS elevator beneath cage

### **TASKS**

deploy Amanda's racetrack at M33 (in Portabox)  
recover 3 arrays from Cloud vent (2 in elevator, 1 in Portabox)  
opportunistic McLane pumping at vents  
DSC transect at Cloud  
opportunistic video of palmworms

### **SEQUENCE**

8/30 19:00 – Deploy ROPOS (w. elevator) @ Cloud, 45°56.004'/-129°58.896'  
20:00 – position and release ROPOS elevator from cage  
21:00 – deploy racetrack at M33 & suction samplers & palmworm video  
22:00 – put 2 arrays from Cloud in elevator, 1 array in Portabox, digital cam pics, suction samplers  
8/31 02:00 – DSC transect between N4 and N6  
04:00 – located wood for later recovery  
06:00 – sampled lava pillar rock and rock with UFO worms  
08:00 - pull pin on elevator / recover elevator  
09:00 – off bottom  
10:00 – recover ROPOS

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## **BETWEEN DIVES**

11:00 – deploy RAS at Virgin / prepare ROPOS elevator for rapid turnaround  
12:00 – CTD #1  
14:00 - prepare to dive site at ASHES – 45°55.997'/-130°0.843' (ROPOS vent)

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## **3) ROPOS DIVE 736 - ASHES – ARRAY RECOVERY and MOVING RAS WEIGHTS**

### **EQUIPMENT**

Reel with line (no biobox, no suction sampler -or only on bumper bar)  
McLane Pump  
Deploy ROPOS elevator beneath cage  
Noreen's markers

### **TASKS**

recover 2 settling arrays from ROPOS vent at ASHES  
place Noreen's markers where arrays were located  
recon for video survey @ Hell and PorkChop  
recover Amanda's transplant cage @ Hell vent (into grey box on elevator)  
release elevator?  
move last year's RAS weights  
position RAS at Virgin with ROPOS

SEQUENCE

8/31 15:00 – Deploy ROPOS (w. elevator) @ ROPOS vent, 45°55.997’/-130°0.843’  
16:00 - position and release ROPOS elevator from cage  
17:00 – put 2 arrays from ROPOS vent in elevator, digital cam pics, Noreen’s markers  
19:00 – put transplant cage from Hell into GreyBox on elevator (IF INTACT ENOUGH)  
20:00 – ROPOS releases elevator with pull-pin (IF ENOUGH DAYLIGHT), ship recovers  
22:00 – recon for video survey @ Hell and PorkChop vents (Marie)  
9/01 00:00 – move weights from Virgin and Dave’s vents  
04:00 – position RAS with ROPOS at Virgin vent  
07:00 - ROPOS off bottom  
08:00 – recover ROPOS

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**BETWEEN DIVES**

10:00 – CTD #2  
12:00 – transit to dive site at North Rift –

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**4) ROPOS DIVE 737 – NORTH RIFT – TRANSPONDER NET RECOVERY**

EQUIPMENT

small platform on front of ROPOS (for holding last XP on way up)  
line cutter  
triple-hook line for joining 1<sup>st</sup> 3 transponders together (line that floats)  
McLane pumps  
suction sampler

TASKS

cut loose 4 transponders, release to the surface in pairs, recover with ship

SEQUENCE

13:00 – Deploy ROPOS at North Rift  
14:00 – cut, hook, and hold 1<sup>st</sup> 3 transponders, then release them together  
20:00 – ship recovers 3 transponders (attached to each other) at surface  
22:00 – ROPOS cut and holds onto 4<sup>th</sup> transponder, holds in arms on way up  
(McLane pump sample on way up for Gitai)  
23:00 – recover ROPOS

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**BETWEEN DIVES**

9/02 00:00 – CTD #3  
04:00 – transit to ASHES for next ROPOS dive

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**5) ROPOS DIVE 738 – ASHES – FLUID SAMPLER DIVE (HIGH TEMP SAMPLING)**

EQUIPMENT

Fluid sampler with 6 gas-tights on top  
suction sampler  
2 HOBOS on bumper bar (to deploy at Virgin)

TASKS

sample fluids at Dave’s, Virgin, Inferno, Hell, Vixen, Castle vents  
deploy 2 HOBOS at Virgin vent  
DOC suction samples  
opportunistic suction sampling for Ray

SEQUENCE

05:00 – Deploy ROPOS at Dave’s vent (ASHES) – 45°56.011’/-129°0.826’

06:00 – Dave’s vent  
07:30 – Virgin vent  
09:00 - deploy HOBOS at Virgin or nearby  
10:00 – Inferno vent  
11:30 – Hell vent  
13:00 – transit to Vixen vent  
14:00 – Vixen vent  
15:30 – transit to Castle vent  
16:30 – Castle vent  
18:00 – ROPOS off bottom  
19:00 – recover ROPOS

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**BETWEEN DIVES**

19:00 – transit to CASM  
20:00 - Deploy CASM transponders & calibrate  
9/3 02:00 – Deploy ROPOS elevator at ASHES  
03:00 – transit to dive site (M33)

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**6) ROPOS DIVE 740 – ASHES – BIO DIVE**

**EQUIPMENT**

Biobox  
suction sampler  
Noreen’s cage in claw

**TASKS**

deploy Noreen’s cage at M33  
recover wood near M33 into biobox  
worm video & suction at Hell and PorkChop  
recover 1 settling array @ Virgin’s daughter and 1 @ Marshmallow  
suction at Noreen’s 2 array sites at ROPOS vent (at markers)

**SEQUENCE**

04:00 – Deploy ROPOS @ M33  
05:00 – deploy Noreen’s cage, move racetrack, recover wood into biobox  
07:00 – transit to elevator at ASHES  
08:00 – put 2 arrays from V.D. and Marshmallow into elevator & suction & DSC  
13:00 – images at RAS, MTR in boot box  
13:00 – suction for Ray Lee and Gitai & McLane pumps  
14:00 – sulfide worm video and suction @ Hell and PorkChop vents  
18:00 – release and recover elevator  
19:00 – off bottom  
20:00 – recover ROPOS

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**BETWEEN DIVES**

21:00 - Deploy 2 BPR moorings  
23:00 – CTD#4 @ Vixen  
9/4 01:00 – transit to dive site (Bag City)

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**7) ROPOS DIVE 741 – LAVA FLOW – FLUID SAMPLING (LOW TEMP)**

**EQUIPMENT**

fluid sampler (2 gas tights underneath)  
suction sampler  
double hook line for 2 transponders

## TASKS

fluid samples at BagCity, Coquille, M113, Village, M33, Cloud, N3  
DOC suction  
video observation of Amanda's racetrack  
opportunistic suction sampling for Ray, Gitai, and Marie  
cut, hook together, and release 2 transponders, recover with ship

## SEQUENCE

01:00 – Deploy ROPOS @ BagCity  
03:00 – Bag City  
05:00 – Coquille  
07:00 – M113  
10:00 – Village  
14:00 – transit to transponder 11.5, cut, hook, and hold  
16:00 – transit to transponder 10.5, cut, hook, and release 2 XP together, recover  
17:00 – N3  
21:00 – M33/Cloud, video of Amanda's racetrack  
9/5 01:00 – off bottom  
02:00 – recover ROPOS

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## BETWEEN DIVES

03:00 - CTD#5 @ N3 area  
05:00 - deploy 4 transponders at lava flow (3 hrs)  
08:00 – calibrate 4 transponders at lava flow (2 hrs)  
10:00 – transit to CASM  
11:00 – Deploy PMEL elevator mooring with extensometers at CASM

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## 8) ROPOS DIVE 742 – NORTH RIFT – EXTENSOMETER DIVE

### EQUIPMENT

biobox  
pressure sensor  
suction sampler  
McLane pumps  
Ray's plunger in biobox  
1 MTR in biobox to put a CASM

### TASKS

deploy 5 extensometer instruments on N rim of caldera (6 hrs)  
pressure measurements at each (6 hrs)  
CASM bio video, suction for Marie and Jean (6 hrs), deploy MTR at Shepherd vent  
suctions and McLane for Gitai  
Ray's plunger in biobox

### SEQUENCE

12:00 – Deploy ROPOS  
13:00 – on bottom, find elevator move instruments into place (1 at a time)  
19:00 – release elevator, recover with ship (DAYLIGHT)  
20:00 – extra time needed for pressure measurements

**DIVE ABORTED AFTER EXTENSOMETER WORK DUE TO HIGH WINDS – NEVER WENT TO CASM (still in plan below).  
Out of water from about midnight to 3 or 4 pm, I think.**

9/6 02:00 – transit to CASM, bio video and suction, deploy MTR at Shepherd vent  
08:00 – off bottom  
09:00 – recover ROPOS



TIMES OF TASKS BETWEEN DIVES (BELOW) ARE WRONG BUT THE TASKS ARE CORRECT

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**BETWEEN DIVES**

10:00 - Deploy two MTR moorings  
14:00 - Recover OBH (DAYLIGHT)

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**9) ROPOS DIVE 743 – LAVA FLOW – M33/NASCENT (6 hrs)**

EQUIPMENT

biobox  
2 MTRs in biobox  
marker in biobox or in claw to deploy at M33 (first thing)  
suction sampler  
McLane pumps  
2 gas-tights with tubing-intakes on 5-function arm

TASKS

deploy MTR at M33 crack  
recover Amanda's racetrack @ M33 (needs all of biobox) (1 hr)  
suctions and McLane for Gitai @ M33  
suction, DSC @ Nascent/N41, deploy MTR at Nascent/N41  
gas-tight samples at Castle and Vixen  
explore rumbleometer area for possible pillar recovery next year  
sample pillar (in biobox)

**NEVER WENT TO NASCENT OR VIXEN ON THIS LAST DIVE. ONLY DID M33, CASTLE, RUMBLE (PILLAR SAMPLE), ASHES (WORM VIDEO).**

SEQUENCE

15:00 – Deploy ROPOS  
16:00 – put marker at M33 site, deploy MTR, recover Amanda's racetrack at M33  
suction and McLane for Gitai @ M33  
17:00 – suction, DSC, and McLane pumping at Nascent/N41, deploy MTR (3 hrs)  
20:00 – transit to Castle  
21:00 – take gas-tight sample at Castle  
22:00 – transit to Vixen  
9/7 00:00 – take gas-tight sample at Vixen  
01:00 – pillar sampling/mapping (4hrs)  
05:00 – off bottom  
06:00 – recover ROPOS

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9/07 08:00 – DEPART AXIAL, TRANSIT TO VICTORIA  
9/08 NOON – ARRIVE VICTORIA (Esquimalt)  
9/08 MIDNIGHT – SHIP DEPARTS VICTORIA, TRANSIT TO SEATTLE  
9/09 11:00 – ARRIVE SEATTLE @ UW PIER (any ROPOS unloading in Seattle will be *after* this)

**THERE WERE 5 CTD OPERATIONS PERFORMED DURING NEMO 2003.**

## 10.4 R734 - 2003 Dive Log

Pressure sensor measurement dive. Three traverses of the caldera taking pressure measurements at all 5 benchmarks (**Bmrk-66 - S. Pillow Mound, Bmrk-4 - BagCity, Bmrk-5 - Mkr-33, Bmrk-1- Magnesia, Bmrk-63 - Caldera center**). Observed the OBH on the bottom near Bmrk-5. Tried to cut loose 2 transponders from the ASHES net but could only find 1 (the 9.5). The 11.0 could not be located. On the third traverse north samples were taken. **Vixen** Recovered 2 hobos, 1SS. Deployed 2 hobos. **Village** Recovered 1 MTR. **Castle** Recovered 1 hobo. **Mkr-33** Recovered 3 MTR, 3 SS. Deployed 3 MTR. Also deployed a marker (Mkr-77) at the vent site. **Cloud** Recovered 1 RK/bio. Deployed 2 MTR in the hole at Cloud. Could not find the 2 that were deployed last year in the pit. **Caldera center** 2 McLane samples about 500 meters above the bottom at 1000 meters depth. The longest dive for ROPOS so far!!

Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
19:58:39 Aug 28 2003	1	82	ROPOS is in the water.			
20:24:51 Aug 28 2003	893	186	The navigation string is not updating yet (or else we're in the wrong hemisphere).			
20:33:23 Aug 28 2003	1212	88	Flushing suction sampler jars 1 - 3.			
20:52:24 Aug 28 2003	1605	3	We've changed from displaying lat/long to UTM Zone 9 XY.			
20:58:02 Aug 28 2003	1720	183	ROPOS is on the bottom.			
21:00:32 Aug 28 2003	1722	175	Skate visible in video.			
21:01:19 Aug 28 2003	1722	171	Digital video turned on while skate in view.			
21:03:16 Aug 28 2003	1721	81	Traversing along a crack in search of the Pillow Mound Bmrk-66.			
21:06:04 Aug 28 2003	1721	271	Traversing over ropey basalt.			
21:06:24 Aug 28 2003	1721	275	Found a crack.			
21:09:09 Aug 28 2003	1720	196	Double crack in view.			
21:10:46 Aug 28 2003	1720	118	We went east and then west; found the crack; drove to the south where lava flow was evident from the eruption in 1998; now we are turning around to the south.			
21:13:31 Aug 28 2003	1722	347	Jogging back and forth with the sit-cam to locate the benchmark.			
21:14:03 Aug 28 2003	1722	275	Pillow Mound Bmrk-66 has been located.			
21:14:41 Aug 28 2003	1723	284	Pillow Mound Bmrk-66 and its marker.			R734-001
21:15:57 Aug 28 2003	1724	320	Pillow Mound benchmark.			R734-002
21:16:58 Aug 28 2003	1724	322	Transferring four digital still images (1-4) at Pillow Mound Bmrk-66.			
21:19:46 Aug 28 2003	1724	322	Positioning pressure sensor.			R734-003
21:20:03 Aug 28 2003	1724	320	Positioning pressure sensor for a 30 min measurement at Pillow Mound Bmrk-66.			
21:23:40 Aug 28 2003	1724	326	Starting pressure sensor measurement at Pillow Mound Bmrk-66.			
21:23:41 Aug 28 2003	1724	325	Starting pressure sensor measurement at Pillow Mound Bmrk-66.			R734-004
21:25:33 Aug 28 2003	1724	323	Taking digital image of pressure sensor reading at Pillow Mound Bmrk-66; transferred this image.			
21:52:53 Aug 28 2003	1724	323	Ending pressure sensor reading at Bmrk-66; stowing pressure sensor for transit to next benchmark.			
21:57:15 Aug 28 2003	1718	287	Heading to the cage.			
21:57:49 Aug 28 2003	1713	85	Turning video off during transits.			
22:02:12 Aug 28 2003	1674	31	Initiating transit to Bag City; transit will be 3-4 hours.			
22:03:07 Aug 28 2003	1658	3	Moving the ship at 1.5 knots.			
01:01:00 Aug 29 2003	1532	21	ROPOS on bottom. Video started.			
01:03:05 Aug 29 2003	1535	23	Cage motor is off; listening for acoustic positioning.			

Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
01:03:35 Aug 29 2003	1534	27	Pillow lavas in the area of Bag City. We're trying to find the vent.			R734-005
01:06:53 Aug 29 2003	1534	25	We're headed northeast to find the benchmark.			
01:09:26 Aug 29 2003	1532	271	We've gone over a bunch of collapsed areas; we believe that we are near the vent. Shimmering water indicates that venting is in the area.			
01:09:40 Aug 29 2003	1533	345	Tubeworms near the vent Bag City.			R734-006
01:11:14 Aug 29 2003	1532	309	Bmrk-4 located.			
01:11:31 Aug 29 2003	1533	327	Mkr-65 near Bag City.			R734-007
01:12:35 Aug 29 2003	1532	3	Five digital images taken; ending with 06559.			
01:13:54 Aug 29 2003	1534	6	Base of Bmrk-4 at Bag City.			R734-008
01:18:15 Aug 29 2003	1534	359	Placement of the pressure sensor on Bmrk-4 near Bag City.			R734-009
01:19:28 Aug 29 2003	1534	1	Two more digital photos taken. Start of pressure measurement.			
01:21:00 Aug 29 2003	1534	358	The pressure sensor in place in the Bmrk-4.			R734-010
01:21:07 Aug 29 2003	1534	359	One more digital photo - number 6602.			
01:22:47 Aug 29 2003	1534	359	Tubeworms and limpets near Bmrk-4.			R734-011
01:27:42 Aug 29 2003	1534	360	Tubeworms and limpets near Bmrk-4.			R734-012
01:49:38 Aug 29 2003	1534	2	Pressure sampling finished.			
01:54:02 Aug 29 2003	1515	70	ROPOS is heading over to cage and beginning transit to Bmrk-33.			
02:58:24 Aug 29 2003	1099	359	We're about 200 meters S/SW of Mkr-33. We're going to try to talk to the OBH. It's still pinging and listening so we'd like to try to disable the acoustic release.			
03:03:28 Aug 29 2003	1185	351	We're finished. The engineers were able to disable the release. We're heading towards Mkr-33 Bmrk-5.			
03:26:39 Aug 29 2003	1513	9	We're on the bottom in the vicinity of Mkr-33.			
03:29:12 Aug 29 2003	1519	8	Sheet lavas in the area of Mkr-33.			R734-013
03:29:53 Aug 29 2003	1522	337	OBH has been sighted near Mkr-33 benchmark area.			
03:31:59 Aug 29 2003	1519	32	OBH near Mrk-33. Navigation fix for the OBH: 45deg 56.0107'N 129deg 58.9521'W.			R734-014
03:34:11 Aug 29 2003	1522	41	Five digital images of the OBH sent to the hard drive.			
03:36:22 Aug 29 2003	1522	60	Crab under the OBH sitting on the weight platform.			R734-015
03:37:43 Aug 29 2003	1523	50	Digital still camera image of ropey sheet lavas in the area of the OBH. Bmrk-5 should be around here someplace.			
03:42:06 Aug 29 2003	1523	63	Bmrk-5 near Mrk-33.			R734-016
03:42:22 Aug 29 2003	1523	59	We're at Bmrk-5 near Mrk-33. Took 3 digital images of the benchmark area.			
03:43:33 Aug 29 2003	1522	81	Bmrk-5 near Mkr-33.			R734-017
03:49:20 Aug 29 2003	1523	96	Positioning the pressure sensor at Bmrk-5.			
03:50:14 Aug 29 2003	1523	97	Two more digital images of the pressure sensor on the Bmrk-5.			
03:51:07 Aug 29 2003	1523	95	Bmrk-5 near Mkr-33.			R734-018
03:55:41 Aug 29 2003	1523	89	Starting the pressure measurement right now.			
03:55:50 Aug 29 2003	1523	89	Preparing for pressure sensor reading at Bmrk-5.			R734-019
03:56:28 Aug 29 2003	1523	91	Shimmering water near the benchmark.			R734-020
03:57:02 Aug 29 2003	1523	92	We notice shimmering water and tubeworms in the vicinity of the benchmark.			

Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
03:57:59 Aug 29 2003	1523	89	Nose cone of a RAS. It was down here as a test cone and couldn't be retrieved. We'll get it later.			R734-021
03:59:35 Aug 29 2003	1523	91	Extensive tubeworm colony in the area of Bmrk-5. We don't remember seeing such lush tubeworms in the past.			R734-022
04:01:27 Aug 29 2003	1523	89	Lush tubeworm cluster from a different angle.			R734-023
04:04:18 Aug 29 2003	1523	90	Closeup of worms near Mkr-33.			R734-024
04:05:18 Aug 29 2003	1523	91	Another closeup of worms near Mkr-33.			R734-025
04:10:32 Aug 29 2003	1523	92	Lots of flock coming up through the tubeworms. Shimmering water all around the bush. We're also seeing palm worms or sulfide worms - not quite sure from this distance.			R734-026
04:23:04 Aug 29 2003	1523	92	One more digital image of the pressure reading at Bmrk-5. The tubeworm bush we've been observing will be in the background on the right of the image.			
04:25:24 Aug 29 2003	1523	89	End of pressure sensor reading at Bmrk-5 near Mkr-33.			
04:30:18 Aug 29 2003	1523	90	The sensor is stashed in its holder.			
04:31:45 Aug 29 2003	1523	118	We're heading east and a bit south to take a look at Mkr-33 crack - then we'll head back to the tubeworm bush and take a closer look.			
04:33:24 Aug 29 2003	1523	140	Mkr-33 crack in the distance.			R734-027
04:34:03 Aug 29 2003	1523	104	Main crack by Mkr-33.			R734-028
04:34:48 Aug 29 2003	1522	100	Two digital images of a far view of Mkr-33.			
04:35:13 Aug 29 2003	1522	86	Elevator weights near Mkr-33.			R734-029
04:35:54 Aug 29 2003	1522	103	Close-up of osmosampler near Mkr-33.			R734-030
04:38:15 Aug 29 2003	1523	87	Close-up of crack with OSMO near Mkr-33.			R734-031
04:39:24 Aug 29 2003	1523	87	Four more digital images sent to the hard drive.			
04:41:02 Aug 29 2003	1522	4	Tubeworm cluster near crack near Mkr-33.			R734-032
04:42:25 Aug 29 2003	1521	18	Five digital images taken of the tubeworm bush from a distance.			
04:42:51 Aug 29 2003	1523	50	Tubeworm bush from a distance.			R734-033
04:44:33 Aug 29 2003	1523	50	Close-up of worm bush with limpets.			R734-034
04:44:56 Aug 29 2003	1523	50	Close-up of tubeworms - palm worms and limpets.			R734-035
04:46:07 Aug 29 2003	1523	52	Started the highlights tape for Embley.			
04:49:44 Aug 29 2003	1523	53	Closeup of tubeworm gills with palm worms and limpets in the background.			R734-036
04:50:45 Aug 29 2003	1523	53	Closeup of tubeworm colony near Mkr-33.			R734-037
04:50:50 Aug 29 2003	1523	53	Highlights tape going off. About 20 digital images sent to the hard drive.			
04:51:47 Aug 29 2003	1523	53	Lots of floc being released through the tubeworm colony.			R734-038
04:55:56 Aug 29 2003	1512	24	We're off the bottom going up to the cage to transit to Magnesia Bmrk-1.			
05:08:54 Aug 29 2003	1396	335	Deep sea jellyfish.			R734-039
05:09:02 Aug 29 2003	1396	335	Jellyfish that MBARI recently "discovered."			R734-040
05:54:31 Aug 29 2003	1524	337	We're on the bottom in the area of Magnesia vent. We're looking for Bmrk-1.			
05:55:34 Aug 29 2003	1525	16	The area of Magnesia vent.			R734-041
05:57:52 Aug 29 2003	1526	326	Lava pillars to the north of Magnesia.			R734-042
06:03:57 Aug 29 2003	1526	225	Bmrk-1 at Magnesia.			R734-043

Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
06:04:07 Aug 29 2003	1526	202	Bmrk-1 at Magnesia has been located. Mkr-67 is visible.			
06:07:29 Aug 29 2003	1528	263	Five digital images were sent to the hard drive featuring Magnesia.			
06:07:38 Aug 29 2003	1528	259	Magnesia vent area.			R734-044
06:14:17 Aug 29 2003	1528	120	Preparing to take pressure sensor reading.			
06:16:32 Aug 29 2003	1528	124	Pressure sensor at Magnesia on Bmrk-1.			R734-045
06:16:36 Aug 29 2003	1528	120	Starting pressure sensor reading at Magnesia Bmrk-1.			
06:17:39 Aug 29 2003	1528	123	One digital image sent to the hard drive.			
06:27:35 Aug 29 2003	1528	120	Pressure sensor reading at Magnesia vent.			R734-046
06:47:45 Aug 29 2003	1528	119	End of pressure sensor reading at Magnesia vent - Bmrk-1.			
06:51:33 Aug 29 2003	1522	235	Five digital images sent to the hard drive.			
08:05:04 Aug 29 2003	1503	258	Heading to bottom - looking for Bmrk-63.			
08:07:13 Aug 29 2003	1534	297	Bottom is in sight - looking for Bmrk-63.			
08:08:00 Aug 29 2003	1536	295	At bottom looking for Bmrk-63.			R734-047
08:09:04 Aug 29 2003	1537	295	Ropey jumbled lava near Bmrk-63.			R734-048
08:09:56 Aug 29 2003	1534	277	More lava near Bmrk-63.			R734-049
08:11:20 Aug 29 2003	1535	248	Lava near Bmrk-63.			R734-050
08:13:54 Aug 29 2003	1535	234	Looking for Bmrk-63 at the center of the caldera.			R734-051
08:21:45 Aug 29 2003	1534	75	Bmrk-63 is in sight.			
08:22:02 Aug 29 2003	1535	77	Bmrk-63 in the distance.			R734-052
08:22:51 Aug 29 2003	1536	85	Three digital photos of bmrk-63 taken.			
08:23:38 Aug 29 2003	1536	72	Bmrk-63.			R734-053
08:27:05 Aug 29 2003	1537	25	Platform of Bmrk-63.			R734-054
08:32:40 Aug 29 2003	1537	26	Bottom pressure sensor in place on bmrk-63. Starting reading.			
08:34:59 Aug 29 2003	1537	27	Two digital photos taken of sensor on benchmark.			
08:35:38 Aug 29 2003	1537	33	Repositioning pressure sensor and cancelling first reading. Will restart reading.			
08:40:48 Aug 29 2003	1537	42	Sensor is repositioned. Starting second reading.			
08:41:16 Aug 29 2003	1537	43	Repositioned pressure recorder at Bmrk-63.			R734-055
09:12:28 Aug 29 2003	1537	43	Finished with pressure reading.			
09:13:29 Aug 29 2003	1536	38	End of pressure measurement at Bmrk-63.			R734-056
09:14:57 Aug 29 2003	1534	58	One digital photo of bmrk-63 with pressure sensor removed.			
09:19:16 Aug 29 2003	1499	197	Transit to Magnesia underway.			
10:42:30 Aug 29 2003	1526	118	ROPOS is on the bottom at Bmrk-1/Magnesia.			
10:47:31 Aug 29 2003	1528	27	Looking for Bmrk-1.			R734-057
10:49:59 Aug 29 2003	1527	333	Approaching Bmrk-1.			R734-058
10:51:20 Aug 29 2003	1528	5	Three digital photos taken of Mkr-67 and surrounding area.			
10:55:21 Aug 29 2003	1528	2	Placing pressure recorder at Bmrk-1.			R734-059
10:57:23 Aug 29 2003	1528	359	Pressure recorder in place; begin recording data.			
10:59:02 Aug 29 2003	1528	2	One digital photo taken of pressure sensor on marker platform.			
10:59:02 Aug 29 2003	1528	2	Pressure recorder at Bmrk-1.			R734-060
10:59:46 Aug 29 2003	1528	360	Pressure recorder at Bmrk-1.			R734-061

Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
11:28:22 Aug 29 2003	1528	360	Pressure sample complete.			
11:31:37 Aug 29 2003	1517	322	Pressure sampler stowed; begin transit to Mkr-33/Bmrk-5.			
12:54:01 Aug 29 2003	1514	207	ROPOS on bottom in the area of Bmrk-5.			
12:54:53 Aug 29 2003	1518	211	Cage motor is turned off to find Bmrk-5.			
12:58:56 Aug 29 2003	1520	179	Bmrk-5 is found.			
12:59:28 Aug 29 2003	1521	192	Bmrk-5 at Mkr-33.			R734-062
13:03:56 Aug 29 2003	1523	234	Pressure sensor.			R734-063
13:04:16 Aug 29 2003	1523	232	Pressure sampler in place; recording begins.			
13:08:26 Aug 29 2003	1523	232	Two digital photos taken of Bmrk-5 while pressure sampling.			
13:11:20 Aug 29 2003	1523	233	Rattail fish up close and personal.			R734-064
13:34:36 Aug 29 2003	1522	232	Pressure sampling complete.			
13:36:19 Aug 29 2003	1519	255	Pressure sampler secure; looking around area.			
13:37:21 Aug 29 2003	1521	135	Bacterial mats in cracks on seafloor.			R734-065
13:38:01 Aug 29 2003	1522	50	New tubeworm bush sprouting out of cracks in seafloor.			R734-066
13:39:03 Aug 29 2003	1519	21	ROPOS off the bottom; begin transit NW toward Transponder 11.			
14:50:31 Aug 29 2003	1306	333	We are at the site of XP 11. Heading down to look for it.			
14:58:42 Aug 29 2003	1350	203	Having trouble finding the transponder. Heading back up a bit to try again.			
15:13:30 Aug 29 2003	1339	0	Still searching for XP 11.			
15:51:03 Aug 29 2003	1342	209	No luck finding transponder. Going back to search near the cage.			
16:03:06 Aug 29 2003	1333	347	Giving up on finding transponder 11 for now. Heading to transponder 9.5.			
17:21:50 Aug 29 2003	1331	183	Approaching the location of transponder 9.5. Heading down to look for it.			
17:24:27 Aug 29 2003	1329	155	Transponder is in sight.			
17:25:54 Aug 29 2003	1326	140	Ash 9.5 Transponder.			R734-067
17:29:57 Aug 29 2003	1326	234	Ash 9.5 Transponder.			R734-068
17:31:25 Aug 29 2003	1326	212	Have a hold of the rim of the transponder float.			
17:31:29 Aug 29 2003	1326	221	Holding Ash 9.5 Transponder.			R734-069
17:34:17 Aug 29 2003	1328	179	Attaching the first hook just below the float of the transponder.			
17:35:26 Aug 29 2003	1329	181	Attaching the hook to the Ash 9.5 transponder.			R734-070
17:35:33 Aug 29 2003	1329	183	First hook is attached.			
17:38:34 Aug 29 2003	1330	182	Attaching the second hook to the handle on the float.			
17:39:11 Aug 29 2003	1330	175	Attaching the second hook to the Ash 9.5 transponder.			R734-071
17:39:18 Aug 29 2003	1331	174	Second hook is attached.			
17:42:22 Aug 29 2003	1329	174	Moving the ship away to give room for the transponder to surface.			
17:47:23 Aug 29 2003	1329	169	Transponder 9.5 has been released. ETA to the surface is 30 minutes.			
18:10:28 Aug 29 2003	1323	200	Transponder is on deck.			
18:13:18 Aug 29 2003	1323	287	Heading to Bag City to continue pressure sensor measurements.			
19:09:41 Aug 29 2003	1495	142	Cloudy seawater in view.			

Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
19:11:59 Aug 29 2003	1529	145	Seafloor in view; we are searching for Bag City bmrk-4 near Mrk-65.			
19:16:14 Aug 29 2003	1534	181	We are searching for the Bag City bmrk-4; visibility is low.			
19:18:11 Aug 29 2003	1535	145	Tubeworms near Bag City.			R734-072
19:18:20 Aug 29 2003	1534	162	Tubeworms near Bag City bmrk-4.			R734-073
19:19:03 Aug 29 2003	1535	160	Tubeworms near Bag City.			R734-074
19:19:40 Aug 29 2003	1535	151	Tubeworms near Bag City.			R734-075
19:20:04 Aug 29 2003	1534	156	Tubeworms and fish near Bag City.			R734-076
19:20:17 Aug 29 2003	1535	158	We have located the bmrk-4 at Bag City and are taking digital stills and framegrabs of the site. Of interest are the large tubeworm bushes in site.			
19:21:40 Aug 29 2003	1534	168	Bag City Bmrk-4.			R734-077
19:23:41 Aug 29 2003	1534	19	Transferred four digital still images.			
19:23:58 Aug 29 2003	1534	358	Bag City bmrk-4.			R734-078
19:30:51 Aug 29 2003	1534	3	Starting pressure measurement at Bag City bmrk-4.			
19:31:08 Aug 29 2003	1534	3	Pressure sensor in place at Bag City bmrk-4.			R734-079
19:36:40 Aug 29 2003	1534	1	Checking gages.			
19:39:24 Aug 29 2003	1535	4	Small tubeworm colony coming out of a crack near Bag City.			R734-080
19:39:47 Aug 29 2003	1534	1	Checking out tubeworms and associated fauna at Bag City.			
19:40:00 Aug 29 2003	1535	1	Small tubeworm colony coming out of a crack near Bag City.			R734-081
19:43:07 Aug 29 2003	1535	4	Closeup of lava adjacent to Bag City Bmrk-4.			R734-082
20:01:11 Aug 29 2003	1535	1	Stopping pressure measurement at Bmrk-4. We are moving to the cage for transit to Pillow Mound benchmark.			
22:41:56 Aug 29 2003	1646	332	ROPOS arrives South Pillow Mound.			
22:57:52 Aug 29 2003	1721	291	ROPOS on bottom; video started.			
23:01:15 Aug 29 2003	1722	93	We're searching for the site; first we went south; now we're headed east in a search pattern.			
23:03:39 Aug 29 2003	1722	272	Bottom at Pillow Mound.			R734-083
23:07:16 Aug 29 2003	1723	345	Crack on the seafloor at Pillow Mound.			R734-084
23:08:21 Aug 29 2003	1722	315	Noticing large dike filled with lava from the 1998 eruption.			
23:10:40 Aug 29 2003	1722	5	ROPOS turns and heads north.			
23:11:46 Aug 29 2003	1724	285	Bmrk-66 comes into view.			
23:13:13 Aug 29 2003	1723	309	Pillow Mound, bmrk-66.			R734-085
23:19:03 Aug 29 2003	1724	357	Putting the sensor probe on the bmrk-66.			R734-086
23:19:42 Aug 29 2003	1724	2	Positioning pressure sensor.			
23:25:59 Aug 29 2003	1724	358	Pressure sensor in place and recording data.			
23:26:08 Aug 29 2003	1724	354	Sensor probe on the Bmrk-66.			R734-087
23:41:30 Aug 29 2003	1724	358	A beautiful plume animal.			R734-088
23:44:41 Aug 29 2003	1723	358	A beautiful tentacular animal.			R734-089
23:55:27 Aug 29 2003	1724	357	Pressure sensor data is done for Bmrk-66.			
23:56:21 Aug 29 2003	1723	357	Move from Bmrk-66.			R734-090

Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
23:59:55 Aug 29 2003	1717	357	Pressure sensor secure; ROPOS headed N to Bag City.			
02:55:59 Aug 30 2003	1395	345	Medusa on the deep.			R734-091
03:03:27 Aug 30 2003	1487	336	Jelly fish close encounter.			R734-092
03:07:37 Aug 30 2003	1532	341	We're on the bottom in the vicinity of Bag City. We're searching for the benchmark.			
03:16:10 Aug 30 2003	1532	107	Searching for Bag City.			R734-093
03:21:36 Aug 30 2003	1533	328	Bag City Vent field.			R734-094
03:22:33 Aug 30 2003	1532	218	We have located the Bmrk-4 at Bag City vent field.			
03:22:42 Aug 30 2003	1533	213	Benchmark at Bag City.			R734-095
03:30:58 Aug 30 2003	1533	19	Starting pressure sensor reading at Bmrk-4 - Bag City vent field.			
03:30:59 Aug 30 2003	1533	19	Bmrk-4 at Bag City.			R734-096
04:00:38 Aug 30 2003	1533	21	End of pressure reading at Bmrk-4 Bag City.			
04:01:07 Aug 30 2003	1532	25	Our next stop will be Vixen Vent in the Coquille vent field. That's about 300 meters to the NW.			
04:30:59 Aug 30 2003	1522	280	The cage is descending over Coquille vent field.			
04:32:48 Aug 30 2003	1531	129	We're back on the bottom.			
04:37:23 Aug 30 2003	1534	300	This is Vixen anhydrite chimney.			R734-097
04:37:26 Aug 30 2003	1534	300	We're at Vixen!! It's spewing black smoke. Obviously still very active.			
04:38:09 Aug 30 2003	1535	293	Vixen with last years hobos.			R734-098
04:38:14 Aug 30 2003	1535	295	Vixen chimney.			R734-099
04:38:59 Aug 30 2003	1536	294	Vixen anhydrite chimney with 2 hobo probes from last year.			R734-100
04:40:36 Aug 30 2003	1536	292	Seven digital images sent to the hard drive.			
04:43:59 Aug 30 2003	1536	292	Sulfide worms at the base of Vixen.			R734-101
04:44:28 Aug 30 2003	1536	294	Sulfide worms at the base of Vixen.			R734-102
04:51:43 Aug 30 2003	1536	296	Ray Lee wants to do a suction sample here.			
04:52:44 Aug 30 2003	1536	295	Before suction begins.			R734-103
04:52:57 Aug 30 2003	1536	293	Two more digitals taken at Vixen but we weren't able to see what we were snapping.			
04:54:20 Aug 30 2003	1536	294	Suction sample of sulfide worms. Start 0454 Stop 0457. [Vixen]	R734-SS-J8-0001	Morineaux	
04:54:32 Aug 30 2003	1536	293	Suction begins.			R734-104
04:55:40 Aug 30 2003	1536	294	Three more digital images - images of sulfide worms that are being suctioned for Ray Lee.			
04:59:24 Aug 30 2003	1536	292	We will take the hobos out of the bio-box and place them near the vent. Next the hobos that are in the vent will be retrieved and replaced.			
05:07:32 Aug 30 2003	1536	294	Recovered hobo-153 (deployed in 2002). [Vixen]	R734-hobo-153-0002	Embley	
05:07:49 Aug 30 2003	1536	292	Recovering hobo-153.			R734-105
05:09:10 Aug 30 2003	1536	293				R734-106
05:10:11 Aug 30 2003	1536	293	Recovering HOBO 152 from the orifice at Vixen.			R734-107
05:11:20 Aug 30 2003	1536	295	Recovered hobo-152 (deployed in 2002). [Vixen]	R734-hobo-152-0003	Embley	
05:11:34 Aug 30 2003	1536	293	The tip of the hobo probe extracted from Vixen.			R734-108



Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
05:14:10 Aug 30 2003	1536	291	152 HOBO being put into the bio box.			R734-109
05:19:03 Aug 30 2003	1536	304	Deploying hobo-132 at Vixen.			
05:22:40 Aug 30 2003	1536	289	Hobo-132 successfully deployed in the vent.			R734-110
05:24:12 Aug 30 2003	1536	255	Deploying hobo-130 at Vixen.			
05:33:05 Aug 30 2003	1536	251	Both HOBO 130 and 132 are successfully deployed. Several DSC images were taken after the hobos were deployed.			R734-111
05:34:27 Aug 30 2003	1533	277	We're finished here at Vixen after deploying 2 hobos (130 and 132) and retrieving 2 (152 and 153). We're now heading to Village/Diffuse.			
06:24:59 Aug 30 2003	1079	4	We're over Diffuse/Village going down.			
06:48:46 Aug 30 2003	1519	266	We're on the bottom in the vicinity of Village and Castle vents.			
06:53:01 Aug 30 2003	1523	203	Marker at village.			R734-112
06:53:20 Aug 30 2003	1523	166	Mkr-44 at village.			R734-113
06:54:11 Aug 30 2003	1523	151	We think that we're at Village. There's a marker here (Mkr-44). Looks like the marker says "UW Ocean".			
06:55:40 Aug 30 2003	1523	111	Bottom of mkr-44.			R734-114
06:56:14 Aug 30 2003	1522	123	Near bottom of mkr-44.			R734-115
06:56:28 Aug 30 2003	1523	135	Four digital images sent to hard drive.			
06:57:19 Aug 30 2003	1522	137	Next to mkr-44.			R734-116
06:57:38 Aug 30 2003	1522	129	Near mkr-44.			R734-117
06:57:55 Aug 30 2003	1522	93	Near mkr-44 looking for MTR.			R734-118
06:58:35 Aug 30 2003	1522	67	Looking towards base of mkr-44.			R734-119
07:00:16 Aug 30 2003	1523	171	Near bottom of mkr-44 looking for MTR.			R734-120
07:00:36 Aug 30 2003	1523	145	Near mkr-44.			R734-121
07:07:31 Aug 30 2003	1522	204	Still searching the Village for MTR 3987. We read the description of the deployment from R674 to try to locate it but haven't been able to.			
07:12:03 Aug 30 2003	1522	201	MTR at village.			R734-122
07:12:06 Aug 30 2003	1522	203	The MTR has been spotted. It is nearly covered with tubeworms. The number is obscured but looks to be 3987.			
07:12:22 Aug 30 2003	1522	191	MTR at village.			R734-123
07:12:46 Aug 30 2003	1523	184	MTR at village.			R734-124
07:13:57 Aug 30 2003	1523	178	Five digital photos of the MTR stored.			
07:14:13 Aug 30 2003	1523	178	Grabbing MTR at village.			R734-125
07:14:34 Aug 30 2003	1523	176				R734-126
07:14:40 Aug 30 2003	1523	177				R734-127
07:17:14 Aug 30 2003	1522	197	MTR 3087 recovered from Village vent. The number recorded at deployment was 3987 - it's actually 3087. [Village]	R734-MTR-3087-000 4	Embley	
07:18:23 Aug 30 2003	1523	81	On the way from Village to Castle.			R734-128
07:18:42 Aug 30 2003	1522	81	On the way from Village to Castle.			R734-129
07:19:33 Aug 30 2003	1521	84	Three digital photos stored of jumbled weathered lava.			
07:22:00 Aug 30 2003	1513	65	Five digital photos taken of chimneys.			

Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
07:23:33 Aug 30 2003	1519	51	Hobo at castle.			R734-130
07:23:34 Aug 30 2003	1519	47	Hobo 128 spotted at base of chimney.			
07:23:45 Aug 30 2003	1521	27	Approaching hobo at Castle.			R734-131
07:23:59 Aug 30 2003	1520	5	Hobo 128 at Castle - to be recovered.			R734-132
07:24:26 Aug 30 2003	1521	18	Hobo sitting at Castle.			R734-133
07:25:24 Aug 30 2003	1521	18	Hobo at castle.			R734-134
07:25:55 Aug 30 2003	1520	2	Three digital photos taken of the Hobo in position.			
07:26:37 Aug 30 2003	1521	5	Two bacteria traps were visible near the anhydrite chimney. The bac traps appeared black.			
07:28:02 Aug 30 2003	1521	10	Grabbing hobo at Castle.			R734-135
07:28:13 Aug 30 2003	1521	13	Hobo 128 recovered successfully. It was deployed in R674. [Castle]	R734-hobo-128-0005	Embley	
07:28:17 Aug 30 2003	1521	13	Tip of hobo being removed.			R734-136
07:30:25 Aug 30 2003	1521	32	Hobo site at Castle.			R734-137
07:31:00 Aug 30 2003	1520	336	Hobo site at Castle.			R734-138
07:33:17 Aug 30 2003	1475	233	Leaving Castle Vent and heading to Cloud.			
08:19:31 Aug 30 2003	1519	310	Bottom is in sight near Cloud.			
08:21:27 Aug 30 2003	1520	319	Looking for Mkr-N6.			
08:22:28 Aug 30 2003	1520	275	On bottom looking for Cloud Vent.			R734-139
08:24:00 Aug 30 2003	1521	268	Looking for Cloud.			R734-140
08:26:41 Aug 30 2003	1520	270	Looking for Cloud vent.			R734-141
08:27:36 Aug 30 2003	1519	239	Looking for Cloud vent.			R734-142
08:28:57 Aug 30 2003	1519	323	Looking for Cloud.			R734-143
08:32:27 Aug 30 2003	1515	270	Stopping looking for Cloud Vent. Will continue on to Mkr-33 and work there and then return to look for Cloud. We hope to have more luck finding it when approaching from the other direction.			
08:33:35 Aug 30 2003	1521	210	Tripod near Mkr-33.			R734-144
08:34:20 Aug 30 2003	1521	186	Approaching at Mkr-33.			R734-145
08:34:49 Aug 30 2003	1522	187	We have reached Mkr-33.			
08:36:46 Aug 30 2003	1524	188	Thirteen digital photos at Mkr-33 stored to hard drive. Ending with 06729.			
08:36:59 Aug 30 2003	1524	221	Near Mkr-33.			R734-146
08:39:22 Aug 30 2003	1525	3	Near Mkr-33.			R734-147
08:39:52 Aug 30 2003	1524	353	Near Mkr-33.			R734-148
08:40:16 Aug 30 2003	1524	319	Seven digital photos at Mkr-33 stored. Ending with 06736.			
08:40:25 Aug 30 2003	1524	285	MTRs at Mkr-33.			R734-149
08:40:43 Aug 30 2003	1524	267	Mkr-33.			R734-150
08:41:03 Aug 30 2003	1524	270	Near Mkr-33.			R734-151
08:41:24 Aug 30 2003	1525	267	MTR at Mkr-33.			R734-152
08:42:04 Aug 30 2003	1524	297	MTR at mkr-33.			R734-153
08:42:51 Aug 30 2003	1525	317	Mkr-33.			R734-154

Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
08:43:53 Aug 30 2003	1525	316	Grabbing MTR at mkr-33.			R734-155
08:44:06 Aug 30 2003	1525	315	MTR at 33.			R734-156
08:45:05 Aug 30 2003	1525	315	MTR 3213 retrieved. [Mkr-33]	R734-MTR-3213-000 6	Embley	
08:45:25 Aug 30 2003	1525	315	MTR 3213 at mkr-33.			R734-157
08:47:39 Aug 30 2003	1525	310	At Mkr-33.			R734-158
08:49:08 Aug 30 2003	1525	312				R734-159
08:49:33 Aug 30 2003	1525	313	Setting MTR 4001 at mkr-33.			R734-160
08:49:49 Aug 30 2003	1525	314	MTR 4001 at resting place.			R734-161
08:49:51 Aug 30 2003	1525	310	Deployment of MTR 4001 in nearly the same location as MTR 3213 was in before retrieval.			
08:50:34 Aug 30 2003	1525	314	MTR 4001 on vent at mkr-33.			R734-162
08:52:12 Aug 30 2003	1524	207	MTR 4127 ready to be picked up.			R734-163
08:53:14 Aug 30 2003	1524	209	Two digital photos of MTR 4127(?) being recovered.			
08:56:39 Aug 30 2003	1524	207	MTR 4127 retrieved. The label was covered with limpets - it is confirmed to be 4127. [Mkr-33]	R734-MTR-4127-000 7	Embley	
08:58:37 Aug 30 2003	1524	209	MTR at mkr-33.			R734-164
09:00:08 Aug 30 2003	1524	201	Three digital photos of the hobo at Mkr-33 stored.			
09:01:02 Aug 30 2003	1524	200	MTR in crack.			R734-165
09:01:56 Aug 30 2003	1524	200	Pulling MTR 3185.			R734-166
09:02:45 Aug 30 2003	1524	201	Retrieval of MTR 3185. The number is very clearly read as 3185, but this MTR number is not listed among those deployed in R661 (we thought it was 3039). We are taking it anyway. The MTR was surrounded thickly with tubeworms. [Mkr-33]	R734-MTR-3185-000 8	Embley	
09:02:54 Aug 30 2003	1524	201	Retrieval of MTR 3185 at Mkr-33.			R734-167
09:08:10 Aug 30 2003	1524	198	Deployment of MTR 3292.			
09:08:43 Aug 30 2003	1524	199	MTR 3292 being deployed at mkr-33.			R734-168
09:08:48 Aug 30 2003	1524	199	MTR 3292 going into hole at mkr-33.			R734-169
09:08:59 Aug 30 2003	1524	198	MTR 3292 at rest at mkr-33.			R734-170
09:09:35 Aug 30 2003	1524	199	Two digital photos of MTR 3292 in place.			
09:11:05 Aug 30 2003	1525	289	Repositioning MTR 4001 to a higher flow area.			
09:12:49 Aug 30 2003	1524	209	SUMMARY of activity at Mkr-33. Three MTRs were listed as deployed in R661: 3213, 4217, and 3039. We retrieved three that were numbered 3213, 4127, and 3185. There were no more MTRs in the area so we assume that 3185 was mis-recorded at 3039.			
09:20:24 Aug 30 2003	1524	196	MTR 4001 at home at mkr-33.			R734-171
09:20:44 Aug 30 2003	1524	191	MTR 4001 at home at mkr-33.			R734-172
09:21:16 Aug 30 2003	1524	188	MTR 4001 successfully redeployed in new location.			
09:22:03 Aug 30 2003	1524	189	Four digital photos of MTR 4001 in its new location.			
09:25:05 Aug 30 2003	1521	197	Near mkr-33.			R734-173
09:25:54 Aug 30 2003	1524	177	New tube worm bush at mkr-33.			R734-174
09:26:42 Aug 30 2003	1524	179	New tube worm bush at mkr-33.			R734-175

Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
09:28:18 Aug 30 2003	1523	123	Three digital photos of new tubeworm bush near Mkr-33 crack.			
09:28:32 Aug 30 2003	1524	118	New tube worm bush near mkr-33.			R734-176
09:30:52 Aug 30 2003	1524	135	Taking temperature reading at new tubeworm bush near Mkr-33.			R734-177
09:33:33 Aug 30 2003	1524	133	Took temperature reading in new tubeworm bush near Mkr-33 crack. Tmax=17.5. This will be the site for MTR 3049.			
09:35:24 Aug 30 2003	1524	127	MTR 3049 being placed at new tube worm site near mkr-33.			R734-178
09:36:26 Aug 30 2003	1524	115	Crab and MTR 3049 at new tube worm bush.			R734-179
09:38:36 Aug 30 2003	1524	121	MTR 3049 being place at new site.			R734-180
09:38:57 Aug 30 2003	1524	126	3049 MTR at home at new tube worm bush.			R734-181
09:39:17 Aug 30 2003	1524	125	Two digital photos of MTR 3049 in place in new tubeworm bush near Mkr-33.			
09:40:39 Aug 30 2003	1524	212	MTR 3049 (purple tape) deployed at new tubeworm bush near Mkr-33 crack.			
09:44:44 Aug 30 2003	1524	214	Sampling to jar 5.			R734-182
09:45:40 Aug 30 2003	1524	213	Suction sample of limpets and other critters for Amanda in a new tubeworm bush near Mkr-33 in the area of the Bmrk-5. Start=0944. End=0949. Start2=0952. End2=0953. Start3=0955. Third suction is at slightly different area. End3=0958. [Mkr-33 area]	R734-SS-J5-0009	Bates [ssmp:: Kelly / Lee]	
09:54:52 Aug 30 2003	1524	127	Adding to suction sample jar 5 at other side of tube worm bush.			R734-183
10:02:07 Aug 30 2003	1524	147	Using J3 as a flush jar.			
10:13:18 Aug 30 2003	1524	280	MTR snout next to MTR at mkr-33.			R734-184
10:15:39 Aug 30 2003	1524	281	McLane and suction sampling next to MTR 3292.			R734-185
10:16:56 Aug 30 2003	1524	204	Gitai abandoned suction and McLane sampling because McLane pump hoses were oriented up for ambient fluid sampling rather than down for vent fluid sampling.			
10:17:49 Aug 30 2003	1524	200	High flow suction sample of limpets at the far side of Mkr-33 crack. Start=1021 End=1025. [Mkr-33 area]	R734-SS-J6-0010	Bates [ssmp: Kelly / Lee]	
10:20:49 Aug 30 2003	1524	186	Site of SS-J6 for Bates. Far side of Mkr-33 near MTR 3292.			R734-186
10:26:52 Aug 30 2003	1524	185	Flushing into J3.			
10:28:34 Aug 30 2003	1524	178	Low flux suction sample of baby limpets at periphery of Mkr-33. Using Jar 4 with 180 micron mesh. [Mkr-33 area]	R734-SS-J4-0011	Bates [ssmp: Kelly / Lee]	
10:28:39 Aug 30 2003	1524	179	Suctioning into jar 4 for limpets at Mkr-33.			R734-187
10:34:27 Aug 30 2003	1524	187	Flushing into Jar 3.			
10:36:08 Aug 30 2003	1523	206	Leaving Mkr-33 and returning to Cloud Vent.			
10:37:44 Aug 30 2003	1524	49	On the way to cloud.			R734-188
10:39:15 Aug 30 2003	1521	25	Coming up on cloud vent.			R734-189
10:40:12 Aug 30 2003	1522	48	Two peripheral arrays at Cloud Vent in sight.			
10:40:39 Aug 30 2003	1522	40	Array at cloud vent.			R734-190
10:41:05 Aug 30 2003	1522	51	Array at cloud.			R734-191
10:42:03 Aug 30 2003	1523	58	On edge of cloud vent.			R734-192
10:43:59 Aug 30 2003	1524	90	Cloud vent.			R734-193

Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
10:44:32 Aug 30 2003	1524	89	Cloud vent.			R734-194
10:44:38 Aug 30 2003	1524	87	Transferring seven digital photos of Cloud Vent.			
10:45:43 Aug 30 2003	1524	106	Two additional digital photos of Cloud taken.			
10:47:18 Aug 30 2003	1525	210	Near cloud vent.			R734-195
10:47:33 Aug 30 2003	1525	207	Cloud vent.			R734-196
10:49:51 Aug 30 2003	1521	116	Cloud appears to be quite active. We're looking for arrays right near the pit.			
10:52:08 Aug 30 2003	1524	96	Array at cloud vent.			R734-197
10:52:30 Aug 30 2003	1525	133	Cloud vent near array.			R734-198
10:52:57 Aug 30 2003	1525	125	Array at cloud vent.			R734-199
10:53:11 Aug 30 2003	1525	112	Second array at cloud vent.			R734-200
10:55:50 Aug 30 2003	1525	260	SVHS video tape switched.			
10:58:43 Aug 30 2003	1526	297	Checking out two arrays in close proximity to each other at Cloud.			
10:59:16 Aug 30 2003	1526	297	Preparing to deploy MTRs 3176 and 3334 - which are tied together.			
11:00:16 Aug 30 2003	1526	310	Unidentified worms at Cloud.			R734-201
11:02:16 Aug 30 2003	1526	312	Curious looking worms so far unidentified.			R734-202
11:06:27 Aug 30 2003	1526	305	Three digital photos sent to hard drive. One of MTR deployment.			
11:06:56 Aug 30 2003	1526	313	Deploying a MTR at Cloud.			R734-203
11:10:51 Aug 30 2003	1526	315	MTR deployed.			R734-204
11:11:43 Aug 30 2003	1526	313	MTRs 3334 and 3176 are deployed; the two MTRs attached together are in the hole with chain attached lying outside the hole.			
11:13:27 Aug 30 2003	1526	312	We're moving to suction some high density unidentified worms.			
11:14:03 Aug 30 2003	1526	294	Zoarcid on rock at Cloud.			R734-205
11:14:27 Aug 30 2003	1526	291	Unidentified worms at Cloud.			R734-206
11:18:36 Aug 30 2003	1526	294	Attempting to suction sample unidentified worms; SS is not working.			
11:21:40 Aug 30 2003	1526	298	Picking up rock sample with unknown worms attached.			R734-207
11:22:07 Aug 30 2003	1526	291	Picked up rock with unidentified worms living on it. [Cloud]	R734-RK-bio-0012	Marcus [ssmp: Bates]	
11:25:04 Aug 30 2003	1523	294	ROPOS is leaving Cloud Vent; headed for Bmrk-5/Mkr-33.			
11:29:47 Aug 30 2003	1524	249	Arrival at Bmrk-5 - position to perform pressure sensor testing.			
11:30:05 Aug 30 2003	1524	249	Bmrk-5 at Mkr-33.			R734-208
11:36:34 Aug 30 2003	1524	287	Third pressure sensor reading at Bmrk-5 near Mkr-33.			R734-209
11:36:49 Aug 30 2003	1524	288	Commence pressure sampling at Bmrk-5.			
11:39:04 Aug 30 2003	1524	288	Close-up of tubeworm colony thriving in cracks on seafloor near Bmrk-5.			R734-210
11:39:19 Aug 30 2003	1524	285	Small tubeworm colony near Bmrk-5.			R734-211
12:06:30 Aug 30 2003	1524	287	Pressure sampling complete; begin transit to Magnesia.			
12:58:40 Aug 30 2003	1524	306	ROPOS on the bottom.			

Time UTC	Z(m)	Hdg	R734 2003 Comments	Samples	Investigator	FrGrab
13:01:07 Aug 30 2003	1526	308	Large pillars being seen; nine digital photos taken.			
13:02:49 Aug 30 2003	1527	320	Pillars and collapsed pit on the way to Magnesia.			R734-212
13:07:20 Aug 30 2003	1527	332	Benchmark 1.			R734-213
13:08:05 Aug 30 2003	1526	355	Transferring five digital photo files of Bmrk-1 and surrounding area.			
13:15:40 Aug 30 2003	1527	87	Positioning of the pressure sensor.			
13:17:55 Aug 30 2003	1527	83	Pressure sensor in place; recording begins.			
13:17:58 Aug 30 2003	1527	85	Third pressure measurement at Benchmark 1.			R734-214
13:48:35 Aug 30 2003	1527	84	End of pressure sensor measurement.			
13:52:32 Aug 30 2003	1524	85	Begin transit to Center/Bmrk-63.			
14:59:39 Aug 30 2003	1510	275	Nearing Bmrk-63. Heading down to the bottom.			
15:01:23 Aug 30 2003	1531	272	ROPOS is on the bottom. There is no nav here now.			
15:02:46 Aug 30 2003	1531	275	Heading west to find Bmrk-63.			
15:03:21 Aug 30 2003	1533	274	We are at Bmrk-63.			
15:03:38 Aug 30 2003	1533	272	Center - benchmark 63.			R734-215
15:08:40 Aug 30 2003	1535	250	Removing the pressure sensor from the basket.			
15:08:53 Aug 30 2003	1535	251	Benchmark 63.			R734-216
15:12:22 Aug 30 2003	1535	256	Pressure sensor is in place at Bmrk-63. Starting measurement.			
15:12:24 Aug 30 2003	1535	255	Pressure measurement at Benchmark 63 (Center).			R734-217
15:42:36 Aug 30 2003	1535	256	Stopping pressure measurement. Heading up to do some filtering at 1000m for Gitai.			
15:44:30 Aug 30 2003	1533	255	Pressure sensor is back in the basket.			
15:45:16 Aug 30 2003	1533	284	Heading back up to the cage.			
15:50:15 Aug 30 2003	1393	265	Going to test the suction sampler again for Gitai.			
15:51:34 Aug 30 2003	1353	296	Suction sampler is still not working.			
16:02:01 Aug 30 2003	998	289	Stopping at 1000m.			
16:02:52 Aug 30 2003	997	285	Running the McLane pump on the port side with a GFF filter for DOC. 2 minute sample 1000m depth 500 meters above the center of the Caldera.	R734-MP-port-0013	Yahel	
16:06:47 Aug 30 2003	999	310	Running the McLane pump with no filter on the starboard side 1000 m depth 500 meters above the center of the Caldera for DOC. Start 1607 Stop 1608.	R734-MP-stbd-0014	Yahel	
16:10:00 Aug 30 2003	978	343	Heading on the surface.			
16:41:42 Aug 30 2003	2	6	ROPOS is at the surface. End of dive R734.			
17:11:26 Aug 30 2003	2	221	ROPOS on deck at 1644 UTC.			

## 10.5 R735 - 2003 Dive Log

The elevator was placed on the bottom after it was released from the cage. **Mkr-33** 2 McLane samples in the tubeworm bush north of Mkr-33. Deployed Amanda's racetrack near the crack. **Cloud** Recovered 3 LA (2 near and 1 periphery) which were deployed in 2002. Digital video and DSC survey. Found wood samples deployed by Voight/Tunncliffe about 50 meters NW of Mkr-33. Proceeded on to look at pillars and collect 2 rock sample, one with unidentified worms (collected 35 meters south of Cloud). ROPOS released the elevator.

Time UTC	Z (m)	Hdg	R735 2003 Comments	Samples	Investigator	FrGrab
03:07:55 Aug 31 2003	1	188	The elevator is going in the water.			
03:22:14 Aug 31 2003	1	177	ROPOS is in the water.			
04:44:21 Aug 31 2003	1480	53	Unknown critter close to Cloud. Amanda believes it may be a pelagic polychaete with epitokes.			R735-001
04:47:38 Aug 31 2003	1521	51	ROPOS is on the bottom somewhere near Cloud vent.			
05:09:24 Aug 31 2003	1521	34	We're in the vicinity of Cloud preparing to drop the elevator from the cage.			
05:11:05 Aug 31 2003	1521	24	The elevator was released. Beautiful gentle landing.			
05:14:33 Aug 31 2003	1516	13	The boys are disconnecting the line from the elevator so it doesn't get tangled up.			
05:24:42 Aug 31 2003	1518	205	We are finally on the bottom. The portabox was dropped - but seems to have survived.			
05:30:33 Aug 31 2003	1523	263	We set the portable array box down next to the arrays. Next we will pick up Amanda's racetrack out of the elevator and transit to Mkr-33.			
05:32:29 Aug 31 2003	1522	297	Lumpfish in the vicinity of the arrays at Cloud.			R735-002
05:32:45 Aug 31 2003	1523	281	Lumpfish approaching.			R735-003
05:32:49 Aug 31 2003	1523	279	Lumpfish near Cloud.			R735-004
05:32:54 Aug 31 2003	1523	268	Lumpfish near Cloud.			R735-005
05:34:22 Aug 31 2003	1523	232	Settling arrays by Cloud.			R735-006
05:41:58 Aug 31 2003	1519	349	Two digital images sent to the hard drive.			
05:42:34 Aug 31 2003	1519	350	We're rotating the elevator around so that we can get the racetrack out of the biobox.			
06:01:20 Aug 31 2003	1524	317	Settling arrays at Cloud.			R735-007
06:01:44 Aug 31 2003	1524	325	Array portabox from elevator with Amanda's racetrack placed beside Cloud N6 hole. We will shortly take the racetrack out and transit to Mkr-33.			
06:08:09 Aug 31 2003	1525	307	Taking the racetrack out of the portabox.			
06:08:28 Aug 31 2003	1524	306	Amanda's racetrack.			R735-008
06:09:05 Aug 31 2003	1524	299	Moving to Mkr-33 with racetrack in claw.			
06:12:18 Aug 31 2003	1523	294	Rattail on the way to Mkr-33.			R735-009
06:17:40 Aug 31 2003	1523	205	Amanda's racetrack being put in placed.			R735-010
06:18:00 Aug 31 2003	1523	206	We're placing the racetrack in the flow at Mkr-33 vent.			
06:18:03 Aug 31 2003	1523	208	Amanda's racetrack.			R735-011
06:20:07 Aug 31 2003	1521	234	Four digital images sent to the hard drive.			
06:28:28 Aug 31 2003	1523	253	Suction sampling tubeworm bush at mkr-33. Suction sampler is not working so did not get a sample.			R735-012
06:29:09 Aug 31 2003	1523	255				
06:33:06 Aug 31 2003	1523	255	McLane pump (stbd) with GFF filter for fluids to sample DOC in the tubeworm bush north of Mkr-33 near the benchmark. 6 liters total at 5 liters per minute. Start 0637 Stop 0639. Talien-max=7.5. [Mkr-33 area]	R735-McLane-stbd-001	Yahel	
06:35:16 Aug 31 2003	1523	255	Trying to suction sampling in tubeworm bush. Suction sampler not working so no sample.			R735-013

Time UTC	Z (m)	Hdg	R735 2003 Comments	Samples	Investigator	FrGrab
06:39:20 Aug 31 2003	1523	255	McLane port sample - No filter (sucks the fluid into a bag) - for fluids to sample DOC in the tubeworm bush north of Mkr-33 near the benchmark. 6 liters total at 5 liters per minute. Start 0641 Stop 0642. Talien-max=7.5. [Mkr-33 area]	R735-McLane-port-0002	Yahel	
06:46:41 Aug 31 2003	1523	256	We're on jar 7 flushing it at low rate with fluorocine dye to see how long it takes to flush the water. This is not a sample.			
06:51:48 Aug 31 2003	1523	255	The suction pump does not appear to be working.			
06:53:57 Aug 31 2003	1521	20	We're going back to Cloud to recover Noreen's arrays.			
06:55:00 Aug 31 2003	1522	87	Leaving mkr-33 on our way to Cloud.			R735-014
06:56:58 Aug 31 2003	1524	291	At Cloud vent.			R735-015
06:57:29 Aug 31 2003	1524	290	Array at Cloud vent.			R735-016
07:00:12 Aug 31 2003	1524	294	Array at Cloud vent.			R735-017
07:01:27 Aug 31 2003	1525	278	Digital photos for Kelly of each component of the larval array near Cloud - 18 photos stored.			
07:06:06 Aug 31 2003	1525	278	Array at Cloud vent.			R735-018
07:07:26 Aug 31 2003	1525	283	Taking temp at array at Cloud vent.			R735-019
07:08:03 Aug 31 2003	1525	284	Temperature readings taken above Kelly's larval array - only slightly (one half to one degree) above ambient.			
07:08:23 Aug 31 2003	1525	285	Taking second temp at array at Cloud vent.			R735-020
07:14:04 Aug 31 2003	1524	260	Repositioning recovery box that slid downhill.			
07:15:14 Aug 31 2003	1524	289	At Cloud vent.			R735-021
07:17:18 Aug 31 2003	1525	277	Grabbing bioarray at Cloud vent.			R735-022
07:17:28 Aug 31 2003	1525	276	Lifting bioarray.			R735-023
07:17:33 Aug 31 2003	1525	280	Transferring larval array to recovery box.			
07:17:33 Aug 31 2003	1525	280	Bioarray lifted at Cloud.			R735-024
07:17:56 Aug 31 2003	1525	281	Undemeath the bioarray at Cloud.			R735-025
07:21:20 Aug 31 2003	1525	204	Bioarray moving towards box.			R735-026
07:22:15 Aug 31 2003	1524	186	Bioarray going into box.			R735-027
07:24:51 Aug 31 2003	1525	163	Box being positioned to drop into transport box.			R735-028
07:25:03 Aug 31 2003	1525	165	Array positioned for drop into box.			R735-029
07:25:33 Aug 31 2003	1525	162	Bioarray in transport box.			R735-030
07:26:07 Aug 31 2003	1525	164	Lid closing on array.			R735-031
07:26:42 Aug 31 2003	1525	166	Larval array successfully stowed in the recovery box.			
07:39:40 Aug 31 2003	1525	268	Still attempting to latch transport box.			
07:41:55 Aug 31 2003	1525	265	Closing lid on box for array.			R735-032
07:42:36 Aug 31 2003	1525	268	Lid of collection box latched.			
07:43:27 Aug 31 2003	1525	262	Taking recovery box to elevator.			
07:43:47 Aug 31 2003	1525	276	Larval array F collected then stowed and secured in transport box. This is a near array - close to the vent. (Deployed in 2001). [Cloud]	R735-LA-F-0003	Kelly	
07:45:38 Aug 31 2003	1519	308	Moving array in box to elevator.			R735-033
07:48:30 Aug 31 2003	1519	158	Box sitting on elevator.			R735-034
08:00:22 Aug 31 2003	1520	17	Larval array F positioned on elevator.			
08:07:35 Aug 31 2003	1521	113	Box tied into elevator.			R735-035



Time UTC	Z (m)	Hdg	R735 2003 Comments	Samples	Investigator	FrGrab
08:09:55 Aug 31 2003	1520	263	Locking arm being placed over array box.			R735-036
08:12:26 Aug 31 2003	1520	270	Finished lashing larval array onto elevator.			
08:15:06 Aug 31 2003	1524	322	Coming up on second bioarray.			R735-037
08:17:04 Aug 31 2003	1525	300	Started taking digital photos of bio (larval) array P.			
08:21:09 Aug 31 2003	1525	330	Twenty digital photos stored.			
08:21:36 Aug 31 2003	1525	326	Taking temperature reading above bio (larval) array. Approximately four degrees above ambient.			
08:22:27 Aug 31 2003	1525	321	Taking temperature at second array to be recovered at Cloud vent.			R735-038
08:31:45 Aug 31 2003	1521	213	Retrieving empty transport box for array P from elevator.			
08:35:48 Aug 31 2003	1525	244	Placing transport box for second pickup.			R735-039
08:38:01 Aug 31 2003	1526	229	Rescuing transport box after fall.			R735-040
08:38:59 Aug 31 2003	1525	264	Transport box with rock on top.			R735-041
08:41:47 Aug 31 2003	1525	354	Transport box slipped down a small hill and was slightly buried but was retrieved and placed to collect array P.			
08:48:41 Aug 31 2003	1526	340	Opening lid on transport box.			R735-042
08:51:29 Aug 31 2003	1523	213	Transport box ready for array.			R735-043
08:54:05 Aug 31 2003	1525	260	Grabbing second array.			R735-044
08:54:31 Aug 31 2003	1525	266	Second array off the bottom.			R735-045
08:56:02 Aug 31 2003	1525	266	Second array going into transport box.			R735-046
08:59:03 Aug 31 2003	1526	321	Closing lid on second box.			R735-047
09:00:56 Aug 31 2003	1523	311	Larval array P recovered. This is a near array - close to the vent. (Deployed 2002). [Cloud]	R735-LA-P-0004	Kelly	
09:02:07 Aug 31 2003	1521	341	Second transport box on elevator.			R735-048
09:05:34 Aug 31 2003	1521	308	Strapping in second transport box.			R735-049
09:10:19 Aug 31 2003	1521	277	Recovery box for bio (larval) array P stowed and lashed on elevator.			
09:12:28 Aug 31 2003	1518	262	Leaving elevator for periphery array.			
09:14:52 Aug 31 2003	1524	274	Transport box sitting next to array.			R735-050
09:15:42 Aug 31 2003	1524	18	Array H next to box.			R735-051
09:16:07 Aug 31 2003	1525	358	Preparing to put bio (larval) array H in portabox.			
09:19:52 Aug 31 2003	1525	351	Array H at Cloud vent.			R735-052
09:20:35 Aug 31 2003	1525	348	Taking digital photos of array H.			
09:26:36 Aug 31 2003	1525	346	Seventeen digital photos of array H stored.			
09:36:46 Aug 31 2003	1525	3	Opening lid on third transport box.			R735-053
09:42:09 Aug 31 2003	1524	42	Grabbing the third bio (larval) array H.			R735-054
09:45:11 Aug 31 2003	1525	316	Array H in the transport box.			R735-055
09:57:17 Aug 31 2003	1525	350	Larval array H secured in Portabox to be placed at base of elevator. This is a "far" - periphery array which was located about 8 meters S/SW of the vent. (Deployed 2001). [Cloud]	R735-LA-H-0005	Kelly	
10:03:55 Aug 31 2003	1523	26	Looking in the vicinity of cloud for unknown worms seen yesterday and sampled but not successfully retrieved. The suction sampler is broken so we need to find a loose rock with the worms on it.			
10:05:41 Aug 31 2003	1525	337	Cloud Vent.			R735-056
10:05:56 Aug 31 2003	1526	313	Cloud Vent.			R735-057

Time UTC	Z (m)	Hdg	R735 2003 Comments	Samples	Investigator	FrGrab
10:09:57 Aug 31 2003	1526	333	Cloud vent looking for rock.			R735-058
10:10:32 Aug 31 2003	1526	283	Unable to find loose rock with worms on it, so proceeding to do Marie's video transect. DVcam recording: Start=1017. Stop=1034.			
10:17:15 Aug 31 2003	1525	291	Doing Digital Still Cam survey at Cloud start 1021.			R735-059
10:17:54 Aug 31 2003	1524	291	Video survey at Cloud.			R735-060
10:20:42 Aug 31 2003	1522	218	Eleven digital photos Transferred.			
10:26:34 Aug 31 2003	1525	288	Searching during video survey.			R735-061
10:28:11 Aug 31 2003	1526	288	Video survey at Cloud.			R735-062
10:28:37 Aug 31 2003	1525	284	Second round of digital photos. N6 to N4. Start=1028. End=1030. Eleven photos.			
10:30:15 Aug 31 2003	1524	284	Video survey continuing at Cloud at N4.			R735-063
10:32:02 Aug 31 2003	1524	92	Third round of digital photos. Start=1032. End=1034. Seven photos Transferred. Entire DSC survey 1021 - 1034 at Cloud. 17 photos first transect N6 to N4. 17 second survey N6 to N4 zoomed. 11 third survey N4 to N6 overview.			
10:35:11 Aug 31 2003	1523	261	Going to Mkr-33 to continue video and digital photos.			
10:36:30 Aug 31 2003	1523	248	Near Cloud vent.			R735-064
10:37:32 Aug 31 2003	1523	219	Fish at mkr-33.			R735-065
10:38:35 Aug 31 2003	1522	282	Three digital photos of fish at Mkr-33 Transferred.			
10:39:12 Aug 31 2003	1523	273	Worms at mkr-33.			R735-066
10:40:17 Aug 31 2003	1524	275	Worms at mkr-33.			R735-067
10:42:13 Aug 31 2003	1524	144	Closeup of worms at mkr-33.			R735-068
10:42:48 Aug 31 2003	1524	146	DVcam recording near Mkr-33 in tubeworm bush for Marie. Start=1042. Entire DVcam survey lasted aprox. 25 minutes at worm bush (saw particles in mouth of palm worm). Then proceeded to DVcam survey at Mkr-33 viewing palm worms about 25 minutes.			
10:43:55 Aug 31 2003	1524	143	Worm closeup at mkr-33.			R735-069
11:11:51 Aug 31 2003	1524	145	Scanning area for another worm clump to observe.			
11:12:44 Aug 31 2003	1524	146	Still checking out worms and such. Moving towards crack.			R735-070
11:30:57 Aug 31 2003	1524	221	Taking the temperature at Mkr-33 after observing the worms.			R735-071
11:33:27 Aug 31 2003	1524	225	Moving three digital photos of the worms for Marie.			
11:36:23 Aug 31 2003	1524	223	Temperature probe reached 7.1; alien file 735C.			
11:37:41 Aug 31 2003	1523	244	We're returning to the first worm site to record the temperature.			
11:39:57 Aug 31 2003	1524	102	More Alien temperature recording.			R735-072
11:43:50 Aug 31 2003	1524	107	Talien-max=4.3. File 735D. We're headed back to Cloud; en route we'll stop at diffuse vents to look for more tubeworms to observe.			
11:43:50 Aug 31 2003	1524	107	Continuing to Cloud for more worm observations.			
11:50:50 Aug 31 2003	1524	290	Mysterious blue goo - possibly blue colonial ciliate but we're not sure.			R735-073
11:57:27 Aug 31 2003	1522	56	Two digital photos transferred of tube worm/limpet close-ups.			
11:58:21 Aug 31 2003	1520	253	We're headed back to Mkr-33 but first will do a transect N looking for three bags of wood deployed by Janet Voight last summer.			

Time UTC	Z (m)	Hdg	R735 2003 Comments	Samples	Investigator	FrGrab
12:05:06 Aug 31 2003	1520	43	Drainback structure.			R735-074
12:05:38 Aug 31 2003	1522	36	It's like Arches National Park only underwater.			R735-075
12:05:45 Aug 31 2003	1522	40	More spiderman crab.			R735-076
12:07:35 Aug 31 2003	1521	271	One digital file transferred of pillar/roof with crab.			
12:12:31 Aug 31 2003	1522	297	Wood is found!			
12:13:55 Aug 31 2003	1524	285	Janet's wood with white growths.			R735-077
12:16:28 Aug 31 2003	1524	268	Voight/Tunncliffe wood.			R735-078
12:17:05 Aug 31 2003	1524	269	Voight/Tunncliffe wood.			R735-079
12:18:12 Aug 31 2003	1524	265	Voight/Tunncliffe wood.			R735-080
12:18:46 Aug 31 2003	1524	267	Voight/Tunncliffe wood.			R735-081
12:18:48 Aug 31 2003	1524	267	Wood has white growths which Jean identifies as siphons.			
12:19:02 Aug 31 2003	1524	266	Voight/Tunncliffe wood.			R735-082
12:19:40 Aug 31 2003	1524	287	Voight/Tunncliffe wood.			R735-083
12:20:00 Aug 31 2003	1524	285	Voight Tunncliffe wood			R735-084
12:20:21 Aug 31 2003	1524	283	Video highlights of the wood.			
12:20:45 Aug 31 2003	1524	282	Voight Tunncliffe wood			R735-085
12:20:46 Aug 31 2003	1524	282	Transferring 16 digital photos of wood.			
12:21:36 Aug 31 2003	1524	286	Voight Tunncliffe wood			R735-086
12:23:15 Aug 31 2003	1524	284	Clam siphons(?) on the wood.			R735-087
12:28:04 Aug 31 2003	1524	334	Highlight video is off.			
12:31:22 Aug 31 2003	1523	311	Two digital files moved of OBH.			
12:39:58 Aug 31 2003	1523	309	OBH business end.			R735-088
12:40:50 Aug 31 2003	1521	11	Switched SVHS tapes.			
12:43:58 Aug 31 2003	1520	77	Five digitals of lava pillars and collapsed areas on the way to Cloud.			
12:48:36 Aug 31 2003	1520	328	At Cloud - looking at pillar lava; hoping to find a good sample to bring to the surface.			
12:52:53 Aug 31 2003	1521	111	Lava pillar.			R735-089
12:52:56 Aug 31 2003	1521	96	Lava pillar.			R735-090
12:54:37 Aug 31 2003	1518	79	Ten digital pictures of lava.			
12:55:50 Aug 31 2003	1520	5	Pillar and collapse.			R735-091
12:57:21 Aug 31 2003	1520	115	Six more digital photos of lava.			
12:59:46 Aug 31 2003	1523	322	Close-up of lava pillar.			R735-092
12:59:49 Aug 31 2003	1523	325	Close-up of lava pillar.			R735-093
13:03:35 Aug 31 2003	1523	2	We knocked one pillar over; which broke open and we're examining the pieces. 35 m S of Cloud.			
13:07:22 Aug 31 2003	1523	0	Grabbing a rock sample to take back to the elevator.			R735-094
13:07:54 Aug 31 2003	1523	3	Rock sample area.			R735-095
13:11:22 Aug 31 2003	1521	338	We're back at the elevator.			
13:18:52 Aug 31 2003	1520	342	Rock sample from 35m S of Cloud is in the elevator; ready to be brought to the surface. [~35m S of Cloud]	R735-RK-0006	Chadwick	
13:21:59 Aug 31 2003	1520	359	We're headed back to the hole at N6 to pick up a rock with unidentified worms for collection.			
13:26:11 Aug 31 2003	1525	302	We're at N6 hole.			

Time UTC	Z (m)	Hdg	R735 2003 Comments	Samples	Investigator	FrGrab
13:28:13 Aug 31 2003	1524	347	Four digital files transferred.			
13:31:12 Aug 31 2003	1525	327	Rock with unidentified worms.			R735-096
13:32:51 Aug 31 2003	1525	329	Rock collected with unidentified worms on it. [Cloud]	R735-RK/Bio-0007	Marcus	
13:36:34 Aug 31 2003	1525	332	Rock sample with strange worms on it.			R735-097
13:38:24 Aug 31 2003	1525	329	We're getting the array box onto the front of the platform.			
13:56:12 Aug 31 2003	1522	288	Array box is onboard; moving ship 200m back and attempt to release the elevator.			
13:57:30 Aug 31 2003	1506	326	Moved one DSC picture over to the hard drive.			
14:00:27 Aug 31 2003	1470	27	Moving into position to recover the elevator for acoustic release.			
14:18:55 Aug 31 2003	1383	95	Cage motor secured to get better navigation.			
14:46:33 Aug 31 2003	1385	40	Acoustic release is not working; moving ship - bow at elevator to release manually.			
15:05:16 Aug 31 2003	1498	322	Heading down to the elevator location.			
15:07:49 Aug 31 2003	1516	318	ROPOS is back on the bottom and looking for the elevator.			
15:13:05 Aug 31 2003	1516	301	The elevator is in sight.			
15:14:50 Aug 31 2003	1521	281	Taking 6 digital pictures of the elevator before releasing it.			
15:22:11 Aug 31 2003	1522	349	The wire broke off the pull pin release. Putting down the biobox with Noreen's array to use both arms to try to release the elevator.			
15:26:31 Aug 31 2003	1522	308	Elevator is released. ETA to surface is 30 minutes.			
15:27:24 Aug 31 2003	1522	348	Picking up the biobox again.			
15:29:57 Aug 31 2003	1522	334	Biobox is back on the basket. Moving it in to a stable position for transit.			
15:32:10 Aug 31 2003	1522	339	Biobox is stable. Moving the ship for elevator recovery.			
15:36:03 Aug 31 2003	1440	122	Bringing ROPOS up as the elevator is ascending.			
15:58:47 Aug 31 2003	874	315	Elevator is at the surface.			
16:04:25 Aug 31 2003	756	157	Elevator is on deck.			
16:44:24 Aug 31 2003	2	195	ROPOS on deck. End of dive.			

## 10.6 R736 - 2003 Dive Log

Arrived on the bottom at ASHES. Saw the weights and RAS. **Virgin** One weight was moved away from the vent, then there was a problem with the line that was spooled to move the weights. The line had loosened and was flapping around. The dive was aborted to fix it.

Time UTC	Z (m)	Hdg	R736 2003 Comments	Samples	Investigator	FrGrab
23:44:14 Aug 31 2003	1	114	ROPOS in water at surface.			
23:45:43 Aug 31 2003	3	15	Motor started.			
01:02:43 Sep 01 2003	1542	38	ROPOS is on the bottom near ROPOS Vent in Ashes field. We're positioning the elevator before it is dropped from the cage.			
01:04:03 Sep 01 2003	1543	39	Elevator was dropped directly under dive target.			
01:05:28 Sep 01 2003	1544	30	Elevator at the bottom at ASHES.			R736-001
01:05:29 Sep 01 2003	1544	37	Attempting to locate RAS.			
01:09:04 Sep 01 2003	1543	39	Cage motor is off to get better navigation.			
01:10:51 Sep 01 2003	1542	58	We're at the elevator - but we will try to pick up a marker to locate where we are in the vent field.			
01:11:14 Sep 01 2003	1543	105	Chimney - name?			R736-002
01:12:35 Sep 01 2003	1545	104	Chimney at ASHES			R736-003
01:13:51 Sep 01 2003	1544	109	Cage motor is turned back on. RAS has been located 100m away.			
01:14:02 Sep 01 2003	1544	121	Bottom at ASHES.			R736-004
01:14:42 Sep 01 2003	1543	316	Arrays spotted.			
01:15:03 Sep 01 2003	1544	27	Marker D on view.			R736-005
01:15:12 Sep 01 2003	1544	19	Mkr D has been located. We should be in the eastern half of the vent field.			
01:16:28 Sep 01 2003	1545	112	Old Marker 22. We don't know who it belongs to.			R736-006
01:16:37 Sep 01 2003	1546	83	Spotted old mkr; either number 22 or 20. Driving towards the RAS.			
01:16:38 Sep 01 2003	1546	83	Suspected yellow material. Most likely Iron Silicates.			R736-007
01:17:51 Sep 01 2003	1544	110	ROPOS is stopping to get a new vector for RAS.			
01:21:22 Sep 01 2003	1545	89	Bottom at ASHES.			R736-008
01:23:32 Sep 01 2003	1544	19	Medusa.			R736-009
01:23:35 Sep 01 2003	1544	23	Medusa.			R736-010
01:25:13 Sep 01 2003	1545	27	RAS near bottom at ASHES.			R736-011
01:25:17 Sep 01 2003	1545	12	RAS in sight.			
01:25:41 Sep 01 2003	1546	33	Drop anchor is out of the way.			
01:25:53 Sep 01 2003	1545	37	Rattail at bottom.			R736-012
01:25:58 Sep 01 2003	1545	28	Two rattails at ASHES near the RAS drop weight.			R736-013
01:26:27 Sep 01 2003	1545	353	RAS touch down bottom ASHES.			R736-014
01:29:44 Sep 01 2003	1535	60	Still the medusa.			R736-015
01:31:23 Sep 01 2003	1542	169	We're headed to the RAS anchors in order to move them. Three digital photos moved or RAS.			
01:33:01 Sep 01 2003	1543	266	Arrays at ASHES.			R736-016
01:34:44 Sep 01 2003	1546	47	Searching for Virgin. Big Johnson in sight.			
01:35:24 Sep 01 2003	1544	63	Flowmeter (aka Big Johnson) at crack.			R736-017
01:38:27 Sep 01 2003	1543	311	Gollum.			R736-018
01:38:34 Sep 01 2003	1544	295	We're at Gollum Vent.			
01:40:07 Sep 01 2003	1545	333	Old RAS weight near Virgin. We have to move it.			R736-019

Time UTC	Z (m)	Hdg	R736 2003 Comments	Samples	Investigator	FrGrab
01:40:15 Sep 01 2003	1545	340	We're at Virgin Mound; we've spotted the weight we need to move.			
01:43:04 Sep 01 2003	1543	350	Nav seems to be off from what we are seeing. Doing a quick move of the ship to see if the nav improves.			
01:43:41 Sep 01 2003	1545	161	Virgin.			R736-020
01:52:53 Sep 01 2003	1545	289	Approaching Virgin vent.			R736-021
01:53:04 Sep 01 2003	1545	299	Highlight video is being turned on to record Virgin.			
01:56:56 Sep 01 2003	1545	282	Highlight video is turned off; we're hooking the frame then we'll head east back to the cage.			
02:00:08 Sep 01 2003	1544	296	Weight is hooked.			
02:06:49 Sep 01 2003	1501	91	ROPOS is in the cage and we're lifting the weight up now.			
02:46:07 Sep 01 2003	1389	252	Problems with reeling in line; delaying the pick-up of the weight.			
02:50:19 Sep 01 2003	1347	167	One line is on the bottom - not sure if the weight was moved.			
02:53:18 Sep 01 2003	1237	145	ROPOS is heading to the surface because the line on the reel is flapping around.			
03:00:20 Sep 01 2003	975	82	1 digital image transferred (probably of the weights at Virgin - might not be anything as it was a mistake).			
03:28:08 Sep 01 2003	1	150	ROPOS is on deck. End of dive R736.			

## 10.7 R737 - 2003 Dive Log

Moved last year's RAS weights near Dave's vent. **Virgin** Moved the RAS to Virgin vent and positioned the RAS, tripod and temperature probes. **ROPOS** Recovered 2 LA (LA-Z deployed '02, LA-I deployed '01). **Hell** Recovered Amanda's transplant cage (deployed '02). Also performed a video reconnaissance survey for Morineaux at Hell. **Above Ashes** 2 McLane and 3SS of ambient water at 1000 meters depth. The elevator was released acoustically.

Time UTC	Z (m)	Hdg	R737 2003 Comments	Samples	Investigator	FrGrab
04:22:03 Sep 01 2003	162	141	ROPOS in the water at 0413. Start of dive R737.			
05:30:12 Sep 01 2003	1536	100	We're on the bottom at ASHES.			
05:31:56 Sep 01 2003	1544	329	ASHES at Marker I.			R737-001
05:32:14 Sep 01 2003	1544	12	Virgin's Daughter near ASHES.			R737-002
05:33:48 Sep 01 2003	1544	221	Found the weight at Dave's vent.			
05:38:42 Sep 01 2003	1545	267	Hooking the weight at Dave's vent.			R737-003
05:40:01 Sep 01 2003	1530	220	We are going to reel it up and move the weight away from the vent - park the vehicle in the cage and use the cage to lift the weight.			
05:41:01 Sep 01 2003	1527	206	Reeling in the weight.			R737-004
05:46:16 Sep 01 2003	1507	203	ROPOS is in the cage - and is hauling up the weight.			
06:05:51 Sep 01 2003	1355	188	The weight has been moved away from the vent - about 100 meters east of Virgin. The line broke as we were moving along but all is well. We're done moving the weights. Next we're going to go get the RAS.			
06:06:33 Sep 01 2003	1362	204	The RAS is going over by Virgin.			
06:19:44 Sep 01 2003	1469	319	ROPOS is out of the cage. We're waiting for the ship to move so that we can get RAS and move it to Virgin.			
06:19:52 Sep 01 2003	1468	308	Out of the cage.			R737-005
06:39:49 Sep 01 2003	1537	232	RAS is in sight.			
06:44:35 Sep 01 2003	1545	272	Pulling remaining line off ROPOS' spool. This should have been done when year's weights were released but because the line severed it must be pulled off manually. Finished at 0656.			
07:00:07 Sep 01 2003	1544	358	ROPOS is pulling the drop-weight release cable on the RAS. ROPOS personnel suggest that these lines be made shorter in the future so they won't be able to tangle in ROPOS' thrusters.			
07:00:48 Sep 01 2003	1544	348	Pulling weight release pin on RAS.			R737-006
07:04:45 Sep 01 2003	1543	3	ROPOS is lifting the RAS off the seafloor and beginning the transit to Virgin.			
07:06:40 Sep 01 2003	1540	5	Picking up RAS for placement.			R737-007
07:09:14 Sep 01 2003	1540	3	Jellyfish going by RAS.			R737-008
07:41:19 Sep 01 2003	1541	225	ROPOS is moving very slowly with the RAS, and a lot of time is being spent on navigation and finding position.			
07:52:31 Sep 01 2003	1541	194	Virgin has been spotted.			
07:56:52 Sep 01 2003	1542	93	ROPOS is having tether problems. We will leave the RAS at Virgin and return to the cage to fix it.			
08:12:21 Sep 01 2003	1499	178	The cage was spinning but the problem is resolved and ROPOS is returning to position the RAS.			
08:16:04 Sep 01 2003	1541	298	Picking up RAS for final deployment.			R737-009
08:17:06 Sep 01 2003	1542	298	The position of the RAS is being discussed and determined.			
08:17:28 Sep 01 2003	1545	292	Base of Virgin Mound.			R737-010
08:18:00 Sep 01 2003	1545	305	Virgin Mound.			R737-011
08:20:52 Sep 01 2003	1545	107	Virgin Mound from other direction.			R737-012

Time UTC	Z (m)	Hdg	R737 2003 Comments	Samples	Investigator	FrGrab
08:36:27 Sep 01 2003	1539	17	The position of the RAS has been determined. Last year it was on the NE side of the vent. This year it is to the south on a nicely level surface.			
08:41:17 Sep 01 2003	1546	57	ROPOS is removing some debris - several old chains and tethers - from the immediate vicinity of the vent.			
08:41:53 Sep 01 2003	1546	64	Preparing to grab old anchor.			R737-013
08:42:18 Sep 01 2003	1546	71	Old anchor grabbed.			R737-014
08:43:57 Sep 01 2003	1541	277	A weight belt from last year was moved to the NW of the vent.			
08:50:00 Sep 01 2003	1545	58	Reaching for pull to remove pin holding in tripod.			R737-015
08:50:12 Sep 01 2003	1545	54	Pulling pin for tripod.			R737-016
08:50:52 Sep 01 2003	1545	56	Funnel released from RAS frame. Preparing to pick up funnel and place in position.			
08:52:38 Sep 01 2003	1546	332	Grabbing tripod to remove from RAS.			R737-017
08:53:02 Sep 01 2003	1546	331	Tripod being dragged from the RAS.			R737-018
08:57:48 Sep 01 2003	1546	324	Tripod grabbed for placing on vent.			R737-019
09:01:16 Sep 01 2003	1545	123	Lowering main intake funnel into position over vent.			
09:01:59 Sep 01 2003	1544	152	Tripod coming down on vent.			R737-020
09:02:34 Sep 01 2003	1545	151	RAS tripod positioned over vent.			R737-021
09:04:48 Sep 01 2003	1545	258	Removing temperature probe from RAS frame.			
09:05:44 Sep 01 2003	1545	259	T probe being grabbed from RAS.			R737-022
09:10:00 Sep 01 2003	1546	77	Virgin Mound under tripod.			R737-023
09:12:27 Sep 01 2003	1546	70	Grabbing leg of tripod to replace it over Virgin Mound.			R737-024
09:16:18 Sep 01 2003	1546	62	Positioning tripod legs.			
09:16:27 Sep 01 2003	1546	61	Trying to get good placement of tripod over Virgin Mound.			R737-025
09:25:46 Sep 01 2003	1543	247	Tripod in first position.			R737-026
09:31:08 Sep 01 2003	1546	67	Breaking off chimney top.			R737-027
10:01:24 Sep 01 2003	1546	175	Tripod above vent.			R737-028
10:03:04 Sep 01 2003	1546	177	Tripod above vent.			R737-029
10:06:23 Sep 01 2003	1546	51	Tripod is in final position.			
10:09:18 Sep 01 2003	1546	60	Placing temperature probe in vent flow.			
10:20:29 Sep 01 2003	1546	36	Temperature probe in final position.			
10:20:37 Sep 01 2003	1546	35	Temperature probe in place.			R737-030
10:21:40 Sep 01 2003	1546	40	Fourteen digital photos stored of various parts of the RAS in place.			
10:23:29 Sep 01 2003	1545	90	Funnel and temperature probe in place.			R737-031
10:25:16 Sep 01 2003	1545	160	RAS assembly in place.			R737-032
10:27:04 Sep 01 2003	1540	164	Fourteen more photos of RAS assembly stored.			
10:28:21 Sep 01 2003	1546	245	Tripod above vent chimney.			R737-033
10:31:07 Sep 01 2003	1543	334	RAS with tripod in place.			R737-034
10:31:31 Sep 01 2003	1543	319	RAS with tripod in place.			R737-035
10:31:57 Sep 01 2003	1542	310	Ten digital photos of RAS stored.			
10:40:22 Sep 01 2003	1543	300	Finished setting up RAS. Overall placement is very satisfactory - better than last year.			
10:41:36 Sep 01 2003	1542	236	ROPOS has arrived at elevator.			



Time UTC	Z (m)	Hdg	R737 2003 Comments	Samples	Investigator	FrGrab
11:04:34 Sep 01 2003	1542	251	We're getting out a box from the elevator to place at ROPOS Vent.			
11:16:44 Sep 01 2003	1545	16	Still searching for ROPOS Vent with one array box in tow.			
11:21:50 Sep 01 2003	1544	303	We're at ROPOS Vent. Looking at the two LAs here.			
11:24:20 Sep 01 2003	1546	100	Kelly settling arrays.			R737-036
11:24:30 Sep 01 2003	1547	99	Kelly settling arrays.			R737-037
11:26:57 Sep 01 2003	1547	94	Kelly settling arrays.			R737-038
11:30:53 Sep 01 2003	1546	318	22 digital pictures transferred of the LA. Several overall pictures and close-ups of each dish.			
11:37:40 Sep 01 2003	1546	37	15 digital pictures transferred - more pictures of the LAs.			
11:51:24 Sep 01 2003	1546	166	Picking up settling array.			R737-039
11:51:33 Sep 01 2003	1546	168	Larval array Z recovered. (Deployed in 2002). [ROPOS]	R737-LA-Z-0001	Kelly	
11:51:35 Sep 01 2003	1546	173	Taking settling array to box.			R737-040
11:54:46 Sep 01 2003	1547	12	Settling array in the box.			R737-041
11:59:12 Sep 01 2003	1548	131	Sample secured in box. Transporting box back to the elevator.			
12:13:22 Sep 01 2003	1540	259	Back at the elevator. Elevator is 5m S of Hell.			
12:29:01 Sep 01 2003	1542	197	Array Z is secure in the elevator. We're headed E back to ROPOS Vent to gather the other array; once we get the empty biobox off the elevator.			
12:34:08 Sep 01 2003	1542	211	Box with settling array in elevator.			R737-042
12:45:43 Sep 01 2003	1540	246	Tether management - back to the cage.			
13:02:53 Sep 01 2003	1514	266	End of tether management; headed back to ROPOS Vent.			
13:08:07 Sep 01 2003	1546	309	The Big Johnson.			R737-043
13:08:35 Sep 01 2003	1546	312	Two digital photos transferred of the Big Johnson.			
13:12:37 Sep 01 2003	1545	267	Leaving Big Johnson. Heading to ROPOS Vent.			
13:19:52 Sep 01 2003	1546	224	We're back at ROPOS Vent; preparing to retrieve the second array.			
13:37:56 Sep 01 2003	1546	188	Second settling array.			R737-044
13:38:16 Sep 01 2003	1546	195	Larval array I is being picked up and put into the sample box. (Deployed in 2001). [ROPOS]	R737-LA-I-0002	Kelly	
13:41:38 Sep 01 2003	1546	246	Second settling array being placed in box.			R737-045
13:45:46 Sep 01 2003	1546	325	ROPOS is having a bit of trouble closing box.			
13:53:27 Sep 01 2003	1546	257	Array I is secure in biobox.			
14:01:48 Sep 01 2003	1546	306	Deploying markers on array spot in order to return to the spot to suction sample.			
14:07:49 Sep 01 2003	1546	222	2nd Marker is down and we're headed back to the elevator.			
14:17:27 Sep 01 2003	1542	289	Back at elevator.			
14:19:31 Sep 01 2003	1541	52	Second settling array box on elevator.			R737-046
14:28:37 Sep 01 2003	1541	17	Array I is secure in elevator.			
14:30:53 Sep 01 2003	1542	296	ROPOS is headed to Hell to observe and possibly retrieve Amanda's transplant cage.			
14:33:16 Sep 01 2003	1545	337	We're at Amanda's box.			
14:34:01 Sep 01 2003	1546	337	Transplant cage.			R737-047
14:34:27 Sep 01 2003	1546	338	Three digital files moved of the transplant cage.			
14:36:47 Sep 01 2003	1540	269	Transplant cage is at elevator.			

Time UTC	Z (m)	Hdg	R737 2003 Comments	Samples	Investigator	FrGrab
14:37:40 Sep 01 2003	1540	299	Transplant cage to elevator note left side of cage with many limpets was in flow.			R737-048
14:38:31 Sep 01 2003	1540	335	Transplant cage retrieved. Left side of cage with many limpets was in flow. This sample number is out of order because it had not been recorded originally. (Deployed in 2001). [Hell]	R737-cage-0008	Bates	
14:41:38 Sep 01 2003	1541	292	Transplant box on the way into the elevator.			R737-049
14:44:47 Sep 01 2003	1541	301	Transplant cage is not fitting in the elevator biobox properly. Taking it out and try to store it another way.			
14:48:41 Sep 01 2003	1541	296	Closing the lid of the elevator biobox. ROPOS will carry the transplant cage while we survey at Hell Vent then it will come up in the arm.			
14:51:20 Sep 01 2003	1541	297	Biobox lid is closed on the elevator.			
14:53:37 Sep 01 2003	1543	358	We are at Hell for Marie's video survey.			
14:55:14 Sep 01 2003	1546	317	Setting the transplant cage down at Hell to do the video survey.			
14:57:29 Sep 01 2003	1546	332	Taking first digital images worms on the south side of Hell vent. Took 5 images at different zooms.			
15:09:48 Sep 01 2003	1546	331	Took 2 digital still pictures. One wide and one zoomed in.			
15:16:08 Sep 01 2003	1545	274	Taking digital photos of the top of Hell Vent. Took 4 images looking to the west.			
15:19:04 Sep 01 2003	1544	309	Took 3 more digital images from the Northwest.			
15:21:11 Sep 01 2003	1543	350	Top of Hell.			R737-050
15:21:40 Sep 01 2003	1544	49	Top of Hell.			R737-051
15:22:05 Sep 01 2003	1544	66	Took 3 more images from the west side of Hell Vent.			
15:22:48 Sep 01 2003	1545	70	Taking 3 more digitals near the base on the west side.			
15:22:53 Sep 01 2003	1545	67	West side of Hell.			R737-052
15:23:19 Sep 01 2003	1545	70	Sulfide worms on the side of Hell.			R737-053
15:23:50 Sep 01 2003	1545	70	Sulfide worms on the side of Hell.			R737-054
15:25:14 Sep 01 2003	1545	68	Marie's second potential site at Hell.			R737-055
15:27:15 Sep 01 2003	1545	70	Ciliates at Hell vent.			R737-056
15:27:30 Sep 01 2003	1545	69	Took 2 more digitals of the west side of Hell.			
15:30:04 Sep 01 2003	1545	120	Looking under a flange on the Northwest side of Hell. Taking 3 digital images.			
15:30:48 Sep 01 2003	1545	123	Marie's third potential site - Flange on northwest side of Hell.			R737-057
15:33:38 Sep 01 2003	1546	308	Retrieving transplant cage.			
15:36:57 Sep 01 2003	1545	319	Transplant cage is situated on the ROPOS basket. Heading back to the cage.			
15:39:31 Sep 01 2003	1487	76	ROPOS is back at the cage and coming up to 1380 meters. Trying to acoustically release the elevator.			
15:44:40 Sep 01 2003	1382	341	Checking the flushing rate of the suction sampler for Gitai. Tested at low speed pumping into jar 8. Flushing time was about 30 seconds.			
15:49:51 Sep 01 2003	1383	350	Tested flushing time of suction sampler at high speed pumping.			
15:53:43 Sep 01 2003	1383	335	Elevator is not releasing acoustically. Taking ROPOS back down to manually release it.			
16:00:06 Sep 01 2003	1381	316	Elevator finally released acoustically. ETA to surface is 30 minutes.			

Time UTC	Z (m)	Hdg	R737 2003 Comments	Samples	Investigator	FrGrab
16:09:01 Sep 01 2003	1382	196	Start bringing the vehicle and the cage up to 1000m for Gitai's McLane sampling.			
16:23:02 Sep 01 2003	1007	255	Pumping with the McLane on the starboard side. Start 1623. Stop 1624. 1000 meters depth (about 500 meters above ASHES). GFF filter cracked so not successful. 6 liters at 5 L/min. [above ASHES]	R737-MP-stbd-0003	Yahel	
16:25:05 Sep 01 2003	1004	266	Pumping with the McLane on the port side. Start 1627. Stop 1628. 1000 meters depth (about 500 meters above ASHES). Bag - no filter. 6 liters at 5L/min. [above ASHES]	R737-MP-port-0004	Yahel	
16:25:42 Sep 01 2003	1004	275	Suction sampling into jar 1. Start 1624 Stop 1627. 1000 meters depth (about 500 meters above ASHES). Ambient water for comparison.	R737-SS-J1-0005	Yahel	
16:29:11 Sep 01 2003	1004	286	Suction sampling Jar 2. Start 1628. Stop 1630. 1000 meters depth (about 500 meters above ASHES). Ambient water for comparison. [above ASHES]	R737-SS-J2-0006	Yahel	
16:30:48 Sep 01 2003	1004	279	Suction sampling into jar 3. Start 1630 Stop 1634. 1000 meters depth (about 500 meters above ASHES). Ambient water for comparison. [above ASHES]	R737-SS-J3-0007	Yahel	
16:35:01 Sep 01 2003	1004	305	Elevator is at the surface.			
16:51:48 Sep 01 2003	575	248	Elevator is on deck.			
17:12:39 Sep 01 2003	56	209	ROPOS is in the cage.			
17:15:04 Sep 01 2003	3	174	ROPOS is at the surface.			
17:16:48 Sep 01 2003	2	125	Near the surface...			R737-058
17:17:17 Sep 01 2003	2	187	Fast on the deck.			R737-059
17:18:30 Sep 01 2003	2	166	ROPOS is on deck. End of dive R737.			

## 10.8 R738 - 2003 Dive Log

NRZ Recovered the 4 transponders in the NRZ net. Three of the transponders were hooked together and sent to the surface where the ship recovered them. The forth was brought up in the ROPOS claw. Two McLane pump samples were taken at 1000 meters depth above the NRZ.

Time UTC	Z (m)	Hdg	R738 2003 Comments	Samples	Investigator	FrGrab
21:38:30 Sep 01 2003	1	171	ROPOS is in the water.			
22:22:19 Sep 01 2003	1152	213	ROPOS is on its way down to NRZ transponder 7.5.			
22:32:14 Sep 01 2003	1302	337	Cage is at transponder depth (1295 m). We dove on the 7.5 XP location and will look for it first.			
22:36:26 Sep 01 2003	1302	336	ROPOS out of the cage after short valve test.			
22:43:25 Sep 01 2003	1300	211	7.5 XP in sight.			
22:47:02 Sep 01 2003	1299	214	ROPOS has 7.5 XP in claw.			
22:55:26 Sep 01 2003	1299	192	7.5 XP hooked.			
22:58:39 Sep 01 2003	1294	147	Moving the ship to the 8.0 XP.			
00:01:14 Sep 02 2003	1304	238	Ship settling out at 8.0 XP site.			
00:06:25 Sep 02 2003	1365	270	ROPOS starting to look for 8.0 (ship hasn't settled yet so cage isn't at target yet).			
00:13:10 Sep 02 2003	1384	246	Found 8.0 XP. Saw it first in the video - not the sonar.			
00:14:22 Sep 02 2003	1382	206	8.0 XP in claw.			
00:18:27 Sep 02 2003	1381	236	8.0 XP hooked.			
00:19:53 Sep 02 2003	1381	235	8.0 XP line cut. 7.5 XP and 8.0 XP now hooked together. Will carry both to 10.5 XP. ROPOS going back to cage before ship starts moving.			
00:24:14 Sep 02 2003	1362	208	Moving the ship to 10.5 XP.			
01:55:30 Sep 02 2003	1370	50	Ship setting up at 10.5 XP.			
02:17:23 Sep 02 2003	1400	197	10.5 XP in claw. This one found on video. Imagenex is bad for this because the beam angle is too narrow.			
02:20:19 Sep 02 2003	1400	289	10.5 XP hooked.			
02:26:00 Sep 02 2003	1400	288	Working on getting a line off the bumper bar.			
02:27:37 Sep 02 2003	1400	295	Line cut and claw let go. XP heading for the surface. Should be about 20-30 minutes on the way up.			
02:57:54 Sep 02 2003	1363	328	The three transponders (7.5; 8.0; 10.5) that were bundled together are on board.			
03:09:56 Sep 02 2003	1341	246	Moving the ship to 9.5 XP.			
04:24:37 Sep 02 2003	1432	244	Ship setting up at 9.5 XP.			
04:26:00 Sep 02 2003	1434	289	We're looking for the last transponder now.			
04:33:16 Sep 02 2003	1432	283	9.5 XP in sight.			
04:37:35 Sep 02 2003	1432	276	Preparing to cut the last transponder XP 9.5. ROPOS will hold onto the transponder during ascent (can't release it because it's dark outside!)			
04:40:09 Sep 02 2003	1433	261	Cut the line of XP 9.5; holding transponder in 5-function arm.			
04:41:29 Sep 02 2003	1417	233	The 9.5 XP is now secured with the 7-function arm.			
04:42:35 Sep 02 2003	1416	120	Coming up to the cage.			
04:44:47 Sep 02 2003	1396	318	Ascending to 1000m depth. Will stop there to sample water.			
04:57:43 Sep 02 2003	1000	282	At 1000m. Preparing to take McLane pump samples.			
04:59:42 Sep 02 2003	1000	302	Start port side McLane pump (unfiltered) at 4:59 for 2 minutes. Volume pumped: 6L at 5L/minute. [above NRZ]	R738-MP-0001	Yahel	

Time UTC	Z (m)	Hdg	R738 2003 Comments	Samples	Investigator	FrGrab
05:01:09 Sep 02 2003	1000	229	Start starboard side McLane pump (filtered) at 5:04; pump for 2 minutes. Volume pumped: 6.37L at 5L/minute. Note: pumping rate dropped during sampling. [above NRZ]	R738-MP-0002	Yahel	
05:05:11 Sep 02 2003	1000	276	McLane pumping done. Resuming ascent to the surface.			
05:09:56 Sep 02 2003	1000	28	Back at the cage. Ascending out of the cage.			
05:50:36 Sep 02 2003	57	201	ROPOS in the cage.			
05:55:11 Sep 02 2003	2	154	ROPOS on deck.			

## 10.9 R739 - 2003 Dive Log

Fluid sampling dive at ASHES. **Dave's** 5 HFS. **Virgin** 2 HFS, 1 GTB. **Marshmallow** Deployed 1 hobo. **Inferno** 2 HFS, 2 GTB, 1 SS. **Hell** 2 HFS, 1GTB. **ROPOS** 2 SS. **Casper** 3 HFS, 2 GTB. **Castle** 3 HFS, 2SS. Deployed 1 hobo.

Time UTC	Z (m)	Hdg	R739 2003 Comments	Samples	Investigator	FrGrab
10:39:02 Sep 02 2003	1	152	Time on computer is wrong; need ROPOS guy to fix it. Actual time of entry to water was 1117.			
10:39:02 Sep 02 2003	1	152	ROPOS is in the water.			
11:21:07 Sep 02 2003	46	210	Time fixed; now showing correct time.			
11:26:13 Sep 02 2003	58	286	ROPOS on way down ASHES vent field and Virgin's Daughter to start.			
11:31:06 Sep 02 2003	113	257	ROPOS still descending. Log entries will not be every five minutes during the descent. Logging will resume once ROPOS is on the bottom.			
12:30:49 Sep 02 2003	1540	341	ROPOS is on the bottom.			
12:35:34 Sep 02 2003	1543	98	Attempting to get navigation; looking to determine where we are.			
12:36:52 Sep 02 2003	1544	218	We're at ROPOS and will try to head NE to find Virgin's daughter.			
12:41:49 Sep 02 2003	1545	57	We're still looking for Virgin's daughter. We've spotted the Big Johnson.			
12:44:28 Sep 02 2003	1543	41	We've spotted the RAS and tripod.			
12:45:14 Sep 02 2003	1546	45	Virgin vent.			R739-001
12:46:36 Sep 02 2003	1545	23	Array N at Marshmallow.			R739-002
12:49:48 Sep 02 2003	1544	154	Still looking around at array near RAS and tripod.			
12:54:10 Sep 02 2003	1545	261	We're still looking for Virgin's Daughter.			
12:59:37 Sep 02 2003	1545	263	Still looking; debating on which direction/vent is best to go to.			
13:04:17 Sep 02 2003	1544	187	Currently back at Virgin. Still in search of Virgin's Daughter.			
13:09:50 Sep 02 2003	1544	106	Found a site W that looked promising; believe it to be Virgin's Daughter. [Now we know (post dive) it's Marshmallow.] We're headed back to the cage.			
13:11:55 Sep 02 2003	1515	7	We're headed back to Virgin's Daughter.			
13:15:34 Sep 02 2003	1544	14	Believe that we've identified Mushroom. Headed NNE.			
13:16:50 Sep 02 2003	1544	329	Back at the RAS and now turned W to Marshmallow.			
13:18:07 Sep 02 2003	1546	167	Marshmallow vent. [On this dive we thought it was Virgin's daughter.]			R739-003
13:18:16 Sep 02 2003	1546	167	At Marshmallow and we're going to place a hobo in the vent.			
13:19:30 Sep 02 2003	1546	167	Two digital photos moved - one of Marshmallow and another of a sulfide structure we passed.			
13:20:31 Sep 02 2003	1546	168	Placing hobo 126 at Marshmallow.			
13:22:38 Sep 02 2003	1546	157	Ripped sulfide structure off to put probe into vent hole.			
13:25:56 Sep 02 2003	1546	153	Switching hobo to seven function hand for better placement into vent.			
13:28:57 Sep 02 2003	1546	199	Hobo popped out of position; we'll try to reposition it.			
13:33:05 Sep 02 2003	1546	199	Still attempting to position hobo.			
13:38:00 Sep 02 2003	1546	201	Continuing to position hobo.			
13:41:04 Sep 02 2003	1546	202	Hobo 126 tip successfully inserted into Marshmallow.			
13:42:56 Sep 02 2003	1545	219	Hobo 126 deployed at Marshmallow.			R739-004

Time UTC	Z (m)	Hdg	R739 2003 Comments	Samples	Investigator	FrGrab
13:43:00 Sep 02 2003	1546	240	ROPOS is headed S to Dave's vent.			
13:43:28 Sep 02 2003	1546	239	Hobo 126 deployed at Marshmallow. [The confusion over Marshmallow/Virgin's Daughter: last year Virgin's Daughter had several small anhydrite chimneys and this year has none. Marshmallow DOES actually look like a big Marshmallow! this year].			R739-005
13:46:04 Sep 02 2003	1544	213	Mushroom currently to the right or W; we'll continue to the S.			
13:50:20 Sep 02 2003	1546	192	Spotted wheel (mkr) and vent. The RAS was here last year. We'll be taking water samples and filters.			
13:51:20 Sep 02 2003	1546	258	Dave's vent.			R739-006
13:51:29 Sep 02 2003	1545	260	MTR is in the area. Thinking we need to bring that back up on a later dive.			
13:51:59 Sep 02 2003	1546	261	Dave's vent close up.			R739-007
13:54:21 Sep 02 2003	1546	262	Checking out the area; noting anemones and small chimney and other area characteristics.			
13:55:12 Sep 02 2003	1546	262	Transferring five digital photos.			
13:56:52 Sep 02 2003	1546	216	Taking first sample right next to MTR.			
13:58:12 Sep 02 2003	1546	209	Removing fluid sampler intake.			R739-008
14:00:16 Sep 02 2003	1546	206	Probing different areas for temperature in order to find the highest temperature in which to take a sample.			
14:01:19 Sep 02 2003	1546	205	Taking fluid samples and measuring temperatures at Dave's vent.			R739-009
14:05:28 Sep 02 2003	1546	206	Start of HFS Sterivex filter #15. Start 1404 Stop 1417. Tmax=68 Tavg=53 T2=26. Vol=1018 mls. [Dave's]	R739-HFS-15-0001	Butterfield [ssmp: Bolton]	
14:20:02 Sep 02 2003	1546	206	Starting HFS RNA filter #10. Start 14:19 Stop 14:30 - shifted out of vent; decided to let that be end of sample. Tmax=70 Tavg=54 T2=26. Vol=920ml. We were able to get a navigation point for this area; call it waypoint "Dave's Vent 03". [Dave's]	R739-HFS-10-0002	Butterfield [ssmp: Bolton]	
14:37:04 Sep 02 2003	1546	208	Repositioning fluid sampler after shifting out of vent.			
14:41:31 Sep 02 2003	1546	218	Begin HFS #2 with FISH filter. Start 1441 Stop 1444. Start2 1454 Stop2 1458 Tmax=60.1 Tave=58.1 T2=28 Vol=604mls Stopped sampling when intake pulled out of flow. [Dave's]	R739-HFS-2-0003	Butterfield [ssmp: Bolton]	
14:55:52 Sep 02 2003	1546	210	Sampling in Daves vent.			R739-010
14:56:40 Sep 02 2003	1546	210	Took one digital still picture while sampling.			
14:59:23 Sep 02 2003	1546	209	Sampling HFS piston #4. Start 1458 Stop 1505 Tmax=60.7 Tave=57.2 T2=26 Vol=626ml. [Dave's]	R739-HFS-4-0004	Butterfield [ssmp: Bolton]	
15:06:26 Sep 02 2003	1546	209	Sampling HFS filtered bag #11. Start 1507 Stop 1510 Tmax=57.3 Tave=54.7 T2=26 Vol=640mls. [Dave's]	R739-HFS-11-0005	Butterfield	
15:08:27 Sep 02 2003	1546	209	Sampling at Dave vent- outflow from the fluid sampler.			R739-011
15:16:04 Sep 02 2003	1546	209	Using the HFS temperature probe to survey temperatures around limpets for Amanda.			
15:18:09 Sep 02 2003	1546	212	Temperature measurements near Limpets and Palm worms at Dave's Vent.			R739-012
15:20:13 Sep 02 2003	1546	216	Picking up the MTR at Dave's Vent. We will take it with us to where the RAS is now.			
15:21:13 Sep 02 2003	1546	216	Taking out the MTR from Dave's Vent.			R739-013
15:23:55 Sep 02 2003	1544	49	Heading to Virgin for more fluid sampling.			

Time UTC	Z (m)	Hdg	R739 2003 Comments	Samples	Investigator	FrGrab
15:26:19 Sep 02 2003	1544	11	We are at the RAS. Passed over a ridge of active venting that runs north-south between Dave's vent and the RAS.			
15:28:14 Sep 02 2003	1546	292	Setting the MTR from Dave's vent down near the end of the RAS farthest from the vent. MTR has red tape on it. It will be retrieved on a later dive.			
15:30:53 Sep 02 2003	1545	76	The RAS setup at Virgin.			R739-014
15:30:53 Sep 02 2003	1545	76	Took 2 digital images of Virgin with the RAS tripod above it.			
15:32:08 Sep 02 2003	1546	52	Tallest chimney at Virgin that was broken off when RAS was placed has grown back about 15cm since yesterday.			
15:32:31 Sep 02 2003	1545	51	Anhydrite chimney re-growth at Virgin.			R739-015
15:34:39 Sep 02 2003	1545	50	We will attempt to place the HFS intake up into the funnel of the RAS tripod for sampling.			
15:37:09 Sep 02 2003	1546	51	Looking for stable temperature under the funnel of the RAS. Taking 2 digital images.			
15:37:13 Sep 02 2003	1546	51	Water sampling at Virgin (with the HFS).			R739-016
15:39:33 Sep 02 2003	1546	51	Sampling HFS unfiltered bag #9. Start 1540 Stop 1546 Tmax=96.2 Tave=92.7 T2=41 Vol=539ml. Sample in the RAS funnel. [Virgin]	R739-HFS-9-0006	Butterfield [ssmp: Bolton]	
15:41:55 Sep 02 2003	1546	49	Sampling with orange gas tight bottle. Fired at 1542. Temp when fired=92 T2=39. Temperature seems stable in the funnel. [Virgin]	R739-GTB-orange-0007	Butterfield	
15:42:16 Sep 02 2003	1545	50	Gas Tight sample at Virgin			R739-017
15:47:16 Sep 02 2003	1546	52	Sampling HFS filtered bag #14. Start 1547 Stop 1552 Tmax=96.9 Tave=92.3 T2=38 Vol=569ml. In the RAS funnel. [Virgin]	R739-HFS-14-0008	Butterfield	
15:52:27 Sep 02 2003	1546	51	Took 4 digital images of HFS intake position while sampling.			
15:53:00 Sep 02 2003	1546	50	End of fluid sampling at Virgin.			R739-018
15:54:17 Sep 02 2003	1546	51	Taking the HFS intake out of the RAS funnel.			
15:58:00 Sep 02 2003	1545	25	Stowing HFS intake. Heading to Inferno vent for more fluid sampling.			
15:58:35 Sep 02 2003	1545	23	The RAS funnel by the end of fluid sampling at Virgin.			R739-019
16:00:46 Sep 02 2003	1544	243	Passing over Mushroom vent. Taking 4 digital images.			
16:02:13 Sep 02 2003	1543	252	Took 2 digital images of Inferno vent from a distance.			
16:03:45 Sep 02 2003	1542	285	Took 5 more digital images of Inferno vent.			
16:04:01 Sep 02 2003	1542	292	Inferno vent.			R739-020
16:05:00 Sep 02 2003	1543	288	Breaking a small part of Inferno vent.			R739-021
16:05:03 Sep 02 2003	1542	289	Knocked off the small chimney where we will fluid sample next.			
16:07:22 Sep 02 2003	1543	296	Inferno vent.			R739-022
16:09:20 Sep 02 2003	1543	277	Placing HFS intake into opening of Inferno to find stable temperature.			
16:12:22 Sep 02 2003	1543	288	Breaking part of the chimney at Inferno Vent; lots of worms within the chimney.			R739-023
16:13:06 Sep 02 2003	1543	286	Breaking part of the chimney at Inferno Vent; lots of worms within the chimney.			R739-024
16:13:16 Sep 02 2003	1543	285	Breaking part of the chimney at Inferno Vent; lots of worms within the chimney.			R739-025
16:14:44 Sep 02 2003	1543	285	Breaking away some pieces of structure around the main flow pipe to get better access for sampling.			
16:17:19 Sep 02 2003	1543	285	Still searching for stable high temperature flow to sample.			



Time UTC	Z (m)	Hdg	R739 2003 Comments	Samples	Investigator	FrGrab
16:19:21 Sep 02 2003	1543	286	Took 4 digital images of tubeworms around sampling venting area at Inferno.			
16:20:41 Sep 02 2003	1543	287	Fluid sampler outlet; Inferno Vent.			R739-026
16:21:12 Sep 02 2003	1543	288	HFS intake is locked in place. Temperature reading is up to 242 and stabilizing.			
16:22:07 Sep 02 2003	1543	286	Sampling HFS piston #5. Start 1622 Stop 1624 Start2 1635 Stop2 1639 Tmax=287 Tavg=255 T2=120 Vol=650ml. Sample pump is slowing down and may be clogging. Stopped to reposition. [Inferno]	R739-HFS-5-0009	Butterfield	
16:22:10 Sep 02 2003	1543	288	Fluid sampling at Inferno Vent.			R739-027
16:26:39 Sep 02 2003	1543	295	Took one digital image of Inferno vent.			
16:30:14 Sep 02 2003	1543	290	Trying to resume fluid sampling at Inferno Vent.			R739-028
16:33:44 Sep 02 2003	1543	288	Resuming sampling at Inferno Vent.			R739-029
16:35:35 Sep 02 2003	1543	288	Sampler outlet at Inferno.			R739-030
16:40:47 Sep 02 2003	1543	289	Sampling HFS filtered bag #16. Start 1641 Stop 1648 Tmax=292.6 Tave=291.2 T2=130 Vol=640mls. Stable temp at start of pumping at 286 degrees. [Inferno]	R739-HFS-16-0010	Butterfield	
16:50:27 Sep 02 2003	1543	289	Firing white gas tight bottle. Fired at 1651. Pulled pin but it didn't fire. [Inferno]	R739-GTB-white-0011	Butterfield	
16:51:27 Sep 02 2003	1543	288	Gas Tight sampling at Inferno Vent.			R739-031
16:52:06 Sep 02 2003	1543	288	Firing black gas tight bottle. Fired at 1652. Temperature at firing was 291. T2=134. [Inferno]	R739-GTB-black-0012	Butterfield	
16:52:14 Sep 02 2003	1543	290	A second gas Tight sampling at Inferno Vent.			R739-032
16:53:20 Sep 02 2003	1543	290	End of fluid sampling at Inferno Vent.			R739-033
16:54:24 Sep 02 2003	1543	315	End of fluid sampling at Inferno. Going to suction worms for Ray.			
16:56:49 Sep 02 2003	1543	263	Flushing into Jar 8.			
17:05:46 Sep 02 2003	1543	242	Palm and tube worms at Inferno Vent.			R739-034
17:07:41 Sep 02 2003	1543	236	Took 2 digital images of worms at Inferno for Marie.			
17:08:00 Sep 02 2003	1543	236	Suction sampling for Palm worms at Inferno Vent.			R739-035
17:08:24 Sep 02 2003	1543	235	Suctioning sulfide worms into jar 6. Start 1708 Stop 1711 Tmax=7. [Inferno]	R739-SS-J6-0013	Lee	
17:12:45 Sep 02 2003	1543	235	Heading to Hell vent for more fluid sampling. Took 2 digital images of the suctioned site after sampling.			
17:13:22 Sep 02 2003	1543	235	Inferno site after sample sulfide worms into Jar 6.			R739-036
17:19:28 Sep 02 2003	1544	212	We are at Hell vent. Taking 2 digital images as we approach. Took 2 more images up closer.			
17:21:07 Sep 02 2003	1542	200	Nice picture of Hell.			R739-037
17:22:51 Sep 02 2003	1543	168	Looking for stable sampling site with HFS intake probe.			
17:26:54 Sep 02 2003	1543	179	Fluid sampling at Hell Vent.			R739-038
17:27:15 Sep 02 2003	1543	179	HFS intake is locked in place in small opening in Hell vent with strong jet of fluid.			
17:29:58 Sep 02 2003	1543	179	Sampling HFS filtered piston #23. Start 1730 Stop1733 Start2 1734 Stop2 1738 Tmax=270.5 Tavg=263.5 T2=114 Vol1=260ml Total Vol=600ml. Pump stopped itself during sampling. [Hell]	R739-HFS-23-0014	Butterfield	
17:31:40 Sep 02 2003	1543	178	Firing blue gas tight bottle. Fired at 1734. Pulled pin but it didn't fire. [Hell]	R739-GTB-blue-0015	Butterfield	
17:34:08 Sep 02 2003	1543	179	Gas Tight sampling at Hell Vent.			R739-039
17:35:23 Sep 02 2003	1543	179	Fluid sampler outlet at Hell Vent.			R739-040

Time UTC	Z (m)	Hdg	R739 2003 Comments	Samples	Investigator	FrGrab
17:38:34 Sep 02 2003	1543	179	Sampling HFS unfiltered piston #20. Start 1739 Stop 1746 Tmax=270.4 Tave=260.4 T2=116 Vol=633mls. [Hell]	R739-HFS-20-0016	Butterfield	
17:40:25 Sep 02 2003	1543	180	Fluid sampling continued at Hell Vent.			R739-041
17:48:19 Sep 02 2003	1542	178	Done with fluid sampling at Hell. Now we will do some suctioning for Noreen at ROPOS vent.			
17:51:42 Sep 02 2003	1545	77	Flushing the lines of the suction sampler.			
17:52:58 Sep 02 2003	1545	76	Suction samples for Noreen at Ropos vent.			R739-042
17:53:30 Sep 02 2003	1545	77	Suction samples for Noreen at Ropos vent.			R739-043
17:53:40 Sep 02 2003	1545	77	Suctioning biota into jar 4. Start 1755 Stop 1800 Taking temperature reading as well. Talien=1. Tmax at surface of biota=5.4. Tmax down in the biota=8.5. SS at LA-Z location. [ROPOS]	R739-SS-J4-0017	Kelly	
18:00:10 Sep 02 2003	1545	80	End of suction sampling at Noreen's Marker 2 at ROPOS vent			R739-044
18:04:12 Sep 02 2003	1545	203	Just noticed the thermocouple on the suction sampler is not in the suction tube so temperature readings are not accurate.			
18:06:01 Sep 02 2003	1545	202	Second suction sample for Noreen at ROPOS vent.			R739-045
18:06:01 Sep 02 2003	1545	202	Suctioning biota into jar 5. Start 1806 Stop 1808 Start2 1809 Stop2 1811. Tmax at surface of biota=5.4. Tmax down in the biota=8.5. SS at LA-Z location. [ROPOS]	R739-SS-J5-0018	Kelly	
18:12:53 Sep 02 2003	1545	193	Going to use the HFS temperature probe to measure temperature where Noreen just suctioned at ROPOS vent.			
18:15:20 Sep 02 2003	1545	189	Temperature max at surface of animals was 5.4 degrees. Max temp down in the animals a bit was 8.5 degrees. Taken where array Z was recovered from.			
18:15:56 Sep 02 2003	1545	191	Temperature measurement for Noreen at Ropos Vent.			R739-046
18:22:18 Sep 02 2003	1545	186	Temperature measurement for Noreen at Ropos Vent.			R739-047
18:23:08 Sep 02 2003	1545	185	Putting away the HFS intake/ temperature probe.			
18:26:03 Sep 02 2003	1545	184	ROPOS is heading up to the cage for transit to Vixen vent.			
19:33:01 Sep 02 2003	1305	142	We are still Transiting to Vixen.			
19:40:26 Sep 02 2003	1314	133	We are starting to slow for approach to target site.			
20:05:15 Sep 02 2003	1530	133	We are on the bottom and beginning the search for Vixen.			
20:06:17 Sep 02 2003	1529	276	We can see signs of venting; tubeworms and white staining.			
20:06:55 Sep 02 2003	1532	317	Dave is interested in sampling this area on the low temperature dive.			
20:08:31 Sep 02 2003	1533	305	Vixen is in site.			
20:09:28 Sep 02 2003	1533	308	A hobo is visible near the Vixen; deciding if it is possible to sample the fluid orifice without disturbing the chimney. We are trying for the other mound.			
20:09:59 Sep 02 2003	1533	338	Vixen Vent.			R739-048
20:10:47 Sep 02 2003	1532	349	We are moving to a small venting mound looking north from the fluid orifice with the hobo in it.			
20:12:57 Sep 02 2003	1535	50	Second of two mounds at Vixen.			R739-049
20:14:18 Sep 02 2003	1537	68	A view of Casper.			R739-050
20:14:41 Sep 02 2003	1537	68	Checking out a small orifice at the base of a larger structure for fluid sampling at Casper.			
20:19:06 Sep 02 2003	1537	1	Preparing to take the temperature readings of fluid from Casper and find a stable positions for HFS.			
20:19:57 Sep 02 2003	1537	0	Knocking chimney over for temperature readings.			R739-051
20:20:09 Sep 02 2003	1537	358	Chimney knocked over.			R739-052

Time UTC	Z (m)	Hdg	R739 2003 Comments	Samples	Investigator	FrGrab
20:21:37 Sep 02 2003	1537	4	The high temperature probe is in the fluid orifice.			
20:22:54 Sep 02 2003	1537	359	Locking position of the temperature probe in place.			
20:23:59 Sep 02 2003	1537	360	Temperature probe in position at Casper.			R739-053
20:25:53 Sep 02 2003	1537	2	Fish at Casper.			R739-054
20:29:49 Sep 02 2003	1537	3	Sampling HFS unfiltered bag # 8. [Casper]	R739-HFS-8-0019	Butterfield	
20:34:27 Sep 02 2003	1537	357	The intake probe came out of the orifice and we are re-positioning it.			
20:39:02 Sep 02 2003	1537	8	Temperature probe repositioned at Casper.			R739-055
20:39:45 Sep 02 2003	1537	6	Close-up of temperature probe.			R739-056
20:41:02 Sep 02 2003	1537	2	The tip of the temperature probe is clogging with anhydrite.			
20:41:19 Sep 02 2003	1537	4	Turning on the S-VHS archive tape which was turned off for the transit to Vixen.			
20:54:00 Sep 02 2003	1537	7	Sampling HFS unfiltered bag # 17. Start=20:49 Stop=20:53 Tmax=232.7 Tave=226 T2=55 Vol=475ml. [Casper]	R739-HFS-17-0020	Butterfield	
20:54:54 Sep 02 2003	1537	2	The gas tight piston loops are tangled.			
20:56:21 Sep 02 2003	1537	6	Firing gas tight bottle with yellow loop. Fired at 20:55. May not have worked so we are firing another bottle. [Casper]	R739-GTB-yellow-0021	Butterfield	
20:56:50 Sep 02 2003	1537	3	Attempting to fire yellow gastight bottle; didn't work.			R739-057
20:58:18 Sep 02 2003	1538	5	Firing the red gas tight bottle. Fired at 20:58. No movement in the bottle detected. (same position as GTB-red-0021). [Casper]	R739-GTB-red-0022	Butterfield	
21:00:03 Sep 02 2003	1538	1	Sampling HFS unfiltered bag # 18. Start 21:00 Stop=21:04 Tmax=262.4 Tave=247.5 T2=90 Vol=466ml. [Casper]	R739-HFS-18-0023	Butterfield	
21:08:44 Sep 02 2003	1538	1	We are taking the probe out of the fluid orifice and are preparing to transit to Castle.			
21:12:37 Sep 02 2003	1537	39	The sampler is safely stowed and we lifting off for transit.			
21:13:26 Sep 02 2003	1537	156	Flow is evident in all directions; but is most abundant to the southeast; emerging from crevices between the lobate pillows.			
21:13:32 Sep 02 2003	1537	171	Staining and tubeworms in crevices of pillows indicating extensive diffuse flow to SE of Casper.			R739-058
21:14:07 Sep 02 2003	1536	63	View to NE - not as much staining.			R739-059
21:14:09 Sep 02 2003	1535	45	The site is surrounded by diffuse flow.			
21:16:42 Sep 02 2003	1508	147	One digital still was taken of Casper in a down view. The image was transferred.			
21:22:25 Sep 02 2003	1425	178	We are Transiting at 100m off the bottom with the cage in view. We are stopping the S-VHS archive tape.			
21:49:23 Sep 02 2003	1395	46	We are still Transiting to Castle.			
22:15:19 Sep 02 2003	1520	330	We are back on the bottom and beginning the search for Castle. The S-VHS archive tape is now recording.			
22:16:23 Sep 02 2003	1520	26	Lobate pillows with a little bit of sediment.			
22:17:45 Sep 02 2003	1514	5	We are sitting in the water using the sonar to detect the Castle chimney.			
22:19:53 Sep 02 2003	1515	4	The chimney is in view; abundant bacterial mat is evident.			
22:20:16 Sep 02 2003	1514	1	Bacterial mat at Castle.			R739-060
22:21:11 Sep 02 2003	1520	17	Chimney at Castle.			R739-061
22:21:40 Sep 02 2003	1521	25	We took two digital still images of the active chimney at Castle before knocking it down for high temperature fluid measurements.			

Time UTC	Z (m)	Hdg	R739 2003 Comments	Samples	Investigator	FrGrab
22:26:31 Sep 02 2003	1521	36	ROPOS arm knocking Castle chimney over.			R739-062
22:26:33 Sep 02 2003	1521	35	Castle chimney toppling.			R739-063
22:26:37 Sep 02 2003	1521	32	Inserting the temperature probe into the orifice of the chimney for pre-sample temperature readings.			
22:34:32 Sep 02 2003	1521	45	Temperature is stable and we are preparing to take a sample.			
22:34:35 Sep 02 2003	1521	46	Temperature probe in position at Castle.			R739-064
22:36:21 Sep 02 2003	1521	45	HFS with filtered gas piston 24 in clear smoker. Start 22:36 Stop=22:41 Tmax=224.6 Tave=223.9 T2=100 Vol=473ml. [Castle]	R739-HFS-24-0024	Butterfield	
22:38:32 Sep 02 2003	1521	46	Took one digital still image of Castle with the temperature probe in position.			
22:43:03 Sep 02 2003	1521	45	Sampling HFS unfiltered gas piston # 22. Start 22:43 Stop=22:49 Tmax=224.3 Tave=223.3 T2=93 Vol=513ml. [Casper]	R739-HFS-22-0025	Butterfield	
22:50:19 Sep 02 2003	1521	46	Sampling HFS unfiltered bag # 19. Start 22:51 Stop=22:56 Tmax=223.9 Tave=221.3 T2=90 Vol=495ml. Current is running west-southwest. [Casper]	R739-HFS-19-0026	Butterfield	
22:58:55 Sep 02 2003	1519	338	We are moving the wand from the vent and stowing it.			
23:00:42 Sep 02 2003	1517	311	Arm of the ROPOS and temperature probe.			R739-065
23:01:14 Sep 02 2003	1517	324	Stowing the temperature wand; preparing to suction sample.			
23:02:15 Sep 02 2003	1514	107	Castle chimney.			R739-066
23:03:31 Sep 02 2003	1521	11	Castle overview.			R739-067
23:03:51 Sep 02 2003	1522	352	One digital photo of Castle.			
23:05:54 Sep 02 2003	1522	13	Looking for an area to suction sample limpets at Castle.			
23:08:01 Sep 02 2003	1522	325	Begin SS into Jar-3 for limpets. [Casper]	R739-SS-J3-0027	Bates	
23:09:21 Sep 02 2003	1522	338	Completion of suction sample. We're continuing to look around area.			
23:09:43 Sep 02 2003	1522	357	Bacterial trap in Castle chimney.			R739-068
23:10:01 Sep 02 2003	1521	354	Castle chimney			R739-069
23:14:36 Sep 02 2003	1521	354	Still looking at area to find a good place to suction sample for Ray Lee.			
23:16:40 Sep 02 2003	1521	352	Preparing to suction at base of Castle chimney for sulfide worms for Ray Lee.			R739-070
23:17:15 Sep 02 2003	1522	352	We've found a good place to sample; but it may be too hot for a sample.			
23:17:44 Sep 02 2003	1522	351	Suctioning at Castle.			R739-071
23:19:15 Sep 02 2003	1522	353	Temperature = 2. We'll sample.			
23:19:47 Sep 02 2003	1522	352	Begin suction sampling. We did two separate suction of the same area and put them into the same jar. Suctioned sulfide worms. [Casper]	R739-SS-J7-0028	Lee	
23:20:56 Sep 02 2003	1521	352	Suction sampling complete.			
23:21:58 Sep 02 2003	1521	352	Rocks at Castle.			R739-072
23:21:59 Sep 02 2003	1521	352	All sampling complete.			
23:23:43 Sep 02 2003	1521	354	We're placing hobo 151 into vent at Castle.			
23:24:07 Sep 02 2003	1521	354	Bacterial trap at Castle.			R739-073
23:25:41 Sep 02 2003	1521	353	Hobo 151 at Castle.			R739-074
23:32:28 Sep 02 2003	1520	47	Positioning hobo with ROPOS.			
23:32:51 Sep 02 2003	1521	54	Hobo 151 at Castle.			R739-075

<b>Time UTC</b>	<b>Z (m)</b>	<b>Hdg</b>	<b>R739 2003 Comments</b>	<b>Samples</b>	<b>Investigator</b>	<b>FrGrab</b>
23:35:29 Sep 02 2003	1521	77	Hobo 151 deployed at Castle.			R739-076
23:36:42 Sep 02 2003	1521	79	Hobo tip successfully placed into vent.			
23:36:42 Sep 02 2003	1521	79	Hobo 151 positioned at Castle.			R739-077
23:38:33 Sep 02 2003	1518	1	Transferring six digital photos of hobo 151 placed at Castle.			
23:39:57 Sep 02 2003	1505	25	All dive tasks completed; ROPOS is coming up.			
23:41:54 Sep 02 2003	1487	340	Turning off SVHS.			
00:44:21 Sep 03 2003	2	171	ROPOS on deck.			

## 10.10 R740 - 2003 Dive Log

60 m NW of Mkr-33 Recovered 2 wood blocks for Voight/Tunnicliffe (recorded as one sample). One block was oak, the other fir. Lots of worm siphons were visible protruding from the wood. **Mkr-33** Deployed one cage-growth experiment. **Virgin's Daughter** Recovered LA-N (deployed '01), 1 SS in area of array. **Marshmallow** Recovered LA-K (deployed '02), 1 SS in area of array, 1 temp reading. **Dave's** Recovered 1 MTR that had been deployed with the 2002 RAS. **Hell** 3 SS, 5 temp readings. Worm Video and DSC Survey at Porkchop flange and Hell chimney. **Unnamed Diffuse Vent** 3 SS, 2 MP.

Time UTC	Z (m)	Hdg	R740 2003 Comments	Samples	Investigator	FrGrab
10:44:56 Sep 03 2003	1	177	ROPOS preparing to go in the water. Elevator is already in.			
11:10:21 Sep 03 2003	1	115	ROPOS is in the water. Beginning transit to Mkr-33.			
11:31:19 Sep 03 2003	459	321	Framegrab screen is green. Trying to adjust.			
11:32:50 Sep 03 2003	488	289	Screen is fixed - color adjusted.			
12:12:36 Sep 03 2003	1518	108	ROPOS on the bottom; looking for Mkr-33.			
12:15:51 Sep 03 2003	1517	161	Cage motor is off, hoping for better nav to locate Mkr-33.			
12:18:46 Sep 03 2003	1513	132	Cage motor is on; we're headed S.			
12:25:42 Sep 03 2003	1523	346	Still searching for Mkr-33.			
12:27:26 Sep 03 2003	1523	312	We're at Mkr-33.			
12:28:34 Sep 03 2003	1523	251	Amanda's racetrack at Mkr-33.			R740-001
12:28:46 Sep 03 2003	1523	241	Searching for an ideal spot to place Noreen's cage - one half in high flow and the other end in lower flow.			
12:30:22 Sep 03 2003	1523	192	Noreen has found a good spot; we're taking a temperature measurement. Temperature is varying between 9 and 18. (Using temperature probe at the end of the suction sampler).			
12:35:23 Sep 03 2003	1524	209	Taking a temperature measurement at Mkr-33 where Noreen is going to deploy her cage-growth experiment.			R740-002
12:36:53 Sep 03 2003	1524	211	Close up of temperature measurement spot. Ridgeia piscesae on right of intake.			R740-003
12:37:20 Sep 03 2003	1524	211	Placing one end of the box into the flow; the box- which contains limpets - will remain in place for one year.			
12:43:49 Sep 03 2003	1524	155	Deployment of Noreen's growth-cage at Mkr-33; about a quarter of the box is in flow.			R740-004
12:46:07 Sep 03 2003	1523	146	We're headed to Amanda's racetrack experiment to retrieve it.			
12:46:56 Sep 03 2003	1523	187	The bars on the racetrack will be pulled; keeping the biota in place on the racetrack during their trip to the surface.			
12:47:47 Sep 03 2003	1524	270	Amanda's racetrack at Mkr-33.			R740-005
12:49:01 Sep 03 2003	1524	267	One end of racetrack in flow at Mkr-33.			R740-006
12:50:35 Sep 03 2003	1524	284	Preventative snail is in the way of one of the racetrack closures.			
12:53:13 Sep 03 2003	1524	229	All the biota in the racetrack are still in the starting position. Amanda believes they have moved a bit. We will spin the ends - biota will be in the high flow area. The racetrack will be left in the area until a later dive.			
12:54:57 Sep 03 2003	1524	266	A total of 12 digital photos have been transferred. 4 of Noreen's cage and 8 of Amanda's racetrack.			
12:55:23 Sep 03 2003	1524	266	Examining racetrack for movement of gastropods.			R740-007
12:58:23 Sep 03 2003	1524	265	All the gastropods are in one end.			R740-008
12:58:44 Sep 03 2003	1524	266	All biota appear to be alive. Depressigyra globulus can not be seen with the ROPOS camera.			

Time UTC	Z (m)	Hdg	R740 2003 Comments	Samples	Investigator	FrGrab
13:02:51 Sep 03 2003	1524	269	Moving the racetrack closer to the MTR so that the racetrack is in the flow. In lab experiments the biota have been moving at a temperature of 24. Hopefully this swap will provide more interesting data.			
13:06:49 Sep 03 2003	1524	301	Racetrack flipped 180 degrees and repositioned with previous colder end now in direct flow.			R740-009
13:07:34 Sep 03 2003	1524	301	Two digital photos of new position and placement of racetrack.			
13:07:59 Sep 03 2003	1524	296	We're headed to retrieve the wood experiment.			
13:11:15 Sep 03 2003	1524	333	We are heading to the wood and are collecting it in the biobox. We are taking digital still images of a spider crab (Lithodidae) for Verena.			
13:14:21 Sep 03 2003	1523	282	Janet's wood had been found. It was approximately 60m from Mkr-33. We're going to bring back one bag containing oak (green) and one containing fir (white).			
13:15:21 Sep 03 2003	1524	310	Voight and Tunnicliffe's wood blocks. Wood was deployed last year. Lots of worm siphons visible. One bag containing oak (green) and one containing fir (white). [60 m NW of Mkr-33]	R740-wood-0014	Voight / Tunnicliffe	R740-010
13:17:41 Sep 03 2003	1524	314	Removing the broom from the biobox; we'll hold it in the claw and place the wood in the biobox. The broom will be left at Mkr-33 until the end of the dive. The broom will be used to brush off the racetrack.			
13:19:31 Sep 03 2003	1524	314	Removing brush from biobox and will leave back at Mkr-33.			R740-011
13:25:23 Sep 03 2003	1524	312	Fir is in biobox and now going back for the oak. First we need to get the marker off of the bag in order to fit it into the biobox.			
13:31:53 Sep 03 2003	1524	311	We're using the knife to cut the marker off.			
13:35:58 Sep 03 2003	1524	310	The line and marker have been successfully cut from the bag of wood.			
13:37:31 Sep 03 2003	1524	312	Putting knife and boom away before transiting.			
13:40:05 Sep 03 2003	1523	65	Headed back to Mkr-33 to drop off the broom and then begin the transit to ASHES.			
13:43:18 Sep 03 2003	1524	214	We are placing the broom north of the box a meter from the racetrack for future use.		Bates	R740-012
13:43:25 Sep 03 2003	1524	213	Broom is down; one meter N of the transplant cage at Mkr-33. Begin transit to elevator - located near Ashes - to pick up LA.			
14:37:29 Sep 03 2003	1286	237	Still transiting to the elevator near ASHES.			
14:51:22 Sep 03 2003	1369	242	We are near ASHES and trying to get some good nav fixes.			
15:03:28 Sep 03 2003	1542	192	We are on the bottom in the ASHES area.			
15:08:33 Sep 03 2003	1539	347	Heading to the Northwest to look for the cage.			
15:10:40 Sep 03 2003	1540	290	The elevator is in sight.			
15:15:36 Sep 03 2003	1539	296	Moving the ship closer to the elevator.			
15:20:14 Sep 03 2003	1542	231	Getting ready to pick up a larval array box from the elevator to take to Virgin's Daughter.			
15:27:16 Sep 03 2003	1542	274	Picking up the larval array box from the elevator. Lid was opening on the array box so ROPOS is repositioning to get a better grip.			
15:29:15 Sep 03 2003	1542	287	Larval array box is off the elevator. Heading to Virgin's Daughter to recover the array.			

Time UTC	Z (m)	Hdg	R740 2003 Comments	Samples	Investigator	FrGrab
15:30:14 Sep 03 2003	1545	353	We just spotted the Big Johnson. It is just below the elevator.			
15:35:22 Sep 03 2003	1543	348	We are passing the RAS.			
15:36:15 Sep 03 2003	1545	25	We have found Noreen's array N to be recovered at Virgin's Daughter.			
15:36:46 Sep 03 2003	1546	25	Noreen's array at Virgin's daughter.			R740-013
15:39:49 Sep 03 2003	1546	17	Setting the array box down next to the larval array.			
15:43:09 Sep 03 2003	1544	90	Array box is on the bottom with the lid open. Now we will take digital images of the sponges.			
15:45:33 Sep 03 2003	1546	73	Took 4 digital images of the entire array.			
15:46:15 Sep 03 2003	1546	71	Noreen's array at Virgin's Daughter.			R740-014
15:49:04 Sep 03 2003	1546	75	Transferred 6 more digital images of the individual settling trays.			
15:49:31 Sep 03 2003	1546	82	Noreen's array at Virgin's Daughter.			R740-015
15:51:23 Sep 03 2003	1546	90	Transferred 6 more images of the settling trays.			
15:52:12 Sep 03 2003	1546	89	Taking temperature readings in the array at the height of the settling trays. Talien=13 max.			
15:55:24 Sep 03 2003	1546	91	Noreen's array at Virgin's Daughter.			R740-016
15:56:48 Sep 03 2003	1546	82	Getting ready to recover the array and place it in the box.			
16:01:56 Sep 03 2003	1545	259	Trying to find the best way to pick up the array.			
16:03:27 Sep 03 2003	1546	260	Retrieving Noreen's array Virgin's daughter.			R740-017
16:06:49 Sep 03 2003	1546	297	Retrieving Noreen's array at Virgin's daughter.			R740-018
16:06:53 Sep 03 2003	1546	299	Picking up the larval array.			
16:07:15 Sep 03 2003	1546	296	Virgin's daughter vent after Noreen's array retrieval.			R740-019
16:10:35 Sep 03 2003	1545	44	Noreen's array from Virgin's daughter goes into the box.			R740-020
16:11:06 Sep 03 2003	1546	47	Noreen's array from Virgin's Daughter goes into the box.			R740-021
16:11:16 Sep 03 2003	1546	48	Noreen's array from Virgin's daughter goes into the box.			R740-022
16:11:36 Sep 03 2003	1545	43	Recovered larval array N from Virgin's Daughter. (Deployed in 2001). [Virgin's Daughter]	R740-LA--0001	Kelly	
16:13:51 Sep 03 2003	1542	108	Took one digital image of the array during recovery.			
16:15:36 Sep 03 2003	1546	165	Readjusting the array in the box to make it fit better.			
16:17:08 Sep 03 2003	1546	238	Repositioning Noreen's array from Virgin's Daughter in the box.			R740-023
16:20:29 Sep 03 2003	1546	237	The array is in the box. We are closing the lid.			
16:22:07 Sep 03 2003	1546	57	Closing the box.			R740-024
16:27:46 Sep 03 2003	1546	158	Larval array box is closed and the lid is latched.			
16:29:50 Sep 03 2003	1546	95	Going to suction sample where Noreen's array was at Virgin's Daughter.			
16:30:27 Sep 03 2003	1546	99	Suctioning around where Noreen's LA-N was sitting. Start 1631 Stop 1633 Start2 1634 Stop2 1637. Talien=28 max. Stopped to reposition the sub. [Virgin's Daughter]	R740-SS-J4-0002	Kelly	
16:34:50 Sep 03 2003	1546	114	Suction sample for Noreen at the array's location at Virgin's daughter.			R740-025
16:38:45 Sep 03 2003	1546	106	Flushing the suction lines.			



Time UTC	Z (m)	Hdg	R740 2003 Comments	Samples	Investigator	FrGrab
16:39:38 Sep 03 2003	1546	121	Picking up the larval array box and heading back to the elevator.			
16:44:08 Sep 03 2003	1546	213	Took 2 digitals of a structure that we think is either Hillock or Phoenix; near marker D.			
16:44:46 Sep 03 2003	1544	254	Vent ?? (on the way to the elevator)			R740-026
16:46:40 Sep 03 2003	1546	219	Setting the larval array box down to pick it up by the handles instead of carrying it by the lid. The lid was not tight so too much was being washed out of the box during transit.			
16:48:38 Sep 03 2003	1547	200	Have a grip on the handles of the array box. Continuing on to the elevator.			
16:55:09 Sep 03 2003	1542	251	We are back at the elevator and trying to put the larval array back on it.			
16:58:02 Sep 03 2003	1541	183	Noreen's array at the elevator.			R740-027
16:58:10 Sep 03 2003	1541	180	Larval array is on the elevator. Trying to get it into a stable position.			
17:02:57 Sep 03 2003	1542	174	Larval array is in the elevator. Getting ready to secure it.			
17:10:33 Sep 03 2003	1542	93	Larval array is secured. Pulling the elevator arm bar down over the top of the array.			
17:13:51 Sep 03 2003	1540	40	Larval array is stowed on the elevator.			
17:15:44 Sep 03 2003	1542	309	Part of the rope holding down the array we just secured is caught in the hook from the arm bar. Need to get that free then grab the other array box.			
17:21:19 Sep 03 2003	1542	139	Unhooking the second array box from the elevator.			
17:23:29 Sep 03 2003	1542	168	Picking up the second array box and Transiting to Marshmallow.			
17:27:25 Sep 03 2003	1542	10	Took one digital of what we think was Phoenix from a distance.			
17:28:44 Sep 03 2003	1543	355	Noreen's array at Marshmallow vent.			R740-028
17:28:44 Sep 03 2003	1543	355	Noreen's array at Marshmallow.			R740-029
17:28:48 Sep 03 2003	1544	352	We are at Marshmallow.			
17:30:44 Sep 03 2003	1545	6	Setting down the array box.			
17:32:12 Sep 03 2003	1545	2	Opening the lid on the array box.			
17:33:13 Sep 03 2003	1544	35	Took one digital image of the entire array from far away.			
17:34:46 Sep 03 2003	1545	37	Noreen's array at Marshmallow vent.			R740-030
17:35:25 Sep 03 2003	1545	36	Noreen has confirmed that this is array K at Marshmallow.			
17:37:31 Sep 03 2003	1546	24	Taking digital images of individual settling trays.			
17:40:28 Sep 03 2003	1546	37	Took 13 digital images of individual settling trays.			
17:42:31 Sep 03 2003	1545	42	Taking temperature measurements at the level of the settling trays. Talien=12 max; Talien=5 avg.			
17:43:08 Sep 03 2003	1545	42	Temperature measurements at Noreen's array at Marshmallow vent.			R740-031
17:45:40 Sep 03 2003	1519	151	Doing some tether management.			
17:48:52 Sep 03 2003	1506	9	Going back to Marshmallow to pick up the array.			
17:53:20 Sep 03 2003	1544	319	We are back at Marshmallow.			
17:54:39 Sep 03 2003	1545	236	Picking up the larval array.			
17:55:26 Sep 03 2003	1545	238	Grabbing Noreen's array at Marshmallow vent.			R740-032

Time UTC	Z (m)	Hdg	R740 2003 Comments	Samples	Investigator	FrGrab
17:56:37 Sep 03 2003	1545	277	Taking the larval array to the box.			
17:59:00 Sep 03 2003	1545	322	Recovering Noreen's larval array K. (Deployed in 2002). [Marshmallow]	R740-LA-K-0003	Kelly	
18:01:37 Sep 03 2003	1545	325	Noreen's array from Marshmallow vent goes into the box.			R740-033
18:02:09 Sep 03 2003	1545	324	Array is in the box. It was dropped a bit when it went in and a lot of stuff came loose.			
18:02:10 Sep 03 2003	1545	324	Noreen's array at Marshmallow vent falls into the box.			R740-034
18:05:37 Sep 03 2003	1545	15	Noreen's array (from Marshmallow vent) after the fall.			R740-035
18:06:36 Sep 03 2003	1545	329	Closing the lid of the array box.			
18:07:27 Sep 03 2003	1545	68	Sea cucumber.			R740-036
18:09:28 Sep 03 2003	1545	63	Array box lid is secured.			
18:10:37 Sep 03 2003	1543	139	Going back to do some suction sampling where the array was at Marshmallow.			
18:13:15 Sep 03 2003	1545	357	Marshmallow after the array's retrieval.			R740-037
18:14:03 Sep 03 2003	1545	11	One DSC taken of overview of Marshmallow (after the array was removed).			
18:15:09 Sep 03 2003	1545	12	Suction sampling at the location of Noreen's array at Marshmallow vent.			R740-038
18:15:15 Sep 03 2003	1545	13	Suction into Jar5 where LA-K was positioned. Start 1815 Stop 1817 Start2 1819 Stop2 1821. Talien max=31. [Marshmallow]	R740-SS-J5-0004	Kelly	
18:22:44 Sep 03 2003	1545	3	Heading to Gollum to take digital images of another array that we will not recover yet.			
18:25:48 Sep 03 2003	1544	106	Noreen's Gollum array.			R740-039
18:26:51 Sep 03 2003	1545	126	We are at Gollum and Noreen's array J.			
18:28:00 Sep 03 2003	1545	193	Fish ??			R740-040
18:28:27 Sep 03 2003	1545	190	Fish with antenna.			R740-041
18:29:42 Sep 03 2003	1545	189	Taking digital images of array J. Took 2 overview images and 23 images of the individual settling trays.			
18:32:38 Sep 03 2003	1545	174	Close up of Noreen's array at Gollum vent.			R740-042
18:35:37 Sep 03 2003	1545	169	Done taking digital images of larval array J.			
18:36:56 Sep 03 2003	1545	167	Going to pick up the MTR that we placed near the RAS on dive R739. This MTR was taken from Dave's vent. There is no visible number or label on the MTR.			
18:38:42 Sep 03 2003	1546	336	MTR retrieval.			R740-043
18:41:11 Sep 03 2003	1546	336	Recovered MTR from near the RAS that was taken out of Dave's vent on dive R739. We believe this was placed next to last years RAS at Dave's. Can't see the number. [Dave's]	R740-MTR-0005	Butterfield	
18:42:44 Sep 03 2003	1543	49	Taking digital images of the RAS. Took 17 images.			
18:46:56 Sep 03 2003	1544	133	DSC's of Dave's RAS.			R740-044
18:47:30 Sep 03 2003	1543	116	Going back to Marshmallow to pick up larval array K and take it back to the elevator.			
18:51:28 Sep 03 2003	1545	243	Picking up the array. Put it down to get a better grip.			
18:54:41 Sep 03 2003	1543	11	We are taking Larval Array K to the elevator.			
19:09:25 Sep 03 2003	1539	147	We have lifted off the bottom and are about to stow the array biobox with Larval Array K onto the elevator.			
19:23:57 Sep 03 2003	1542	166	Securing the biobox with the bar.			

Time UTC	Z (m)	Hdg	R740 2003 Comments	Samples	Investigator	FrGrab
19:39:54 Sep 03 2003	1545	177	Started digital video cam.			
19:41:02 Sep 03 2003	1545	331	We think the chimney in view is Hell Vent.			
19:42:55 Sep 03 2003	1542	311	We are circling the chimney and it is not Hell Vent. We are heading further to the west.			
19:44:37 Sep 03 2003	1544	130	ROPOS vent is in site; so we are continuing to the west.			
19:47:02 Sep 03 2003	1546	314	Porkchop is in view and Marie is looking at the sulfide worms. We are planning on videoing the sulfide worms for 30 mins.			
19:54:36 Sep 03 2003	1546	271	We are trying to find a good spot on a beehive to get a clear view (minimal fluid shimmering) of sulphide worms for imaging.			
19:56:15 Sep 03 2003	1546	272	Starting color videoing of sulphide worms in low particulates on the Porkchop beehive at Hell Vent.			
20:00:05 Sep 03 2003	1546	268	The digital still in place and we are taking video still images every 20sec for 30min. Started the series at 20:00.			
20:01:54 Sep 03 2003	1546	269	Stygiopontius quadrispinosus (copepods) are visible jumping in the video.			
20:01:54 Sep 03 2003	1546	269	Color video position for worm imaging at Porkchop.			R740-045
20:03:38 Sep 03 2003	1546	269	Ten digital images were just transferred. We are stopping the digital video series and bringing the ROV nearer to site.			
20:06:53 Sep 03 2003	1546	254	We are repositioning the digital still camera and the color video camera. We are focusing on a spout with vigorous flow and are trying to find the spot in which we previously imaged the sulfide worms.			
20:08:32 Sep 03 2003	1546	277	The pilots are having trouble getting the ROV into a stable position for the sulphide worm imaging.			
20:11:48 Sep 03 2003	1546	270	We are trying to find another site because the ROV is now too close for the focus.			
20:14:03 Sep 03 2003	1546	264	We are again repositioning the ROV because it is now too close to focus on the sulfide worms.			
20:15:21 Sep 03 2003	1546	271	We are checking to make sure the ROV is in a stable position before searching for an appropriate site. We are at the same site as previously imaged.			
20:16:46 Sep 03 2003	1546	269	Initiating digital images at 20s intervals for 30min.			
20:17:15 Sep 03 2003	1546	271	View of the low particulate site for sulphide worm imaging after the ROV was repositioned.			R740-046
20:19:41 Sep 03 2003	1546	268	ROPOS has lost its stable position and lifted off. We are stopping the digital series and transferring 9 files.			
20:21:23 Sep 03 2003	1546	261	ROPOS is being tugged by the cage and it is difficult to get a stable position. We are trying to come back to the same site and continual the color video and digital still series.			
20:22:34 Sep 03 2003	1546	255	Changing DV cam tape to # 7.			
20:23:32 Sep 03 2003	1546	255	We have repositioned the ROV and are again at the same site.			
20:23:58 Sep 03 2003	1546	254	Starting the DV cam tape # 7.			
20:24:58 Sep 03 2003	1546	255	Zooming the digital still camera on the sulfide worm imaging site.			
20:25:36 Sep 03 2003	1546	256	View of the first color video imaging site following repositioning of the ROV.			R740-047
20:25:38 Sep 03 2003	1546	255	Re-starting the digital still imaging series at 1 every 20sec.			
20:27:20 Sep 03 2003	1546	254	We are moving the cage closer to the ROV because the tether is pulling the ROV.			

Time UTC	Z (m)	Hdg	R740 2003 Comments	Samples	Investigator	FrGrab
20:31:43 Sep 03 2003	1546	265	The cage is currently being moved.			
20:33:59 Sep 03 2003	1546	260	We are recording color video of the sulfide worms and are waiting until the cage is closer to take the digital still series.			
20:34:50 Sep 03 2003	1546	264	Calibrating the digital still camera by focusing on limpets near the imaging site.			
20:40:08 Sep 03 2003	1546	272	The color video camera is in the same position as previous; we are currently calibrating the digital still camera.			
20:42:13 Sep 03 2003	1546	271	Starting the digital still imaging series at 1 every 20s. We have transferred 22 digital images in total.			
20:45:43 Sep 03 2003	1546	271	Just transferred 11 digital files.			
20:50:00 Sep 03 2003	1546	270	Just transferred 10 digital still files.			
20:54:20 Sep 03 2003	1547	271	Just transferred 10 digital still files.			
20:58:42 Sep 03 2003	1547	269	Just transferred 10 digital still files.			
21:00:12 Sep 03 2003	1547	270	We are stopping the digital still series and are moving to another sulphide worm imaging site where there is more particulate matter on the substratum.			
21:00:51 Sep 03 2003	1546	270	Just transferred 1 digital still file.			
21:02:02 Sep 03 2003	1546	270	We transferred 64 digital still images for the first sulfide worm imaging site viewed in the color video frame.			
21:06:21 Sep 03 2003	1546	271	Restarting the digital still imaging series. The color video is in a new position; the digital still camera has a larger frame and includes both sites imaged.			
21:07:03 Sep 03 2003	1546	271	Second color video site with high particulates.			R740-048
21:09:58 Sep 03 2003	1547	270	Just transferred 10 digital still files.			
21:13:57 Sep 03 2003	1547	271	Just transferred 10 digital still images.			
21:17:34 Sep 03 2003	1547	270	There is a limpet moving at 'high speed' across the video frame. It approached the fast fluid flow and retreated. Stygiopontius is also visible and is jumping - as similar to previous site.			
21:18:05 Sep 03 2003	1547	271	Just transferred 10 digital still files.			
21:22:26 Sep 03 2003	1547	271	Just transferred 11 digital still files.			
21:25:06 Sep 03 2003	1547	270	Stopping the digital still series. Transferring 5 images.			
21:25:39 Sep 03 2003	1547	271	Porkchop sulphide worm imaging.			R740-049
21:29:40 Sep 03 2003	1546	285	A total of 115 images were transferred from Porkchop.			
21:30:06 Sep 03 2003	1546	284	Taking the fluid temperature 10cm above the worms imaged at Porkchop.			
21:31:09 Sep 03 2003	1546	282	Position of the temperature probe.			R740-050
21:33:10 Sep 03 2003	1547	285	Flushing into Jar 8 and preparing to take a suction sample of worms imaged at Porkchop.			
21:34:34 Sep 03 2003	1546	283	Suction sample intake position at Porkchop.			R740-051
21:35:05 Sep 03 2003	1547	284	Start of suction sample of worms imaged from high and low particulate site at Porkchop. Max temperature measured with alien 10cm above the worms is 10C. [Hell]	R740-SS-J6-0006	Morineaux	
21:42:22 Sep 03 2003	1547	276	Contents of suction sample in jar 6.			R740-052
21:43:42 Sep 03 2003	1547	277	Flushing into Jar 8 in preparation for our next suction sample. We are checking gages.			
21:45:40 Sep 03 2003	1547	275	Taking three digital stills of the Porkchop imaging site following suction sampling.			

Time UTC	Z (m)	Hdg	R740 2003 Comments	Samples	Investigator	FrGrab
21:47:40 Sep 03 2003	1547	274	Starting a new S-VHS tape on the grey deck for Marie.			
22:02:56 Sep 03 2003	1546	95	Flange.			R740-053
22:03:07 Sep 03 2003	1546	97	Flange.			R740-054
22:04:15 Sep 03 2003	1546	96	We are trying to find an appropriate site for Marie to image sulphide worms on a flange at Hell Vent.			
22:07:40 Sep 03 2003	1546	96	Marie has chosen a site on the west side of Hell Vent. Particulates are dense on the alvinellid tubes and substratum. We are adjusting light levels on the color video.			
22:11:26 Sep 03 2003	1546	94	Starting the 30min color video imaging of a high particulate site with sulphide worms on a flange at Hell Vent.			
22:12:21 Sep 03 2003	1546	94	We are not taking digital still images because the camera can not view what we are seeing.			
22:19:39 Sep 03 2003	1546	97	We are looking around the site with the color camera.			
22:23:37 Sep 03 2003	1546	101	At the flange at west side of Hell.			R740-055
22:26:37 Sep 03 2003	1546	103	Changing the DV-cam to tape # 9. The tape stopped for a maximum of 4 minutes before we changed from # 8 to #9.			
22:54:24 Sep 03 2003	1546	103	Continuing to watch the worms for at least five more minutes.			
22:56:15 Sep 03 2003	1546	103	Observation is done; were positioning to take a temperature sample and a suction sample.			
23:02:44 Sep 03 2003	1546	89	Three digital photos moved over.			
23:04:16 Sep 03 2003	1546	74	Two digital photos moved of the temperature sampling location at Hell.			
23:10:17 Sep 03 2003	1546	68	Begin suction sample of sulfide worms and associated biota into Jar 7 and taking a temperature reading at the same time. Start=23 10 Stop=23 12. Tmax=41. [Hell]	R740-SS-J7-0007	Morineaux	
23:10:26 Sep 03 2003	1546	69	Suction Sampling at Hell.			R740-056
23:14:55 Sep 03 2003	1546	99	Next we will suction for extra sulfide worms in an area about half a meter from SS-J7.			
23:16:56 Sep 03 2003	1546	74	End of DV Cam tape #9.			
23:21:18 Sep 03 2003	1546	37	Starting SS of sulfide worms into Jar-8 for Ray Lee. Start=2321 Stop=2326. [Hell]	R740-SS-J8-0008	Lee	
23:21:39 Sep 03 2003	1546	35	Suction Sample 8 for Ray Lee.			R740-057
23:26:58 Sep 03 2003	1546	58	Positioning the digital camera in front of the sulfide worms.			
23:28:29 Sep 03 2003	1546	69	Begin taking digital photos.			
23:30:11 Sep 03 2003	1546	69	Ten digital photos taken of sulfide worms at Hell.			
23:32:01 Sep 03 2003	1544	120	We'll be headed to low temperature areas to take some DOC samples.			
23:35:49 Sep 03 2003	1547	155	Ten digital photos transferred of sulfide of worms.			
23:37:59 Sep 03 2003	1543	85	Headed ENE looking for a good low temperature Vent to take samples for Gitai.			
23:42:50 Sep 03 2003	1548	129	Found an unnamed diffuse vent in close proximity to ROPOS vent. We'll flush jar 8; before sampling into jars 1 2 and 3.			
23:45:27 Sep 03 2003	1547	124	Preparing suction at an unnamed diffuse vent.			R740-058
23:45:32 Sep 03 2003	1548	127	Flushing into jar-8.			
23:48:50 Sep 03 2003	1548	124	SS into jar-1. Start=2348 Stop=2352. Sampling on low flow for bacteria; particulates and DOC. [unnamed diffuse vent]	R740-SS-J1-0009	Yahel	

Time UTC	Z (m)	Hdg	R740 2003 Comments	Samples	Investigator	FrGrab
23:52:15 Sep 03 2003	1548	128	SS into jar-2. Start=2352 Stop=2354. We haven't moved the arm; still sampling in the same area for bacteria; particulates and DOC. [unnamed diffuse vent]	R740-SS-J2-0010	Yahel	
23:54:19 Sep 03 2003	1548	128	Begin SS into jar-3. Start=2354 Stop=2356. Still in same location for bacteria; particulates and DOC. [unnamed diffuse vent]	R740-SS-J3-0011	Yahel	
23:57:00 Sep 03 2003	1548	128	Jar 3.			R740-059
23:57:01 Sep 03 2003	1548	128	Next we will take two McLane Pump samples. Taking the plugs out.			
00:04:42 Sep 04 2003	1548	124	Line broke while trying to remove stoppers. Now trying to get stoppers out without the line.			
00:08:38 Sep 04 2003	1548	124	BRAVO Bob!			R740-060
00:08:51 Sep 04 2003	1548	127	McLane line stopper taken by the arm of Ropos.			R740-061
00:09:52 Sep 04 2003	1548	126	Red stopper is out; working on the green one.			
00:11:58 Sep 04 2003	1548	126	Green stopper is off.			
00:13:38 Sep 04 2003	1548	126	Repositioning the flow intake for the red side of the McLane Pump.			
00:14:24 Sep 04 2003	1548	124	Positioning for McLane pump.			R740-062
00:14:54 Sep 04 2003	1548	127	We're waiting for the particulates to settle.			
00:15:12 Sep 04 2003	1548	125	Starting McLane pump.			R740-063
00:15:18 Sep 04 2003	1548	125	Starting red side McLane Pump for bacteria; particulates and DOC. Pumping at 5 liters/min for a total of 6 liters. Start=0016 Stop=0017. [unnamed diffuse vent]	R740-MP-red-0012	Yahel	
00:15:48 Sep 04 2003	1548	125	McLane pumping.			R740-064
00:17:22 Sep 04 2003	1548	124	Pushing green intake into flow and then sampling will begin after waiting for particles in area to settle.			
00:17:41 Sep 04 2003	1548	126	Sampling with green tube.			R740-065
00:19:42 Sep 04 2003	1548	125	Begin MP sample in green			
00:19:52 Sep 04 2003	1548	127	Begin McLane pump into green intake for bacteria; particulates and DOC. Pumping at 5 liters/min for a total of 6 liters. This pump has a filter on it. Start=0019 Stop=0021. [unnamed diffuse vent]	R740-MP-green-0013	Yahel	
00:23:14 Sep 04 2003	1548	125	Suction.			R740-066
00:26:06 Sep 04 2003	1548	128	Doing a temperature reading in the area of McLane Sampling area for limpet study.			
00:27:11 Sep 04 2003	1548	124	Limpet area temperature between 2 and 10 degrees.			R740-067
00:29:20 Sep 04 2003	1547	115	Looking around for venting sites to figure out the insitu max temperature for limpet study.			
00:36:23 Sep 04 2003	1547	154	Ambient temperature reading in area is 0.5.			
00:40:45 Sep 04 2003	1547	153	Taking temperature at 10 meters from Hell around limpets.			R740-068
00:43:48 Sep 04 2003	1547	149	10 meters from Hell.			R740-069
00:47:17 Sep 04 2003	1546	110	Searching for an opportunistic site to sample limpets.			R740-070
00:48:22 Sep 04 2003	1547	127	Taking a temperature reading in a spot with flow and no limpets.			
00:48:23 Sep 04 2003	1547	127	Preparing to take temperature (no limpets).			R740-071
00:52:41 Sep 04 2003	1547	129	Temperature probe. T=15 with limpets.			R740-072
00:53:20 Sep 04 2003	1546	130	Transferring two digital files of limpet temperature sampling area.			

<b>Time UTC</b>	<b>Z (m)</b>	<b>Hdg</b>	<b>R740 2003 Comments</b>	<b>Samples</b>	<b>Investigator</b>	<b>FrGrab</b>
00:54:15 Sep 04 2003	1547	126	We are finished sampling and are headed to the elevator.			
00:55:30 Sep 04 2003	1543	24	Searching for another site.			R740-073
01:01:14 Sep 04 2003	1546	50	Elevator is released.			
01:01:16 Sep 04 2003	1546	52	Elevator away.			R740-074
01:02:07 Sep 04 2003	1542	97	ROPOS is headed to the surface.			
02:06:53 Sep 04 2003	1	184	ROPOS is on deck. End of R740.			

## 10.11 R741 - 2003 Dive Log

Fluid sampling dive on the nSRZ. **BagCity** (Mkr-36) 5 HFS, 1 SS. "**FeO Field**" (iron oxide area between BagCity and Coquille) 1SS. **Coquille** 3 HFS, 1SS. **Mkr-113** 3 HFS, 4 temp probes. **Village** 3 HFS; 3 SS, 4 temp probes. **Mkr-N3** 3 HFS, 3 temp probes. **Cloud** 1 HFS, 1 SS. **Mkr-33** 4 HFS; 1 SS. Recovered Ashes net transponders 10.5 and 11.5.

Time UTC	Z (m)	Hdg	R741 2003 Comments	Samples	Investigator	FrGrab
07:52:51 Sep 04 2003	1	200	ROPOS is in the water.			
08:08:23 Sep 04 2003	57	221	ROPOS has returned to the cage and is coming to the surface. It is too heavy; the ballast needs to be adjusted.			
08:16:02 Sep 04 2003	0	207	ROPOS is out of the water.			
08:48:18 Sep 04 2003	1	56	ROPOS is fixed and back in the water.			
09:03:56 Sep 04 2003	270	304	Species along the water column.			R741-001
09:09:31 Sep 04 2003	405	285	Seven digital photos Transferred to hard drive. The last several are of fish on the descent at ~400m depth.			
09:59:01 Sep 04 2003	1532	307	ROPOS is on the bottom.			
09:59:11 Sep 04 2003	1532	301	On bottom to start dive.			R741-002
10:00:06 Sep 04 2003	1531	329	We are at Bag City.			
10:00:11 Sep 04 2003	1531	330	Approaching Bag City.			R741-003
10:02:44 Sep 04 2003	1534	302	Two digital photos moved - seafloor near Bag City.			
10:04:22 Sep 04 2003	1534	336	Bag City area.			R741-004
10:06:21 Sep 04 2003	1534	324	Mkr-36 is in sight.			
10:06:43 Sep 04 2003	1534	323	Tubeworm bush SE of Mkr-36.			R741-005
10:06:57 Sep 04 2003	1534	323	We are looking at a tubeworm bush SE of Mkr-36 and checking it for flow to see if it is a good candidate for fluid sampling.			
10:09:33 Sep 04 2003	1534	324	Taking temperature at tubeworm bush.			R741-006
10:11:09 Sep 04 2003	1534	321	Checking temperature at tubeworm bush.			
10:14:38 Sep 04 2003	1534	324	High temperature of 12.3 at this tubeworm bush.			
10:15:35 Sep 04 2003	1534	320	Transferring one digital photo to hard drive.			
10:18:24 Sep 04 2003	1534	322	Scanning the area for other possible sites for fluid sampling.			
10:19:01 Sep 04 2003	1534	320	Turning on sensor port. Stop 1022. Steady pH was around 7.4; but the sensor may not have been calibrated.			
10:23:40 Sep 04 2003	1534	322	HFS Piston #4 in tubeworm bush SE of Marker 36. Start 1023 Stop 1030. T1=12.9 T2=8 T1max=12.9 T1avg=12.8. pH=7.4. Vol=704ml. [BagCity]	R741-HFS-4-0001	Butterfield	
10:32:53 Sep 04 2003	1533	327	Leaving area to look for higher temperatures.			
10:35:51 Sep 04 2003	1534	339	Rattail fish.			R741-007
10:36:29 Sep 04 2003	1534	329	Testing temperature in another tubeworm bush.			
10:36:39 Sep 04 2003	1535	318	Preparing to sample second site at Bag City.			R741-008
10:37:34 Sep 04 2003	1535	322	One digital photo transferred.			
10:38:55 Sep 04 2003	1534	326	Taking temp with vent fish in foreground.			R741-009
10:43:37 Sep 04 2003	1534	308	Scanning for a new location.			
10:46:53 Sep 04 2003	1535	309	Taking temp for another possible sample site.			R741-010
10:47:59 Sep 04 2003	1534	309	Temperature 27.8 and rising. Tmax = 29.8. We'll check the pH here.			
10:49:04 Sep 04 2003	1535	310	T=29.8 degrees and taking sensor sample.			R741-011
10:50:12 Sep 04 2003	1535	310	Running sensor until we get a constant pH reading; then we'll begin the sample.			



Time UTC	Z (m)	Hdg	R741 2003 Comments	Samples	Investigator	FrGrab
10:52:55 Sep 04 2003	1535	307	Sensor pH=6.3. The calibration for the pH may not be correct - unsure if the pH sensor was corrected calibrated. Future readings may not be accurate.			
10:54:08 Sep 04 2003	1535	354	ROPOS moving away; want to see what happens with temp before taking a sample.			
10:54:37 Sep 04 2003	1533	305	Tubeworm bush at Bag City.			R741-012
10:57:39 Sep 04 2003	1534	301	Second attempt at fluid sampling in tubeworm bush at Bag City.			R741-013
10:59:18 Sep 04 2003	1535	300	HFS filtered bag #11. Start=1058 Stop=1106. T2=19.5 T1max=31.4 T1avg=31.2. pH=6.3. Vol=630ml. Location is 5m S of mkr-36 near 2001 RAS frame. [BagCity]	R741-HFS-11-0002	Butterfield	
11:08:43 Sep 04 2003	1534	299	HFS piston #5. Start=1107 Stop=1115. T1=31.1 T2=18.6 T1max=31.3 T1avg=31.1. pH=6.3. Vol=706ml. Location is 5m S of mkr-36 near 2001 RAS frame. [BagCity]	R741-HFS-5-0003	Butterfield [ssmp: Bolton]	
11:16:54 Sep 04 2003	1535	303	HFS Sterivex filter #1. Start=1116 Stop=1128. T1=30.9 T2=18.9 T1max=31.4 T1avg=31.2. pH=6.3. Vol=1003ml. Location is 5m S of mkr-36 near 2001 RAS frame. [BagCity]	R741-HFS-1-0004	Butterfield	
11:18:33 Sep 04 2003	1535	299	Mkr-36 in distance at Bag City.			R741-014
11:20:47 Sep 04 2003	1535	299	Fluid sampling at Bag City.			R741-015
11:26:01 Sep 04 2003	1535	303	Transferring two digital photos of sampling sites at Bag City.			
11:30:08 Sep 04 2003	1535	303	HFS with RNA filter #7. Start=1129 Stop=1141. T1=31.3 T2=18.9 T1max=31.5 T1avg=31.3. Vol=1001ml. Location is 5m S of mkr-36 near 2001 RAS frame. [BagCity]	R741-HFS-7-0005	Butterfield	
11:36:05 Sep 04 2003	1535	303	Tubeworm bush near fluid sampling site at Bag City.			R741-016
11:43:01 Sep 04 2003	1535	300	Conducting a short sensor run in same area that we have been sampling.			
11:43:29 Sep 04 2003	1535	301	Sensor started 1143. Stopped 1145. pH=6.11.			
11:44:59 Sep 04 2003	1535	303	Close up of low temp fluid sampling site in tubeworm bush at Bag City.			R741-017
11:46:49 Sep 04 2003	1535	303	We're flushing in jar-8 in preparation for taking a sulfide worm SS. Checking out the site before sampling.			
11:49:24 Sep 04 2003	1535	283	Transferring six digital photos of sulfide worm SS site.			
11:49:40 Sep 04 2003	1535	293	SS into jar-4 of sulfide worms and limpets. Start=1150 Stop=1154. Turning suction tube in worm bush to stir up contents. Location is 5m S of mkr-36 near 2001 RAS frame. [BagCity]	R741-SS-J4-0006	Morineaux	
11:50:51 Sep 04 2003	1535	292	Suction sampling in tubeworm bush at Bag City.			R741-018
11:54:39 Sep 04 2003	1535	292	Checking out the contents of jar-4.			
11:54:42 Sep 04 2003	1535	291	Suction of worms into Jar 4.			R741-019
11:57:08 Sep 04 2003	1535	288	Four digital photos transferred of tubeworm suction sample aftermath.			
11:57:55 Sep 04 2003	1535	288	Fluid sampler stowed in holster.			R741-020
11:57:58 Sep 04 2003	1535	289	Putting away Butterfield Sampler and beginning transit to Coquille; moving along the bottom to search for iron oxides.			
12:13:47 Sep 04 2003	1533	272	Iron Oxides spotted! Seven digital photos transferred of FeO site where we will do a sulfide worm/biota SS.			
12:15:07 Sep 04 2003	1534	12	Iron oxides (?) found during transit from Bag City to Coquille.			R741-021
12:19:44 Sep 04 2003	1535	28	SS into Jar-6 of all biota in FeO area of old lava flow. Start=1219 Stop=1224. [Between Bag City and Coquille]	R741-SS-J6-0007	Morineaux	

Time UTC	Z (m)	Hdg	R741 2003 Comments	Samples	Investigator	FrGrab
12:20:23 Sep 04 2003	1534	34	Suctioning possible iron oxides.			R741-022
12:25:03 Sep 04 2003	1535	78	Suction jar 6 contains bacterial mats and iron oxides.			R741-023
12:26:51 Sep 04 2003	1533	317	Created nav position called "FeO Field" where sample was taken.			
12:31:32 Sep 04 2003	1536	274	Fish sighting during transit between sites.			R741-024
12:32:31 Sep 04 2003	1535	275	Tubeworm bushes sighted on edge of a collapse. Looks like we're headed into a high vent area; most likely start of Coquille area.			
12:35:02 Sep 04 2003	1536	274	MTR spotted #3317 which was deployed on Dive R551 - several years ago.			
12:41:44 Sep 04 2003	1537	360	We're at Coquille preparing to conduct more HFS sampling.			
12:43:25 Sep 04 2003	1537	355	Inserting probe for fluid sampling at Coquille.			R741-025
12:44:30 Sep 04 2003	1537	357	Temperature probing in a tubeworm bush. T=23. We'll sample here.			
12:44:42 Sep 04 2003	1537	355	Fluid sampler inserted into low temperature vent at Coquille.			R741-026
12:48:08 Sep 04 2003	1537	357	Fluid sampling at Coquille.			R741-027
12:51:25 Sep 04 2003	1537	20	Probe moved; we're repositioning.			
12:52:05 Sep 04 2003	1538	4	Coquille vent field.			R741-028
12:54:09 Sep 04 2003	1537	3	T=27 in repositioned spot.			
12:55:15 Sep 04 2003	1537	4	HFS unfiltered bag#8. Start=1255 Stop=1302. T2=17.4 Tmax=29.3 Tavg=26. Vol=626ml. Sample is being taken in a typical vent in a crevice of lobate flow with the following biota: small tubeworms and palmworms and limpets. [Coquille]	R741-HFS-8-0008	Butterfield [ssmp: Bolton]	
13:06:14 Sep 04 2003	1538	2	HFS flat DNA filter #3. Same location as last sample. Start=1306 Stop=1319. T2=16 Tmax=28.7 Tavg=23.1. Vol=1096ml. [Coquille]	R741-HFS-3-0009	Butterfield [ssmp: Bolton]	
13:13:29 Sep 04 2003	1538	1	Fluid sampling at Coquille.			R741-029
13:20:32 Sep 04 2003	1538	3	Checking out the surrounding area - looking at the biota.			
13:21:14 Sep 04 2003	1538	2	Tubeworm bush and associated fauna at Coquille.			R741-030
13:21:16 Sep 04 2003	1537	1	HFS filtered piston#24 in same tubeworm bush area. Start=1321 Stop=1328. T2=16 Tmax=29 Tavg=25.1. pH=5.8. Vol=670ml. [Coquille]	R741-HFS-24-0010	Butterfield	
13:29:38 Sep 04 2003	1538	3	Running sensors: pH=5.8.			
13:32:34 Sep 04 2003	1537	4	Coquille.			R741-031
13:36:33 Sep 04 2003	1536	28	Remaining in the area to conduct a SS - looking for good area.			
13:39:21 Sep 04 2003	1538	8	Six digital photos transferred.			
13:42:07 Sep 04 2003	1537	31	Changed sites from HFS samples because the area was too deep. Looking for another area along the crack.			
13:44:19 Sep 04 2003	1537	15	SS of fauna into jar-5. Start=1346 Stop=1350. Talien=1.1 Tmax=7. [Coquille]	R741-SS-J5-0011	Morineaux	
13:45:45 Sep 04 2003	1537	12	Suction sampling at Coquille.			R741-032
13:50:23 Sep 04 2003	1537	17	Suction sample in jar 5 from Coquille site.			R741-033
13:56:53 Sep 04 2003	1537	7	Had a STS breakdown - everything went offline.			
13:57:41 Sep 04 2003	1537	7	STS is back up.			

Time UTC	Z (m)	Hdg	R741 2003 Comments	Samples	Investigator	FrGrab
13:59:20 Sep 04 2003	1536	11	Four digital photos transferred of the SS-5 site.			
14:01:44 Sep 04 2003	1536	336	Touring vent field before beginning transit to Mkr-113. Area is fairly extensive and seems whiter than last time.			
14:03:29 Sep 04 2003	1537	12	HOBO at Vixen.			R741-034
14:03:48 Sep 04 2003	1536	19	At Vixen so last site was 30m from Vixen. Lots of flow here. Continuing to the West.			
14:06:10 Sep 04 2003	1537	314	Collapsed pillow with surrounding venting.			R741-035
14:06:30 Sep 04 2003	1535	252	Looking at venting out of a collapse lobate pillow. Area has a cave full of tubeworms.			
14:07:58 Sep 04 2003	1537	210	Transferring five digital photos of collapse pillow lava and tubeworm field. Showing underside of most vents we're studying.			
14:09:14 Sep 04 2003	1538	216	Macrofauna concentrated in underside of collapsed pillow.			R741-036
14:10:03 Sep 04 2003	1537	18	Venting on edge of collapsed pit.			R741-037
14:11:09 Sep 04 2003	1536	327	Passing collapsed pit.			
14:12:40 Sep 04 2003	1538	334	Pillar within collapsed pillow basalt with associated venting.			R741-038
14:13:43 Sep 04 2003	1538	346	Moving two digital photos of collapsed vent with folding indicating old vent tubes.			
14:15:50 Sep 04 2003	1511	169	Begin transit to Mkr-113.			
14:51:39 Sep 04 2003	1521	336	We are back on the bottom and looking for Mkr-113.			
14:59:24 Sep 04 2003	1524	341	We found Mkr-113.			
15:01:28 Sep 04 2003	1522	345	Arriving Mkr-113.			R741-039
15:02:05 Sep 04 2003	1523	323	Next to Mkr-113.			R741-040
15:02:06 Sep 04 2003	1524	326	Mkr-113.			R741-041
15:05:05 Sep 04 2003	1525	36	Mkr-113.			R741-042
15:05:08 Sep 04 2003	1525	37	Took 5 digital images of large tubeworm bushes around mkr-113.			
15:07:00 Sep 04 2003	1525	36	Worms at Mkr-113.			R741-043
15:09:21 Sep 04 2003	1525	35	Taking out the HFS probe to start looking at temperatures for sampling areas.			
15:10:20 Sep 04 2003	1525	35	Fluid sampling at Mkr-113.			R741-044
15:13:33 Sep 04 2003	1525	32	Fluid sampler outlet at Mkr-113.			R741-045
15:15:25 Sep 04 2003	1525	34	Found a good sampling site in a large bunch of tubeworms and limpets. Temperature is around 25 degrees.			
15:16:37 Sep 04 2003	1525	34	Sampling HFS unfiltered bag #9. Start 1516 Stop 1523. Tmax=26.6 Tave=26.6 T2=16.5 pH=5.8. Vol=594mls. [Mkr-113]	R741-HFS-9-0012	Butterfield [ssmp: Bolton]	
15:24:45 Sep 04 2003	1525	32	Running the HFS sensors; pH reading 6.06 compared to background of 7.5.			
15:29:13 Sep 04 2003	1525	34	Sampling HFS Sterivex DNA filter #13. Start 1528 Stop 1542. Tmax=26.6 Tave=26.6 T2=16.9 pH=5.8. Vol=1100mls. [Mkr-113]	R741-HFS-13-0013	Butterfield [ssmp: Bolton]	
15:33:40 Sep 04 2003	1525	34	Took 2 digital images of the HFS intake probe.			
15:33:45 Sep 04 2003	1525	32	Fluid sampling continued at Mkr-113.			R741-046

Time UTC	Z (m)	Hdg	R741 2003 Comments	Samples	Investigator	FrGrab
15:43:47 Sep 04 2003	1525	34	Sampling HFS filtered piston #23. Start1 1544 Stop1 1548 Start2 1548 Stop2 1551 Start3 1551 Stop3 1553. Tmax=26.8 Tave=26.6 T2=16.9. pH=5.8. Vol1=255mls Vol2=510mls Total Vol=697mls. Pump stopped itself and was restarted twice. [Mkr-113]	R741-HFS-23-0014	Butterfield	
15:46:13 Sep 04 2003	1525	35	Piston sample at Mkr-113.			R741-047
15:48:01 Sep 04 2003	1525	34	Outlet of the sampler at Mkr-113.			R741-048
15:54:01 Sep 04 2003	1525	35	Turning on the HFS sensors again to take some more data.			
15:59:24 Sep 04 2003	1525	34	Done fluid sampling at mkr-113. We will move around the area here and take some temperature measurements for Amanda.			
16:04:42 Sep 04 2003	1525	18	Mkr-113 - T=5.6 near the Limpets.			R741-049
16:06:02 Sep 04 2003	1525	17	Mkr-113 - T=4.0.			R741-050
16:07:35 Sep 04 2003	1525	18	Mkr-113 - T=13. Near Palm worms.			R741-051
16:08:01 Sep 04 2003	1525	17	Mkr-113 - T=22 measured approximately 10cm(?) underneath the surface of the limpets.			R741-052
16:10:22 Sep 04 2003	1525	22	Done with Amanda's temperature survey. Stowing the HFS probe.			
16:12:02 Sep 04 2003	1525	21	Heading to Village for more fluid sampling.			
17:02:15 Sep 04 2003	1521	45	Back to the bottom; approaching Village.			
17:03:58 Sep 04 2003	1523	360	Passing over some visible flow with some FeO deposits.			
17:04:40 Sep 04 2003	1521	308	Passing over more FeO on a lava pillar.			
17:05:36 Sep 04 2003	1522	71	DSC of landscape near to Village vent.			R741-053
17:05:51 Sep 04 2003	1522	57	Took one digital image of collapsed pillow with more FeO.			
17:08:16 Sep 04 2003	1519	66	Took 2 more digitals of lava pillars.			
17:09:49 Sep 04 2003	1522	47	Took another digital image of pillow lava.			
17:13:01 Sep 04 2003	1522	47	Still Transiting along the bottom trying to find Village.			
17:14:32 Sep 04 2003	1522	82	Coming over a pillar with hydrothermal activity evidence as we transit East. It appears to be right in the middle of sheet flow.			
17:15:29 Sep 04 2003	1522	72	2 DSCs of pillars next to Village vent.			R741-054
17:16:04 Sep 04 2003	1518	59	Arriving Mkr-44.			R741-055
17:16:26 Sep 04 2003	1521	67	We are at Village. Taking digital images around the site.			
17:16:42 Sep 04 2003	1520	60	Village vent.			R741-056
17:17:22 Sep 04 2003	1521	48	A worm bush at Village Vent.			R741-057
17:18:14 Sep 04 2003	1521	11	There is lots of blue mat around the site.			
17:18:32 Sep 04 2003	1523	353	Worm bush on top of the collapsed area at Village vent.			R741-058
17:19:14 Sep 04 2003	1522	4	Looking around for fluid sampling site.			
17:20:20 Sep 04 2003	1523	47	Blue mats at Village.			R741-059
17:21:00 Sep 04 2003	1523	47	Took 2 more digital images of the blue mat and other fauna at Village.			
17:30:21 Sep 04 2003	1523	51	Tube worm bush with limpets at Village Vent.			R741-060
17:31:40 Sep 04 2003	1523	47	Still searching for good fluid sampling site where ROPOS can set down.			
17:32:15 Sep 04 2003	1523	67	The sampling site at Village vent.			R741-061

Time UTC	Z (m)	Hdg	R741 2003 Comments	Samples	Investigator	FrGrab
17:32:38 Sep 04 2003	1523	66	Found a good potential site. Taking out the HFS probe to look for temperature. Took one digital image.			
17:34:34 Sep 04 2003	1523	67	T= 7.8 (Village Vent).			R741-062
17:35:11 Sep 04 2003	1523	67	HFS valve is not working. Just came back on.			
17:35:55 Sep 04 2003	1524	66	T= 9.8 (Village Vent).			R741-063
17:36:34 Sep 04 2003	1523	66	T ~12 (Village Vent).			R741-064
17:37:50 Sep 04 2003	1523	67	T=12 (Village Vent).			R741-065
17:40:23 Sep 04 2003	1523	67	T= 27 - Village Vent.			R741-066
17:41:03 Sep 04 2003	1523	66	Found a good place to fluid sample and locked off the arm. Wait for temperature to stabilize.			
17:42:22 Sep 04 2003	1523	64	PH reading here is 5.6.			
17:42:26 Sep 04 2003	1523	64	Fluid sampler positioned at Village Vent.			R741-067
17:43:20 Sep 04 2003	1523	64	Sampling HFS unfiltered piston #22. Start 1743 Stop 1750. Tmax=28.1 Tave=27.4 T2=14 pH=5.6. Vol=675mls. [Village]	R741-HFS-22-0015	Butterfield [ssmp: Bolton]	
17:43:34 Sep 04 2003	1523	64	Fluid sampler outlet during piston sampling.			R741-068
17:46:20 Sep 04 2003	1523	62	Tube worms and limpets at Village Vent.			R741-069
17:52:04 Sep 04 2003	1523	63	Sampling HFS DNA flat filter #12. Start 1752 Stop 1804. Tmax=27.3 Tave=24.8 T2=13 pH=5.6. Vol=1045mls. [Village]	R741-HFS-12-0016	Butterfield [ssmp: Bolton]	
17:52:08 Sep 04 2003	1523	63	Outlet of fluid sampler at Village.			R741-070
17:57:58 Sep 04 2003	1523	63	Mkr-44 at Village vent.			R741-071
18:01:00 Sep 04 2003	1523	63	Snails at the periphery of Village Vent.			R741-072
18:02:46 Sep 04 2003	1523	62	Limpets and blue mats at Village Vent.			R741-073
18:03:29 Sep 04 2003	1523	61	Limpets and blue mats at Village Vent.			R741-074
18:04:38 Sep 04 2003	1523	62	Took 3 digital images of limpets hanging down showing suspension feeding. Blue mat above.			
18:05:29 Sep 04 2003	1523	61	The periphery of Village vent.			R741-075
18:06:15 Sep 04 2003	1523	61	Sampling HFS filtered bag #14. Start 1805 Stop 1812. Tmax=24.7 Tave=24.0 T2=13 pH=5.6. Vol=636mls. [Village]	R741-HFS-14-0017	Butterfield	
18:07:40 Sep 04 2003	1523	61	Village vent - tube worms and limpets.			R741-076
18:10:16 Sep 04 2003	1523	62	Landscaping at Village.			R741-077
18:13:20 Sep 04 2003	1523	62	Running the HFS sensors for pH reading. Measured a pH of 5.55.			
18:17:53 Sep 04 2003	1523	63	Going to do some suction sampling in the flow for Gitai.			
18:21:48 Sep 04 2003	1523	59	Flushing into jar 8 first.			
18:24:12 Sep 04 2003	1523	62	Moving the suction intake into place then flush into jar 8 again before beginning to sample.			
18:26:24 Sep 04 2003	1523	61	Measuring temperature in flow above tubeworm patch before sampling. Talien=13 max.			
18:26:32 Sep 04 2003	1523	61	Intake of suction sampler for dissolved organic carbon fluid. Fluid temperature with alien is 9.5C.			R741-078
18:30:54 Sep 04 2003	1523	63	Suctioning into jar 1 for DOC. Start 1831 Stop 1834. [Village]	R741-SS-J1-0018	Yahel	
18:37:08 Sep 04 2003	1523	60	Suctioning a duplicate DOC sample into jar 2. Start 1837 Stop 1840. Talien=5 average. [Village]	R741-SS-J2-0019	Yahel	

Time UTC	Z (m)	Hdg	R741 2003 Comments	Samples	Investigator	FrGrab
18:37:25 Sep 04 2003	1523	61	Position of intake for suction into jar #2 for Gitai Yahel at Village.			R741-079
18:42:13 Sep 04 2003	1523	62	Repositioning the suction intake for a third duplicate DOC sample.			
18:43:07 Sep 04 2003	1523	61	Suctioning a third duplicate sample for DOC into jar 3. Start 1844 Stop 1845. [Village]	R741-SS-J3-0020	Yahel	
18:44:12 Sep 04 2003	1523	61	Position for suction into Jar#3 at Village for Yahel.			R741-080
18:57:52 Sep 04 2003	1450	146	Rising to depth 1300m and Transiting to first transponder for release.			
19:29:58 Sep 04 2003	1269	165	Still transiting to XP 10.5.			
20:11:50 Sep 04 2003	1319	180	Starting to look for XP 10.5; nearing location on nav.			
20:16:34 Sep 04 2003	1339	178	XP 10.5 in view; great navigation!			
20:21:00 Sep 04 2003	1342	208	Approaching XP 10.5. Positioning to hook XP 10.5 and cut the line. We will hold onto XP 10.5 until we reach XP 11.5 and then release them together.			
20:25:30 Sep 04 2003	1347	151	Hooking transponder XP 10.5.			R741-081
20:26:09 Sep 04 2003	1347	155	Still trying to hook the line of XP 10.5.			
20:29:23 Sep 04 2003	1348	149	XP 10.5 successfully hooked.			
20:32:06 Sep 04 2003	1349	133	Line of XP 10.5 cut. We will now transit to XP 11.5 with XP 10.5 attached to ROPOS.			
20:38:55 Sep 04 2003	1306	302	Transit to XP 11.5 will be about 1 to 1.5 hours.			
22:10:06 Sep 04 2003	1290	335	Going down. Starting to search for XP 11.5.			
22:12:52 Sep 04 2003	1306	319	XP 11.5 in sight on the SIT camera.			
22:22:17 Sep 04 2003	1307	234	Positioning to hook XP 11.5.			
22:23:04 Sep 04 2003	1308	268	XP 11.5 hooked! So quick - these guys are good!			
22:23:59 Sep 04 2003	1308	273	Preparing to pull the pin to release both XP 10.5 and 11.5 at the same time.			
22:24:26 Sep 04 2003	1308	269	Releasing tethered transponders.			R741-082
22:27:13 Sep 04 2003	1308	262	Line cut; XPs released. It will be about 20-25 minutes to the surface.			
22:27:30 Sep 04 2003	1309	255	Releasing tethered transponders.			R741-083
22:29:20 Sep 04 2003	1323	342	ROPOS back to the cage; waiting for transponders to be recovered on the ship.			
22:49:38 Sep 04 2003	1267	237	'Eyelash' jelly.			R741-084
23:05:25 Sep 04 2003	1260	110	XPs on board.			
23:08:22 Sep 04 2003	1265	77	We're headed NW towards N3.			
23:52:01 Sep 04 2003	1271	317	Jelly fish.			R741-085
00:06:31 Sep 05 2003	1520	27	We can see bottom and there are white clumps in the basalt.			
00:08:00 Sep 05 2003	1526	26	We are hovering a meter off the bottom and taking a look around.			
00:09:19 Sep 05 2003	1529	294	Crack with blue mat near N3.			R741-086
00:10:40 Sep 05 2003	1528	142	Tubeworms are evident with visible fluid flow.			
00:11:04 Sep 05 2003	1528	136	Blue mat and tubeworms near N3.			R741-087
00:12:49 Sep 05 2003	1529	179	Tubeworms and bluemats.			R741-088

Time UTC	Z (m)	Hdg	R741 2003 Comments	Samples	Investigator	FrGrab
00:14:10 Sep 05 2003	1529	186	Moving three digital images of tubeworm bush with distinct zones of limpets and blue mat.			
00:18:14 Sep 05 2003	1529	182	Checking out temperatures to decide if we want to sample. T=4.5 at worm bush. Not here.			
00:23:58 Sep 05 2003	1529	144	Tubeworms at N3.			R741-089
00:24:02 Sep 05 2003	1529	141	Taking temperature at large tube worm bush. Tmax=16.0. Out-take fluid is clear. We'll take the sample here; temperature is stable; Tave=15.			
00:27:00 Sep 05 2003	1529	138	Transferred six digital images of blue mat area.			
00:32:22 Sep 05 2003	1529	141	Running sensors to determine pH; pH=5.38.			
00:38:02 Sep 05 2003	1529	141	HFS piston #20. Start=0037 Stop=0045. T1=16 T2=9.2 Tmax=17.6 Tavg=14.1. pH=5.38. Vol=756ml. Location is in large tube worm bush surrounded by blue mats. [Mkr-N3]	R741-HFS-20-0021	Butterfield	
00:38:38 Sep 05 2003	1529	142	White and blue at N3.			R741-090
00:39:17 Sep 05 2003	1529	141	Blue mats at N3.			R741-091
00:39:40 Sep 05 2003	1529	141	Blue mats at N3.			R741-092
00:40:38 Sep 05 2003	1529	140	Transferred two digital files of blue mats.			
00:42:06 Sep 05 2003	1529	142	Hot fluid sample at N3.			R741-093
00:46:15 Sep 05 2003	1529	139	Tubeworms, limpets and scale worms at N3.			R741-094
00:46:58 Sep 05 2003	1529	141	HFS with DNA/Sterivex filter #15. Start=0047 Stop=0103. T2=9.6 Tmax=18.1 Tavg=15.2. pH=5.38. Vol=1229ml. Location is in large tube worm bush surrounded by blue mats. [Mkr-N3]	R741-HFS-15-0022	Butterfield [ssmp: Bolton]	
00:48:19 Sep 05 2003	1529	143	Blue mats at N3.			R741-095
00:52:29 Sep 05 2003	1530	142	Blue mats and limpets at N3.			R741-096
00:57:23 Sep 05 2003	1530	138	Limpets and blue mats at N3.			R741-097
01:03:25 Sep 05 2003	1530	139	Tubeworms, limpets and blue mats around N3.			R741-098
01:05:40 Sep 05 2003	1530	142	Taking some temperature measurements in the flow area and in the area next to sampling spot in blue mats. Tmax=8 in limpets. Tavg=3.5 in blue mats. Hard rock is underneath mats; no flow.			
01:06:58 Sep 05 2003	1530	141	Temperature in tubeworms at N3.			R741-099
01:10:26 Sep 05 2003	1530	138	Temperature in blue mats.			R741-100
01:10:43 Sep 05 2003	1530	143	Surveying area for limpet population and other high/low flow areas.			
01:12:00 Sep 05 2003	1530	144	Blue mats at N3.			R741-101
01:12:14 Sep 05 2003	1530	140	Bluemats at N3.			R741-102
01:13:20 Sep 05 2003	1530	142	N3.			R741-103
01:24:59 Sep 05 2003	1530	19	Tubeworms and blue mats at N3.			R741-104
01:25:04 Sep 05 2003	1531	16	White low flow at N3.			R741-105
01:26:33 Sep 05 2003	1529	36	N3.			R741-106
01:28:51 Sep 05 2003	1531	360	Taking temperature samples at high flow/high flock area. Tmax=21.8. Taking a pH reading; pH=5.17.			
01:30:51 Sep 05 2003	1530	359	Temperature probe at N3 into the white mat.			R741-107

Time UTC	Z (m)	Hdg	R741 2003 Comments	Samples	Investigator	FrGrab
01:41:20 Sep 05 2003	1530	351	HFS with bag filter #16. Start=0143 Stop=0146 Start2=0146 Stop2=0148. T2=12.5 Tmax=20.6 Tavg=17.2. pH=5.38. Vol=500ml. The sample is in an area of high flow/high flock. Filter has clogged twice. [Mkr-N3]	R741-HFS-16-0023	Butterfield	
01:43:04 Sep 05 2003	1530	355	Three files transferred of sample HFS-16 area.			
01:50:08 Sep 05 2003	1530	359	Begin transit to Mkr-33 and Cloud.			
02:41:14 Sep 05 2003	1484	188	ROPOS has arrived nearby Cloud.			
02:44:12 Sep 05 2003	1519	202	Rock formation near Cloud?			R741-108
02:47:25 Sep 05 2003	1521	183	Lava pillar in the area of Mkr-33/Cloud we think. We have no transponders.			R741-109
02:48:00 Sep 05 2003	1521	297	A lava pillar roof.			R741-110
02:49:14 Sep 05 2003	1518	283	We're looking for Cloud Vent.			
02:50:42 Sep 05 2003	1519	300	We're on top of lobate flow with lots of hydrothermal features. Collapse areas all around us.			
02:51:20 Sep 05 2003	1518	132	We're going to head southeast toward the cage.			
02:52:28 Sep 05 2003	1521	138	Searching for cloud and looking for vent.			R741-111
02:53:24 Sep 05 2003	1523	219	Looks like we're there.			
02:53:42 Sep 05 2003	1523	212	We're at Cloud.			R741-112
02:54:07 Sep 05 2003	1523	209	We're going to take a water sample in the hole (formerly the spot of Mkr-N6 - which has disappeared).			
02:54:26 Sep 05 2003	1525	255	We're at Cloud which is a unique vent.			R741-113
02:54:51 Sep 05 2003	1525	292	2 digital images sent to hard drive.			
02:55:30 Sep 05 2003	1526	325	Beautiful image of worms.			R741-114
02:58:01 Sep 05 2003	1526	332	Going to take a bag sample - no filter for Sheryl.			
02:59:12 Sep 05 2003	1526	333	Probe inserted in vent.			R741-115
03:01:09 Sep 05 2003	1526	332	Over the last three years the hole has gone for ~15 to ~8 degrees.			
03:02:04 Sep 05 2003	1526	333	Dave's trying to get a pH first here in the hole. Temp=8 and slowly going up. Dave says this is a great big pipe - tapping some type of reservoir. Mostly particulate sulfur - pH looks like 6.72.			
03:04:21 Sep 05 2003	1526	332	HFS unfiltered bag#18. pH=6.72. Start 0305:30 Stop 0311. Tmax=8.1 Tavg=8.0 T2=6.1 Standard dev 0.03. pH=6.72. Vol=623ml. In the hole. [Cloud]	R741-HFS-18-0024	Butterfield	
03:16:07 Sep 05 2003	1526	330	Flushing Jar#8 right now.			
03:16:44 Sep 05 2003	1526	331	SS where LA-F (a near array) was placed for the last 2 years. Background collection of the community to compare it with what settled on the array. Start 0320 Stop 0328. [Cloud]	R741-SS-J7-0025	Kelly	
03:20:54 Sep 05 2003	1526	328	Suction sampling near LA-F.			R741-116
03:30:35 Sep 05 2003	1523	219	We're on our way to Mkr-33 for more fluid and suction sampling.			
03:32:09 Sep 05 2003	1522	214	We're stirring up the bacterial flock.			
03:32:17 Sep 05 2003	1523	221	Experiments at Mkr-33.			R741-117
03:34:21 Sep 05 2003	1525	155	Osmo sampler at Mkr-33. Looks like the work of Geoff Wheat. May have been deployed by MBARI last year.			R741-118
03:36:50 Sep 05 2003	1525	130	Biological experiments at Mkr-33.			R741-119



Time UTC	Z (m)	Hdg	R741 2003 Comments	Samples	Investigator	FrGrab
03:37:21 Sep 05 2003	1525	133	Three digitals sent to hard drive.			
03:39:00 Sep 05 2003	1524	167	Another digital image of biology experiments. The cage may be moved.			
03:41:59 Sep 05 2003	1524	188	We're looking for a spot with high flow for Dave to do a few water samples.			
03:43:45 Sep 05 2003	1524	217	We're trying to decide what to do with the growth cage. We will probably have to move it while water sampling.			
03:43:57 Sep 05 2003	1524	213	Racetrack and growth cage.			R741-120
03:46:08 Sep 05 2003	1524	126	Probe sampling water at growth cage.			R741-121
03:46:24 Sep 05 2003	1524	126	Dave is checking the temperature near the cage.			
03:50:17 Sep 05 2003	1524	125	The cage has been pushed away from the crack so that Dave can check the temp.			
03:54:57 Sep 05 2003	1524	121	Looks like we've found a hot spot to sample. We're waiting for the temperature to stabilize.			
03:55:00 Sep 05 2003	1524	123	Temperature probe in vent beside experiments.			R741-122
03:56:46 Sep 05 2003	1524	123	pH sensors are on and we're waiting for that to stabilize. pH=6.2.			
03:58:35 Sep 05 2003	1524	124	HFS filtered bag #17. pH=6.2. Start 0400 Stop 0406. Tmax=13.0 Tavg=12.4 T2=6.5 pH=6.2. Vol=570ml. [Mkr-33]	R741-HFS-17-0026	Butterfield	
04:02:52 Sep 05 2003	1524	121	Sampling site at Mkr-33.			R741-123
04:07:52 Sep 05 2003	1524	124	Start bag #19 unfiltered. Start 0408 Stop 0414. Tmax=12.5; Tavg=11.5+/-0.5; T2= 6.2; Vol=625ml; pH=6.2. [Mkr-33]	R741-HFS-19-0027	Butterfield [ssmp: Bolton]	
04:15:38 Sep 05 2003	1524	121	Start sterivex filter #21 for DNA. Start 0415 Stop 0428. Tmax=12.6; Tave=10.9 .76; T2=6.1; Vol=1047ml; pH=6.2. [Mkr-33]	R741-HFS-21-0028	Butterfield [ssmp: Bolton]	
04:31:06 Sep 05 2003	1524	121	Start #10 for RNA. Start 0431 Stop 0444. Tmax=12.4; Tave=11.2=+/-0.5; T2=7.0; Vol=1002 ml; pH=6.2. This will have an in situ RNA later preservative pumped into the sample afterwards. [Mkr-33]	R741-HFS-10-0029	Butterfield [ssmp: Bolton]	
04:39:03 Sep 05 2003	1524	121	Two digital stills of HFS sampling nozzle and growth cage at Mkr-33.			
04:46:33 Sep 05 2003	1524	122	65ml of RNA later reverse pumped into sample #10.			
04:48:24 Sep 05 2003	1524	125	Just forward pumped an additional 20ml into #10.			
04:52:46 Sep 05 2003	1524	121	We're done fluid sampling.			
04:57:02 Sep 05 2003	1524	122	Preparing to suction sample into jar #8 for palm worms.			
04:58:37 Sep 05 2003	1524	129	Mkr-33 suctioning for palm worms.			R741-124
04:59:02 Sep 05 2003	1524	127	Suction for palm worms into jar#8. Start1 0459; Stop1 0450. Repositioning. Start2 0503; Stop2 0506. Moving to do other tasks (see below). We will reposition along crack to sample more palm worms later. Start3 0525; Stop3 0528. [Mkr-33]	R741-SS-J8-0030	Lee	
05:03:30 Sep 05 2003	1524	113	Suction of palm worms.			R741-125
05:09:23 Sep 05 2003	1524	122	Stowed the HFS intake. Repositioning Noreen's growth cage more into the flow.			
05:15:14 Sep 05 2003	1524	127	Noreen's cage repositioned. Two digital images of the growth cage.			
05:15:31 Sep 05 2003	1524	115	Noreen's growth cage.			R741-126
05:21:01 Sep 05 2003	1524	283	15 digital images of Amanda's racetrack transferred.			

Time UTC	Z (m)	Hdg	R741 2003 Comments	Samples	Investigator	FrGrab
05:22:33 Sep 05 2003	1524	278	Two more digital images of the racetrack.			
05:24:06 Sep 05 2003	1524	217	Recommencing suctioning of palm worms into jar#8 at Mkr-33.			
05:26:03 Sep 05 2003	1524	221	Sucking up Ray's palm worms.			R741-127
05:31:47 Sep 05 2003	1524	247	We just moved to the tubeworm bush just west of Mkr-33 crack to find more palm worms to suction into Jar#8. Start4 0523; Stop 0533.			
05:35:36 Sep 05 2003	1523	340	Picked up Dave's old RAS tripod; we are heading back to the cage to begin ascent.			
05:39:23 Sep 05 2003	1439	42	Moving two DSCs.			
05:40:45 Sep 05 2003	1394	40	Coming up.			
06:24:41 Sep 05 2003	1	24	ROPOS is on deck. End of the dive.			

## 10.12 R742 2003 Dive Log

**North Caldera Rim** Five extensometers were deployed on the north rim of the caldera. Pressure sensor measurements were performed at EXT#1-5 then back again to EXT#1 to close the loop. Ray's plunger was tested. The dive finished early due to high winds. Due to the weather we were not able to go to CASM and finish with the dive tasks.

Time UTC	Z (m)	Hdg	R742 2003 Comments	Samples	Investigator	FrGrab
17:14:15 Sep 05 2003	0	8	ROPOS in the water.			
17:16:54 Sep 05 2003	21	2	Elevator on the bottom.			
18:18:20 Sep 05 2003	1506	59	ROPOS arriving at the bottom.			
18:19:18 Sep 05 2003	1510	127	We're looking for the elevator.			
18:33:22 Sep 05 2003	1511	115	Video tapes started.			
18:33:53 Sep 05 2003	1512	116	Still searching for the extensometer elevator. Not getting a response from the elevator.			
18:45:06 Sep 05 2003	1512	121	Elevator is about 50m from the cage but we don't know in what direction. Still searching.			
18:51:01 Sep 05 2003	1511	238	Going back to the cage. Tether management.			
18:56:41 Sep 05 2003	1478	146	Back at the cage. Going back down to the bottom right beneath the cage.			
19:03:22 Sep 05 2003	1511	158	We found the elevator!			
19:05:50 Sep 05 2003	1513	133	Pulling out the lower release line which holds the five extensometers in place.			
19:06:11 Sep 05 2003	1511	137	Elevator with extensometers.			R742-001
19:06:40 Sep 05 2003	1510	146	Elevator with extensometers.			R742-002
19:09:13 Sep 05 2003	1510	206	Note: the upper line holding the extensometers on the elevator had come off during descent. Preparing to grab extensometer (EXT) #1 out of the elevator.			
19:12:13 Sep 05 2003	1509	133	EXT#1 in claw. Placing it on the bottom in order to re-grab it at the base.			
19:19:05 Sep 05 2003	1508	107	Picking up EXT#1 again. Moving it to a flatter spot so it's easier to grab at base.			
19:23:33 Sep 05 2003	1514	130	Trying to readjust the DSC camera.			
19:28:32 Sep 05 2003	1514	128	EXT#1 picked up by the base. We're just waiting around until the DSC is fixed.			
19:29:23 Sep 05 2003	1514	128	Crab.			R742-003
19:34:59 Sep 05 2003	1513	126	Acoustic position for the elevator: X=420330 Y=5093759.			
19:35:34 Sep 05 2003	1513	121	Bearing to the first deployment site (E1) is 120 for 34 m. Moving to E1 site.			
19:42:31 Sep 05 2003	1514	188	Placing EXT#1 at E1 site. First put EXT#1 in thick sediment, but the legs sunk in most of the way and were not touching rock beneath. This site is between two cracks about 4m apart. EXT#1 is on a rise between the cracks.			
19:46:52 Sep 05 2003	1514	175	First extensometer settled in position.			R742-004
19:48:16 Sep 05 2003	1514	313	Bill is considering moving EXT#1 because it sunk into the sediment quite a bit. Looking around for a better spot.			
19:50:49 Sep 05 2003	1514	311	Adjusting the SIT camera.			
19:53:03 Sep 05 2003	1514	282	Back at EXT#1. We are going to push down on EXT#1 and see if it is stable in the sediment (i.e. sitting on rock below the sediment). If so EXT#1 will stay in this position.			
19:55:11 Sep 05 2003	1514	282	Pushing down on base of EXT#1. It does not look stable so we're going to look around for a new site nearby and then pick up EXT#1 and move it.			
20:02:02 Sep 05 2003	1512	138	Still looking for a good spot for repositioning EXT#1.			

Time UTC	Z (m)	Hdg	R742 2003 Comments	Samples	Investigator	FrGrab
20:07:11 Sep 05 2003	1512	280	Picked a new spot for E1 about 5m away on the lava without sediment near the edge of a crack. Going back to EXT#1. Picking EXT#1 up and moving it to the new E1 site.			
20:11:02 Sep 05 2003	1514	168	Crab and crack.			R742-005
20:16:44 Sep 05 2003	1514	3	Landed at new E1 site. Stirred up sediment; waiting for it to settle to pan around with the color camera to document terrain. Looking north. There is a big crack oriented NW/SE; putting EXT#1 on the west side of the crack.			
20:20:01 Sep 05 2003	1513	1	There is a large pillow in the east side of the crack.			
20:20:18 Sep 05 2003	1513	5	Deploying EXT#1 at new E1 site. Good XY fix of this new location is 420343.6 5093736.			
20:22:03 Sep 05 2003	1514	3	Position of EXT#1.			R742-006
20:22:54 Sep 05 2003	1513	331	Flying around to check out the orientation of EXT#1. Looks very good!			
20:23:05 Sep 05 2003	1513	260	Position of EXT#1.			R742-007
20:24:32 Sep 05 2003	1512	273	Position of EXT#1.			R742-008
20:24:37 Sep 05 2003	1511	282	Position of EXT#1.			R742-009
20:25:21 Sep 05 2003	1512	12	Position of EXT#1.			R742-010
20:25:42 Sep 05 2003	1513	27	Position of EXT#1.			R742-011
20:25:51 Sep 05 2003	1513	20	Going back to EXT#1 to take pressure measurements.			
20:29:18 Sep 05 2003	1513	18	Took 8 digital images since the beginning of the dive. First few of the elevator. Last 5 or so of EXT#1 positioned at E1 site.			
20:30:34 Sep 05 2003	1513	19	Starting a pressure measurement at E1 site. Holding the pressure sensor on the nose of the baseplate.			
20:35:57 Sep 05 2003	1513	18	Pressure sensor reading at EXT#1.			R742-012
20:36:45 Sep 05 2003	1513	21	Pressure sensor reading at EXT#1 with fish in background.			R742-013
20:38:48 Sep 05 2003	1513	18	Rattail fish.			R742-014
20:39:11 Sep 05 2003	1513	20	Rattail fish.			R742-015
20:59:56 Sep 05 2003	1513	20	Stopped pressure measurement at E1 site. We are now getting a frame grab as we are backing away from EXT#1 and will then head to the elevator.			
21:01:47 Sep 05 2003	1513	20	Restarted STS; pressure measurements interrupted for ~10-20 seconds.			
21:03:48 Sep 05 2003	1513	21	One digital image of EXT#1 and pressure sensor taken up close.			
21:05:42 Sep 05 2003	1513	37	Backing away from site E1 and stowing pressure sensor in the cradle.			
21:07:39 Sep 05 2003	1510	170	Re-approaching site E1 for some images (digitals and framegrabs).			
21:08:06 Sep 05 2003	1512	181	EXT#1 in place.			R742-016
21:09:23 Sep 05 2003	1511	262	Transferring 4 digital files. We lost the comms on the digital still camera.			
21:19:41 Sep 05 2003	1509	359	We are back at the elevator and are getting EXT#2.			
21:22:48 Sep 05 2003	1508	180	We are grabbing the top of the tube on EXT#2 and placing it on seafloor to reposition for transport. We are trying to untangle the line wrapped around the base of the EXT#2.			
21:29:24 Sep 05 2003	1513	254	Untangling the line at the base of EXT#2.			R742-017
21:34:26 Sep 05 2003	1513	253	The line has been successfully removed. We are grabbing the leg of EXT#2 for transit to site E2.			

Time UTC	Z (m)	Hdg	R742 2003 Comments	Samples	Investigator	FrGrab
21:38:23 Sep 05 2003	1509	89	We have left the bottom for transit at 21:36.			
21:39:42 Sep 05 2003	1512	113	We have reached the site for E2. We are on a 5m ledge of intact pillows between two fissures. The site is on the edge of the fissure to the west. The fissure to the east is the largest one on the north rift (50m).			
21:40:41 Sep 05 2003	1515	340	We are looking north and there is no sediment on this site.			R742-018
21:40:59 Sep 05 2003	1516	356	Checking out a pillow lava for deployment of E2.			R742-019
21:42:13 Sep 05 2003	1518	330	A close image of E2 site before we deploy EXT#2.			R742-020
21:44:01 Sep 05 2003	1519	310	Digital camera is now online. We are going to see how long it remains online.			
21:45:12 Sep 05 2003	1519	310	We are approximately 15m north of the target site.			
21:46:00 Sep 05 2003	1519	304	We are positioning the base of EXT#2 so that the platform for the pressure sensor is stable.			
21:47:07 Sep 05 2003	1519	307	We took one additional digital still. When we tried to transfer this file we received a timeout error message for 5 images. The additional 4 images are from 21:09:23. These images have not been successfully transferred.			
21:50:23 Sep 05 2003	1519	356	We turned the digital still camera on and tried to do a picture count and the camera again went offline.			
21:53:16 Sep 05 2003	1519	353	We are still positioning the platform of EXT#2 in a stable position with all three legs on the seafloor in a flat orientation.			
21:53:40 Sep 05 2003	1519	5	Checking leg position after repositioning EXT#2.			R742-021
21:54:16 Sep 05 2003	1519	92	Checking leg position after repositioning EXT#2.			R742-022
21:55:50 Sep 05 2003	1519	86	We are using the arm to push down on the platform to ensure that the platform is stable. Two of the legs are too high and the platform is tilting with the pressure from the arm. We are repositioning the platform.			
22:01:15 Sep 05 2003	1519	78	The platform is now in a stable position. Good fix of E2 site: UTM X=420458.3 Y=5093763.			
22:02:10 Sep 05 2003	1519	80	Preparing to do a pressure measurement.			
22:05:14 Sep 05 2003	1519	83	We are starting the pressure measurement at E2.			
22:05:16 Sep 05 2003	1519	83	Pressure sensor reading at E2.			R742-023
22:06:15 Sep 05 2003	1519	82	The digital camera is still offline.			
22:34:34 Sep 05 2003	1519	80	Stopping pressure measurement at E2. We are going to stow the pressure sensor first and then back away taking framegrabs of EXT#2 position.			
22:37:44 Sep 05 2003	1517	74	We have successfully stowed the pressure sensor and are now backing away taking framegrabs of EXT#2 on the 5m ledge.			
22:37:47 Sep 05 2003	1517	71	Position of EXT#2.			R742-024
22:37:51 Sep 05 2003	1517	58	Position of EXT#2.			R742-025
22:38:33 Sep 05 2003	1516	345	Position of EXT#2.			R742-026
22:39:17 Sep 05 2003	1517	328	Position of EXT#2.			R742-027
22:39:24 Sep 05 2003	1518	342	Position of EXT#2.			R742-028
22:39:42 Sep 05 2003	1519	357	We are now heading back to the elevator to get EXT#3. The elevator is at 114 degrees west. Navigation is getting good fixes.			
22:39:58 Sep 05 2003	1518	346	Crack near E2.			R742-029
22:42:21 Sep 05 2003	1508	239	The elevator is in site.			
22:46:06 Sep 05 2003	1508	237	We are pulling EXT#3 out of the elevator.			

Time UTC	Z (m)	Hdg	R742 2003 Comments	Samples	Investigator	FrGrab
22:49:02 Sep 05 2003	1513	241	Placed EXT#3 on the seafloor and are grabbing the platform leg in the arm.			
22:50:13 Sep 05 2003	1513	248	We have EXT#3 in the claw and we are driving toward the E3 site. We are getting in front of the cage before we move the ship. The line of instruments is west to east (E1 to E5).			
22:52:08 Sep 05 2003	1508	90	We are able to access E3 without moving the ship.			
22:57:06 Sep 05 2003	1515	268	Headed back west to look at the big crack in the rift zone. Looks like a big fissure.			
22:58:20 Sep 05 2003	1518	38	ROPOS is headed back east to E3. Trying to get in the middle of the first high spot east of the fissure.			
23:00:27 Sep 05 2003	1517	60	Found a good spot; approximately 4m east of fissure. On top of a big pillow.			
23:00:51 Sep 05 2003	1517	55	We will try to put he EXT#3 on one of this big pillow.			R742-030
23:05:21 Sep 05 2003	1517	323	We're now attempting to position EXT#3. The position is about 20m west of proposed position for EXT#3; new position bears 278 from proposed position.			
23:08:27 Sep 05 2003	1517	325	Site ended up being unworkable; moving more to the east.			
23:11:28 Sep 05 2003	1517	149	Placing EXT#3 at new site. EXT#3 settles well on the pillow lava.			
23:12:18 Sep 05 2003	1517	134	EXT#3 on the top of the pillow.			R742-031
23:12:38 Sep 05 2003	1515	210	EXT#3 on the top of the pillow.			R742-032
23:13:46 Sep 05 2003	1517	315	New E3 position is approximately 6m east of largest fissure. The three legs are resting on a pillow lava; sticking out of the sediment.			
23:15:08 Sep 05 2003	1517	306	Site is good. Preparing to do a pressure sensor reading.			
23:20:18 Sep 05 2003	1517	268	Pressure sensor has been placed on the nose of the baseplate. Starting pressure measurement at 2320.			
23:22:00 Sep 05 2003	1517	268	Taking the pressure of EXT#3.			R742-033
23:24:51 Sep 05 2003	1517	268	Position of E3: X=420513.5 and Y=5093753.			
23:50:00 Sep 05 2003	1517	265	Pressure sensor measurement complete.			
23:51:21 Sep 05 2003	1517	267	Pressure done at EXT#3.			R742-034
23:52:16 Sep 05 2003	1515	230	Pressure sensor almost in the box.			R742-035
23:52:51 Sep 05 2003	1514	212	Successfully stowed pressure sensor and backing away from E3 while getting framegrabs of area.			
23:53:41 Sep 05 2003	1513	202	Overview of the site around EXT#3.			R742-036
23:53:55 Sep 05 2003	1514	184	Overview of the site around EXT#3.			R742-037
23:54:12 Sep 05 2003	1513	179	Overview of the site around EXT#3.			R742-038
23:54:38 Sep 05 2003	1515	172	Overview of the site around EXT#3.			R742-039
23:54:48 Sep 05 2003	1515	168	Base of the EXT#3.			R742-040
23:55:00 Sep 05 2003	1516	161	Base of the EXT#3.			R742-041
23:55:05 Sep 05 2003	1516	153	ROPOS is headed west back to the elevator.			
00:03:11 Sep 06 2003	1509	258	Elevator in sight.			
00:03:55 Sep 06 2003	1507	277	We're going to try to grab both remaining extensometers (EXT#4 and EXT#5) so that we only have to move the ship once.			
00:12:51 Sep 06 2003	1511	313	Grabbed EXT#5 and are lifting it out of the elevator.			
00:14:39 Sep 06 2003	1510	7	Placing EXT#5 down to retrieve EXT#4.			
00:18:05 Sep 06 2003	1510	189	We've got EXT#4 out of the elevator.			

Time UTC	Z (m)	Hdg	R742 2003 Comments	Samples	Investigator	FrGrab
00:26:52 Sep 06 2003	1514	277	In the process of picking up both extensometers in each of ROPOS' arms for transit.			
00:35:16 Sep 06 2003	1514	283	ROPOS has successfully picked up EXT#4 and EXT#5. Next we will be moving the ship into position over E3.			
00:56:39 Sep 06 2003	1518	270	Dropping off EXT#4 at a temporary spot and continuing on to E5 to place EXT#5 and then we'll return.			
00:57:24 Sep 06 2003	1513	100	Headed east and dropping down 5m closer to the bottom.			
01:04:52 Sep 06 2003	1522	109	Fish near the hole.			R742-042
01:05:18 Sep 06 2003	1522	115	Passing over an area of sinkholes.			
01:05:54 Sep 06 2003	1521	136	In search of a good spot to put EXT#5.			
01:10:40 Sep 06 2003	1523	125	Putting down EXT#5 in order to pick it up with the 7-function arm for better control.			
01:17:08 Sep 06 2003	1523	88	Trying to position EXT#5.			R742-043
01:17:10 Sep 06 2003	1523	86	Placing EXT#5. Checking to make sure the base is stable and on hard rock.			
01:18:45 Sep 06 2003	1523	87	We're on the edge of a little depression - making minor adjustments.			
01:21:49 Sep 06 2003	1523	98	Area won't work; looking for a new site within the immediate area.			
01:24:16 Sep 06 2003	1523	82	Site proves to not be a good one; we're headed farther east.			
01:26:12 Sep 06 2003	1520	87	We can't see any outcrops to the east - we'll head back to the west.			
01:29:43 Sep 06 2003	1522	238	Finally a promising site!			
01:32:31 Sep 06 2003	1523	181	Attempting to position EXT#5. The rock outcrop is fairly uneven.			
01:34:07 Sep 06 2003	1523	177	Trying to position EXT#5.			R742-044
01:39:57 Sep 06 2003	1523	172	EXT#5 looks to be stable; ROPOS will fly around E5 to make sure.			
01:40:59 Sep 06 2003	1522	79	Flying around EXT#5.			R742-045
01:41:12 Sep 06 2003	1523	60	Success! E5 is located at UTM X=420641 Y=5093765; which is approximately 50m west of the original target.			
01:42:12 Sep 06 2003	1523	127	Flying around EXT#5.			R742-046
01:43:25 Sep 06 2003	1523	145	Pressure measurement at EXT#5.			R742-047
01:43:50 Sep 06 2003	1523	149	Preparing to take pressure measurements. Beginning measurements at 0144.			
01:46:21 Sep 06 2003	1523	146	E5 is on a pillow outcrop; approximately 4m east of a fissure that is approximately 3m wide. Thick sediment to the west and the pillow outcrops are exposed on the edge of the fissure.			
02:14:34 Sep 06 2003	1523	148	End of pressure measurements.			
02:17:20 Sep 06 2003	1517	141	Pressure sensor is stowed. Getting some framegrabs of E5.			
02:17:57 Sep 06 2003	1520	146	EXT#5.			R742-048
02:18:05 Sep 06 2003	1521	147	Base of EXT#5.			R742-049
02:18:10 Sep 06 2003	1522	146	Base of EXT#5.			R742-050
02:18:17 Sep 06 2003	1523	145	Base of EXT#5.			R742-051
02:18:39 Sep 06 2003	1522	174	Around EXT#5.			R742-052
02:18:44 Sep 06 2003	1521	168	Around EXT#5.			R742-053
02:19:13 Sep 06 2003	1519	238	Headed west while the elevator is being released. We'll retrieve the elevator before we position and stabilize EXT#4.			

Time UTC	Z (m)	Hdg	R742 2003 Comments	Samples	Investigator	FrGrab
02:20:29 Sep 06 2003	1518	209	ROPOS is at E4.			
02:23:13 Sep 06 2003	1519	152	Elevator has been released.			
02:24:23 Sep 06 2003	1511	160	Ship is moving into position to recover the extensometer elevator.			
02:54:08 Sep 06 2003	1467	17	The elevator is on board after a fairly rough recovery.			
02:55:08 Sep 06 2003	1472	4	We have to go back to E4 to position it and do pressure measurements. After that we will go back to E1 for a pressure measurement.			
03:19:01 Sep 06 2003	1475	172	The ship is finally moving.			
03:32:42 Sep 06 2003	1523	138	Arrived on site. Waiting for cage to settle out in water column. Soon we will begin to look for E4.			
03:39:03 Sep 06 2003	1519	89	EXT#4 in sight at E4.			
03:41:02 Sep 06 2003	1519	194	We're at EXT#4 and we're going to try to position it so that it is stable.			
03:41:11 Sep 06 2003	1519	195	Positioning EXT#4 for stability.			R742-054
03:43:21 Sep 06 2003	1519	187	ROPOS is positioning the instrument. We're having trouble getting all 3 legs on hard rock.			
03:54:52 Sep 06 2003	1519	240	We're going to try the push test. It didn't pass.			
03:57:38 Sep 06 2003	1519	232	We're going to look at the other side. It looks pretty good actually.			
03:59:04 Sep 06 2003	1519	323	We're going to push down on the nose to see if it's stable. Bill says it looks good.			
04:03:48 Sep 06 2003	1519	324	One of the legs is unstable. We're going to have to move the tripod again or pick another site.			
04:08:55 Sep 06 2003	1519	351	EXT#4 has been repositioned and survived the push test. Next comes the pressure measurement.			
04:12:37 Sep 06 2003	1519	311	Starting the pressure measurement at E4 now.			
04:12:41 Sep 06 2003	1519	310	Starting pressure measurement at EXT#4.			R742-055
04:15:33 Sep 06 2003	1519	311	Pressure measurement at EXT#4.			R742-056
04:15:36 Sep 06 2003	1519	310	We're taking the pressure measurements at each extensometer to get a relative depth of all the instruments. The extensometers ping on each other to get distance apart within a millimeter - which will tell us if there is extension across the rift.			
04:17:59 Sep 06 2003	1519	310	Because the instruments are so close to the caldera rim we may also see inflation of the caldera if we notice depth changes from the pressure measurement readings.			
04:32:35 Sep 06 2003	1519	309	EXT#4 position: x=420566 y=5093749. E4 site is mainly sediment covered. EXT#4 is on a small low-lying rock outcrop.			
04:41:47 Sep 06 2003	1519	308	End of pressure measurement at EXT#4. We're going to stow the pressure sensor then will get some frame grabs from a distance.			
04:44:17 Sep 06 2003	1518	203	EXT#4 in position after pressure reading.			R742-057
04:44:45 Sep 06 2003	1519	205				R742-058
04:45:07 Sep 06 2003	1518	203	EXT#4 after pressure reading.			R742-059
04:45:30 Sep 06 2003	1518	207	EXT#4 in position.			R742-060
04:45:35 Sep 06 2003	1518	210	We're on our way to E1 to do a pressure reading at EXT#1.			
04:48:22 Sep 06 2003	1523	261	We're crossing the NRZ.			R742-061
04:58:04 Sep 06 2003	1516	158	North rim of the caldera.			R742-062
05:05:26 Sep 06 2003	1512	149	EXT#1 in sight.			



Time UTC	Z (m)	Hdg	R742 2003 Comments	Samples	Investigator	FrGrab
05:06:19 Sep 06 2003	1513	168	EXT#1 perched on the edge of a crack.			R742-063
05:14:30 Sep 06 2003	1514	38	Starting pressure sensor reading at EXT#1.			
05:16:23 Sep 06 2003	1514	37	Taking bottom pressure reading on EXT#1.			R742-064
05:23:13 Sep 06 2003	1514	38	Brittle star near EXT#1.			R742-065
05:23:49 Sep 06 2003	1514	38	Brittle star near E1.			R742-066
05:28:21 Sep 06 2003	1514	37	Crab closeup.			R742-067
05:28:43 Sep 06 2003	1514	38	Look at that nose!			R742-068
05:43:56 Sep 06 2003	1514	38	Finished with pressure sensor reading at EXT#1. We did 2 pressure readings here (at the start and at the end) so that we could close the loop.			
05:45:23 Sep 06 2003	1514	145	We're going to activate Ray's plunger in the biobox that hopefully - in the future - will be able to keep an animal under pressure on the ascent to the surface. This is a test of the experiment.			
05:47:58 Sep 06 2003	1512	71	We're driving east to get out of this sediment to find a place where there is hard rock so that we can push down the plunger.			
05:50:41 Sep 06 2003	1516	116	Plunger test for Ray.			R742-069
05:51:01 Sep 06 2003	1516	117	We're grabbing Ray's plunger out of the biobox to test it.			
05:54:49 Sep 06 2003	1516	118	Ray's plunger.			R742-070
05:55:22 Sep 06 2003	1516	123	Ray's plunger.			R742-071
05:56:18 Sep 06 2003	1516	119	Testing Ray's plunger device.			R742-072
05:57:01 Sep 06 2003	1516	122	Testing Ray's plunger device.			R742-073
05:58:17 Sep 06 2003	1516	127	ROPOS is trying to push down the plunger.			
05:59:37 Sep 06 2003	1516	116	The experiment is over. Looks like the plunger worked. We'll know when we get to the surface.			
05:59:48 Sep 06 2003	1516	118	Putting Ray's device back in the biobox.			R742-074
06:03:07 Sep 06 2003	1516	119	The plunger is back in the biobox after a bit of abuse from the ROPOS guys.			
06:03:50 Sep 06 2003	1512	165	We're ending the dive because of the wind situation - over 25 knots. ROPOS is coming to the surface.			
07:08:44 Sep 06 2003	2	342	ROPOS on deck.			

## 10.13 R743 2003 Dive Log

Last dive of Cruise TN160 - finished up any high priority tasks. **Mkr-33** Deployed Mkr-77 and 1 MTR. Retrieved Amanda's racetrack experiment, 1 SS. Performed digital video and Ray's Plunger experiment. **Castle 2** GTB, 1SF **Village 1** SS. **Rumbleometer Area** 1 pillar lava RK sample, digital video tour of pillars. **Hell** digital video survey, sulfide worm video, digital mosaic, 3 SS. **Phoenix** digital video survey; digital mosaic. **Inferno** digital video survey, digital mosaic. **Mushroom** digital video survey, digital mosaic. Diffuse area **near Ropos** 3 SS.

Time UTC	Z (m)	Hdg	R743 2003 Comments	Samples	Investigator	FrGrab
17:23:06 Sep 06 2003	1	48	ROPOS in the water.			
17:23:06 Sep 06 2003	1	48	The time on log is wrong - not updating. The actual time of ROPOS deployment was 2003-09-06 23:02:00 UTC.			
23:08:09 Sep 06 2003	49	170	Time fixed! All time stamps should be correct from now on. ROPOS begins descent to Mkr-33.			
00:22:40 Sep 07 2003	1515	332	ROPOS is at the bottom.			
00:23:20 Sep 07 2003	1518	331	Cage motor is off to aid navigation.			
00:29:13 Sep 07 2003	1513	329	We're at Cloud; moving ship to head towards Mkr-33.			
00:31:02 Sep 07 2003	1518	223	R743 is the first dive with the new transponder net - we'll be interested if the new positions match the old ones.			
00:38:22 Sep 07 2003	1518	238	Digital camera is working - two files transferred of Cloud.			
00:42:30 Sep 07 2003	1519	224	Moving to Mkr-33 past Cloud.			
00:43:31 Sep 07 2003	1520	237	Currently over Cloud.			
00:47:09 Sep 07 2003	1520	253	We're coming up on the Mkr-33 crack.			
00:49:02 Sep 07 2003	1516	213	We'll be placing a new marker (#77) since mkr-33 is missing.			
00:50:44 Sep 07 2003	1524	180	Mkr-33.			R743-001
00:50:51 Sep 07 2003	1524	179	Getting out MTR and marker for deployment.			
00:55:16 Sep 07 2003	1524	177	Deploying the new Mkr-77 at Mkr-33 vent.			R743-002
00:55:44 Sep 07 2003	1524	174	Mkr-77 deployed in the crack. Next we're deploying MTR 3201.			
00:59:37 Sep 07 2003	1523	162	Mrk-33 vent at Mkr-77.			R743-003
01:00:07 Sep 07 2003	1524	177	Placing MTR 3201 in flow about halfway between the end of crack and MTR 3292.			
01:01:42 Sep 07 2003	1524	173	MTR 3201 at Mkr-33 vent.			R743-004
01:02:52 Sep 07 2003	1524	174	Three digital photos moved of MTR deployment area and worm close-up.			
01:04:38 Sep 07 2003	1524	179	Ray's pressure plunger at Mkr-33 vent.			R743-005
01:04:43 Sep 07 2003	1524	179	Conducting Ray's plunger experiment in the biobox.			
01:04:46 Sep 07 2003	1524	177	Ray pressure plunger at Mkr-33 vent.			R743-006
01:05:45 Sep 07 2003	1524	180	Plunger experiment is complete.			
01:05:47 Sep 07 2003	1524	180	Ray pressure plunger at Mkr-33 vent.			R743-007
01:07:03 Sep 07 2003	1524	179	Test of Ray's plunger at Mkr-33 vent.			R743-008
01:07:15 Sep 07 2003	1524	176	Next we'll take digital photos; close and retrieve Amanda's racetrack.			
01:08:19 Sep 07 2003	1524	178	MTR and Noreen's cage at Mkr-33 vent.			R743-009
01:08:42 Sep 07 2003	1523	209	Amanda's racetrack and Noreen's cage at Mkr-33 vent.			R743-010
01:09:13 Sep 07 2003	1524	200	Racetrack of Amanda's at Mkr-33 vent.			R743-011
01:09:48 Sep 07 2003	1524	201	Taking digital stills of each compartment of the racetrack.			
01:10:59 Sep 07 2003	1524	202	Noticing that the flow is different. Seems to have more flow over the whole racetrack this dive.			

Time UTC	Z (m)	Hdg	R743 2003 Comments	Samples	Investigator	FrGrab
01:12:41 Sep 07 2003	1524	203	Taking the rods from under the combs; which will keep the biota in their compartments during the transits and ascent.			
01:13:29 Sep 07 2003	1524	201	Transferring 15 digital photos of the racetrack and its compartments.			
01:15:05 Sep 07 2003	1524	202	Amanda's racetrack attempting to be closed.			R743-012
01:16:00 Sep 07 2003	1524	203	First rod successfully removed!			
01:16:21 Sep 07 2003	1524	202	Successful closing of Amanda's racetrack.			R743-013
01:17:24 Sep 07 2003	1524	202	Putting rod into biobox. Failed - leaving rod behind.			
01:19:58 Sep 07 2003	1524	197	Removing other rod. Success!			
01:20:41 Sep 07 2003	1524	199	Amanda's racetrack being closed.			R743-014
01:20:47 Sep 07 2003	1524	198	Amanda's racetrack is closed.			R743-015
01:24:04 Sep 07 2003	1524	197	Transferring twelve digital files of the racetrack closure.			
01:25:52 Sep 07 2003	1524	196	Putting brush into biobox. It wasn't needed this time.			
01:32:18 Sep 07 2003	1524	194	Placing racetrack in biobox.			
01:34:16 Sep 07 2003	1524	192	Racetrack is securely placed in the biobox. [Mkr-33]	R743-RT-0001	Bates	
01:37:33 Sep 07 2003	1524	205	Preparing to SS.			
01:39:03 Sep 07 2003	1524	204				
01:39:07 Sep 07 2003	1524	202	Begin SS Jar#7 of all biota near crack. Start=0139 Stop=0142. Start2=0143 Stop2=0144. Additional sampling in attempt to collect active palm worms. [Mkr-33]	R743-SS-J7-0002	Lee	
01:42:59 Sep 07 2003	1524	205	Ray Lee's suction sample at Mkr-33 vent.			R743-016
01:44:21 Sep 07 2003	1524	201	Begin transit to Castle while doing fly-by digital video tour of the Mkr-33 area.			
01:45:05 Sep 07 2003	1523	203	Survey at Mkr-33 vent.			R743-017
01:47:02 Sep 07 2003	1521	150	Facing S; flying towards Mkr-33. Looking at the tubeworm bush - hdg=148.			
01:47:54 Sep 07 2003	1523	146	Tubeworms bush near Mkr-33 vent.			R743-018
01:48:13 Sep 07 2003	1523	135	A skate is swimming over the growth cage; MTRs; and crack area.			
01:48:21 Sep 07 2003	1523	125	Mkr-33 vent.			R743-019
01:48:41 Sep 07 2003	1523	134	Skate around Mkr-33 vent.			R743-020
01:48:57 Sep 07 2003	1523	100	Another shot of the skate.			R743-021
01:49:45 Sep 07 2003	1520	323	Skate around Mkr-33 vent.			R743-022
01:51:16 Sep 07 2003	1518	307	Flying over an area that looks like a rose in the rock formation.			
01:51:37 Sep 07 2003	1520	82	Twelve digital pictures moved of the skate.			
01:51:57 Sep 07 2003	1523	121	Flying by Mkr-77 (just deployed at Mkr-33 vent) headed SE.			
01:54:10 Sep 07 2003	1524	266	Digital video tour is complete. Headed 166 to transit to Castle.			
02:23:14 Sep 07 2003	1454	135	Red stuff eating the cage!			R743-023
02:33:44 Sep 07 2003	1515	170	On bottom near Castle.			
02:35:06 Sep 07 2003	1511	166	Troubleshooting some telemetry problems.			
02:37:01 Sep 07 2003	1513	88	Near Castle.			R743-024
02:37:04 Sep 07 2003	1514	79	Turning on digital highlights video.			

Time UTC	Z (m)	Hdg	R743 2003 Comments	Samples	Investigator	FrGrab
02:37:29 Sep 07 2003	1514	81	Came upon the 2nd distinct sulfur structure (15m). The other active one (10m) is near by. This appears to have a smoker on top of the structure with white staining all over base. This spot should be NE of Castle. The active smoker has been named TopGun.			
02:41:08 Sep 07 2003	1514	129	Five digital photos moved of sulfur structure.			
02:43:19 Sep 07 2003	1517	154	Headed towards more sulfide. We're at Castle!			
02:44:59 Sep 07 2003	1511	141	Benthooctopus.			R743-025
02:45:13 Sep 07 2003	1511	175	Octopus.			R743-026
02:45:35 Sep 07 2003	1512	202	Octopus.			R743-027
02:45:59 Sep 07 2003	1512	202	Benthooctopus.			R743-028
02:46:53 Sep 07 2003	1512	192	Moved ten digitals of both sulphide structures and octopus.			
02:47:13 Sep 07 2003	1512	109	Octopus is sitting on Flattop; which used to be active. Some white staining and dead tubeworms on base. See Mkr-N5 near some flow-the vent isn't dead. Blue mats are present as well.			
02:47:54 Sep 07 2003	1513	47	Octopus shot.			R743-029
02:48:16 Sep 07 2003	1513	50	Good shot of Octopus siphon.			R743-030
02:49:14 Sep 07 2003	1513	167	Octopus approaching camera.			R743-031
02:49:21 Sep 07 2003	1512	188	Octopus.			R743-032
02:49:45 Sep 07 2003	1512	238	Octopus approaching camera.			R743-033
02:50:49 Sep 07 2003	1510	192	Ten digital photos moved of octopus.			
02:52:13 Sep 07 2003	1516	114	Mkr-5 by flow.			R743-034
02:53:01 Sep 07 2003	1515	103	Blue mat.			R743-035
02:54:40 Sep 07 2003	1517	332	Checking out hobo at Castle. Hobo is no longer in the vent.			
02:56:15 Sep 07 2003	1521	352	Castle vent with hobo.			R743-036
02:58:29 Sep 07 2003	1521	359	We're going to do gastights here at Castle and then will re-position the hobo which fell out.			
03:01:04 Sep 07 2003	1521	357	We're trying to find a good spot for the gastight intake - knocking away small pieces of the chimney.			
03:02:20 Sep 07 2003	1521	360	Gastight sample in the anhydrite. (We're do 2 samples here in the same spot). [Castle]	R743-GTB-0003	Evans [ssmp: Lilly / Butterfield]	
03:02:55 Sep 07 2003	1521	356	Gas tight sample at Castle anhydrite.			R743-037
03:03:15 Sep 07 2003	1521	356	Gastight sample in the anhydrite. (We're do 2 samples here in the same spot). [Castle]	R743-GTB-0004	Evans [ssmp: Lilly / Butterfield]	
03:04:05 Sep 07 2003	1521	356	The wand is going back in the biobox.			
03:07:32 Sep 07 2003	1521	350	We're putting hobo-151 back in the anhydrite vent. It had fallen out sometime previously - don't know when.			
03:10:35 Sep 07 2003	1521	334	Repositioned hobo probe into vent.			R743-038
03:10:43 Sep 07 2003	1521	336	Put the tip in with the 5-function and pushed it down with the 7-function. Looks like its in there now.			
03:12:06 Sep 07 2003	1521	7	2 digital images of the hobo.			
03:13:23 Sep 07 2003	1520	6	We will spend a bit of time searching for sulfide worms here.			
03:14:20 Sep 07 2003	1518	349	We've decided to proceed to Village (about 40 meters to the west). Consensus is that there are no sulfide worms here so we'll go to ASHES for that.			

Time UTC	Z (m)	Hdg	R743 2003 Comments	Samples	Investigator	FrGrab
03:16:35 Sep 07 2003	1520	264	Village vent 40 meters west of Castle.			R743-039
03:16:49 Sep 07 2003	1521	248	We are going to do a few suctionings of blue mat here for Marie.			
03:19:01 Sep 07 2003	1522	119	Cave and blue mat at Village.			R743-040
03:24:45 Sep 07 2003	1523	113	SS for blue ciliate mat in Jar#4. Poking around in several spots to get enough mat. Start 0325 Stop 0331. [Village]	R743-SS-J4-0005	Morineaux	
03:31:35 Sep 07 2003	1523	95	So now we're heading back to Castle to grab a piece of sulfide for the Juniper lab.			
03:33:23 Sep 07 2003	1519	95	Two digitals at Village of the blue mat that was suctioned.			
03:34:35 Sep 07 2003	1516	84	Rattail.			R743-041
03:34:49 Sep 07 2003	1518	75	Two digitals of rattails.			
03:36:14 Sep 07 2003	1518	0	We're back at Castle searching for the perfect sulfide.			
03:37:46 Sep 07 2003	1514	359	Two digitals of the top of Castle.			
03:40:37 Sep 07 2003	1515	46	Broke a piece of sulfide off the top side of the structure. (For the Juniper lab). [Castle]	R743-SF-0006	Leveille	
03:40:38 Sep 07 2003	1515	46	Sulfide sample for Juniper.			R743-042
03:42:52 Sep 07 2003	1512	330	We are transiting to the rumbleometer site for pillar mapping.			
04:29:40 Sep 07 2003	1478	191	We're heading down to the bottom.			
04:31:58 Sep 07 2003	1519	192	We're on the bottom.			
04:33:50 Sep 07 2003	1520	194	We're near the 1998 rumbleometer site. We'd first like to find the railroad wheel weight. That was where the rumbleometer ended up after the eruption.			
04:35:20 Sep 07 2003	1522	193	We'd like to poke around this year - do a digital still camera survey. Next year we'd like to come back and get a whole lava pillar.			
04:36:08 Sep 07 2003	1522	190	Rumbleometer site area.			R743-043
04:36:43 Sep 07 2003	1522	193	Searching around the area.			
04:38:38 Sep 07 2003	1521	301	The rumbleometer was on sort of jumbled lava.			R743-044
04:39:48 Sep 07 2003	1523	65	Shiny - sort of glassy lavas. We're going to the xy of the rumbleometer to see if we can find the railroad wheel anchor.			
04:42:26 Sep 07 2003	1520	223	First went north then southwest. Starting to see some small pillars.			
04:45:40 Sep 07 2003	1519	212	We're heading more S/SW - still searching for the rumbleometer weight.			
04:49:38 Sep 07 2003	1519	265	Doing one more trip south in search of the weight.			
04:51:28 Sep 07 2003	1522	130	We're back where we started.			
04:55:12 Sep 07 2003	1521	240	Lava swirls on the bottom caused by shearing on both sides.			
04:58:05 Sep 07 2003	1521	253	We found the anchor weight from the rumbleometer.			
05:00:38 Sep 07 2003	1522	239	Taking three digital stills of the weight.			
05:00:45 Sep 07 2003	1522	237	Railroad wheel weight for rumbleometer.			R743-045
05:02:34 Sep 07 2003	1522	241	Just waiting to get a good fix here. Good XY is: 423706 5086757.			
05:05:04 Sep 07 2003	1524	284	Heading due west from rumbleometer site to search for lava pillars. One more digital image of the weight was transferred.			

Time UTC	Z (m)	Hdg	R743 2003 Comments	Samples	Investigator	FrGrab
05:07:13 Sep 07 2003	1521	196	Pillars by rumbleometer site.			R743-046
05:07:19 Sep 07 2003	1522	188	Two digitals of the pillars sent to hard drive.			
05:07:54 Sep 07 2003	1521	215	Weird formation.			R743-047
05:08:31 Sep 07 2003	1520	220	We're in a field of pillars. They're everywhere! A couple more connected by a bridge.			
05:10:31 Sep 07 2003	1520	180	Pillars near former rumbleometer site.			R743-048
05:11:05 Sep 07 2003	1519	213	Keith is going to check to see how sturdy they are. Some have grown together and end up being walls instead of just isolated pillars.			
05:12:00 Sep 07 2003	1521	265	A singular pillar.			R743-049
05:12:47 Sep 07 2003	1522	234	Nudged one of the pillars and it fell over and shattered.			
05:13:42 Sep 07 2003	1517	214	Tapes changed out - both highlights and SVHS.			
05:16:28 Sep 07 2003	1521	189	Nice pillar formation with arch.			R743-050
05:16:41 Sep 07 2003	1521	192	We're heading SW to get to the collapse edge.			
05:17:39 Sep 07 2003	1521	227	We're going to start here and look to the right.			
05:18:36 Sep 07 2003	1521	263	Roof and alcove.			R743-051
05:19:25 Sep 07 2003	1521	199	Four digitals sent to hard drive.			
05:19:34 Sep 07 2003	1522	181	Sort of like a lava tube.			R743-052
05:19:55 Sep 07 2003	1521	219	Roof of a cave.			R743-053
05:23:22 Sep 07 2003	1521	214	Bill would like to grab a piece of pillar that's hollow inside.			
05:24:20 Sep 07 2003	1523	224	Bill's sample piece.			R743-054
05:24:49 Sep 07 2003	1523	226	Two digitals of possible sample.			
05:26:41 Sep 07 2003	1523	227	We're attempting to grab a circular piece of a pillar with the claw.			
05:27:08 Sep 07 2003	1523	231	Got it!			R743-055
05:27:14 Sep 07 2003	1523	231	Piece of lava pillar with hole in the middle. It's fragile. Putting in the boot. The piece broke up into a couple pieces. [x=423679/y=5086745 rumbleometer area]	R743-RK-0007	Chadwick	
05:27:27 Sep 07 2003	1523	231	Bill's rock sample.			R743-056
05:29:47 Sep 07 2003	1523	228	Nice sample, but where to put it?			R743-057
05:30:28 Sep 07 2003	1523	229	We're trying to decide where to put the piece of pillar. No room in the biobox or the boot. What to do...			
05:33:15 Sep 07 2003	1523	226	A piece removed and put into the boot.			R743-058
05:38:51 Sep 07 2003	1523	224	Still trying to get more of the pillar sample.			
05:39:21 Sep 07 2003	1523	223	Looks like we have it.			
05:41:30 Sep 07 2003	1523	221	Successfully in the boot.			R743-059
05:43:24 Sep 07 2003	1523	221	The piece of pillar looks pretty good in the boot. It must not be in there totally because we're still messing around with it. Moving the sulfide and pillar sample around. Broke the sulfide and the pillar sample.			
05:43:43 Sep 07 2003	1523	221	Sample loaded in the boot!			R743-060
05:48:38 Sep 07 2003	1523	218	Remelt from the inside of a tube?			R743-061
05:49:37 Sep 07 2003	1523	218	Broken pillar with bath tub rings.			R743-062

Time UTC	Z (m)	Hdg	R743 2003 Comments	Samples	Investigator	FrGrab
05:50:18 Sep 07 2003	1523	218	We're going to look in the garage next. It's stunning. Looks like Roman ruins.			
05:51:23 Sep 07 2003	1523	228	Cool Pillars!			R743-063
05:52:05 Sep 07 2003	1521	230	Sent several digitals to hard drive.			
05:52:50 Sep 07 2003	1520	242	Roof edge.			R743-064
05:54:20 Sep 07 2003	1523	244	The sit camera view is spectacular. We're zooming in on a pillar with bathtub rings.			
05:54:41 Sep 07 2003	1523	245	Pillar with lava drips.			R743-065
05:55:03 Sep 07 2003	1523	243	Closeup of pillar.			R743-066
05:56:04 Sep 07 2003	1523	245	Lava pillar.			R743-067
05:56:16 Sep 07 2003	1523	244	The orange stuff is iron (iron oxide?).			R743-068
05:56:28 Sep 07 2003	1523	244	Above the rings this was filled with steaming water before it started freezing. The orange stuff is iron (iron oxide?).			
05:56:33 Sep 07 2003	1523	245	Underside of roof.			R743-069
05:57:20 Sep 07 2003	1523	244	Lava pillars with bathtub rings.			R743-070
05:57:47 Sep 07 2003	1523	246	Bathtub rings in pillars.			R743-071
05:58:04 Sep 07 2003	1522	247	The roof is there for awhile then usually breaks. As the lava starts draining it forms the rings.			
06:02:02 Sep 07 2003	1521	354	Anemone dangling from a pillar.			R743-072
06:02:20 Sep 07 2003	1521	356	Anemone dangling from a pillar.			R743-073
06:04:42 Sep 07 2003	1522	300	Several digital images sent to hard drive.			
06:04:52 Sep 07 2003	1522	289	Lava drips.			R743-074
06:05:43 Sep 07 2003	1522	284	Incredible pillars with lava drips.			
06:06:01 Sep 07 2003	1523	284	Incredible pillars with lava drips.			R743-075
06:07:52 Sep 07 2003	1523	284	Incredible pillars with lava drips.			R743-076
06:08:11 Sep 07 2003	1523	284	Drips because: Lava drains out and is exposed to seawater. A space develops between crusts that water gets in and turns to steam. Remnants of the lava drip off crust. Eventually breaks. 1998 lava was deflating at 0.5mm/sec.			
06:08:55 Sep 07 2003	1523	283	Closeup of drips.			R743-077
06:09:28 Sep 07 2003	1523	283	Each layer is new crust formed every 3 minutes. 30 seconds of crust making and 2.5 minutes of steam. The steam is why it's hot enough for the lava to drip. That's why it's glassy on top of the shelf and not on the bottom.			
06:09:41 Sep 07 2003	1523	283	Close-up view of drips.			R743-078
06:10:58 Sep 07 2003	1523	280	Wide view of drips.			R743-079
06:14:42 Sep 07 2003	1521	205	Window in a pillar.			R743-080
06:15:11 Sep 07 2003	1520	217	Why all the pillars? We're a bit farther from the eruptive vent. Flow was thicker (higher) and not moving as fast. The pillars form more on the edges than in the center of the flow. Pillars are pipes that water trapped under the flows travels up.			
06:19:59 Sep 07 2003	1521	258	The pillar density increases to the west.			
06:21:43 Sep 07 2003	1522	240	Mosaic.			R743-081
06:21:43 Sep 07 2003	1522	240	We've found the pillar that we did framegrabs of a couple years ago. Made a framegrab mosaic of this wall (embayment) at that time.			

Time UTC	Z (m)	Hdg	R743 2003 Comments	Samples	Investigator	FrGrab
06:23:11 Sep 07 2003	1522	306	"Droopy pillar" - dubbed by Bill. We have a fix for this pillar which was mosaiced of a couple years ago.			R743-082
06:24:02 Sep 07 2003	1522	292	Bill has called this "droopy pillar". Sebastian is getting a fix of this. [x=423683 y=5086726]			
06:29:42 Sep 07 2003	1522	289	Several more digitals.			
06:33:51 Sep 07 2003	1522	294	We're going to take a series of digital pictures here of "Droopy Pillar".			
06:35:08 Sep 07 2003	1522	225	Layered cavern.			R743-083
06:35:23 Sep 07 2003	1522	302	Part of Bill's digital panorama.			R743-084
06:36:00 Sep 07 2003	1522	347	Hollow and layered pillar.			R743-085
06:39:20 Sep 07 2003	1520	267	8 more digital images.			
06:40:18 Sep 07 2003	1522	237	Pillar with bathtub rings in droopy area.			R743-086
06:40:36 Sep 07 2003	1522	223	We were looking in the Droopy area of the embayment - now we've come around the corner and are looking at the back side of it.			
06:42:39 Sep 07 2003	1522	331	8 more digitals sent to hard drive.			
06:49:57 Sep 07 2003	1520	354	Rumble site.			R743-087
06:50:15 Sep 07 2003	1520	23	Rumble site.			R743-088
06:50:25 Sep 07 2003	1521	26	Rumble site.			R743-089
06:50:48 Sep 07 2003	1521	40	Rumble site.			R743-090
06:50:54 Sep 07 2003	1521	37	We are seeing what looks to be folding in the top layer of the formation. The layer splits and bends down to converge at the top of a supporting pillar. It looks like a horizontally compressed synclinal structure. The layer is 20cm or so thick.			
06:51:58 Sep 07 2003	1521	36	Rumble site.			R743-091
06:52:33 Sep 07 2003	1521	34	Sampling at Rumble site.			R743-092
06:54:44 Sep 07 2003	1520	352	Two digital photos transferred.			
06:55:01 Sep 07 2003	1519	1	We are returning to the cage and transiting to ASHES.			
08:09:52 Sep 07 2003	1522	249	We have reached ASHES and are heading to the bottom.			
08:11:47 Sep 07 2003	1544	255	Starfish at Ashes.			R743-093
08:13:52 Sep 07 2003	1545	276	Bottom near Ashes.			R743-094
08:15:22 Sep 07 2003	1545	331	Two digital files moved.			
08:15:34 Sep 07 2003	1545	251	The seafloor is covered with large amounts of iron oxides.			
08:15:39 Sep 07 2003	1545	263	Moving toward Ashes.			R743-095
08:16:06 Sep 07 2003	1546	250	Crab near Ashes.			R743-096
08:17:17 Sep 07 2003	1546	359	Mound near Ashes.			R743-097
08:17:45 Sep 07 2003	1545	335	Big Johnson is in sight - we need to go west from here.			
08:24:49 Sep 07 2003	1529	335	We are returning to the cage because the tether is passing over it and needs to be untangled.			
08:31:19 Sep 07 2003	1544	162	We have arrived at Hell. We can see Mkr-2. We are facing almost due south, and are looking for a site for Marie's video.			
08:31:42 Sep 07 2003	1545	167	In ASHES field looking for Hell.			R743-098



Time UTC	Z (m)	Hdg	R743 2003 Comments	Samples	Investigator	FrGrab
08:32:53 Sep 07 2003	1543	275	Looking for Hell.			R743-099
08:35:08 Sep 07 2003	1546	194	Face of Hell looking south.			R743-100
08:36:24 Sep 07 2003	1546	193	North face of Hell.			R743-101
08:37:11 Sep 07 2003	1546	191	Worm on Hell.			R743-102
08:39:02 Sep 07 2003	1546	191	North face of Hell.			R743-103
08:40:23 Sep 07 2003	1546	194	Marie has found a region to tape, and now we are positioning the ROPOS and determine the optimal spot to film.			
08:40:51 Sep 07 2003	1546	192	Overview of worm site.			R743-104
08:42:11 Sep 07 2003	1546	192	Starting digital photos on 20sec intervals.			
08:42:48 Sep 07 2003	1546	194	A piece of chimney fell into our field of view and disintegrated.			
08:44:36 Sep 07 2003	1546	195	Ten digital photos transferred.			
08:45:01 Sep 07 2003	1546	192	More small pieces of chimney are falling.			
08:48:36 Sep 07 2003	1546	193	Ten digital photos transferred.			
08:52:45 Sep 07 2003	1546	194	Ten digital photos transferred.			
08:56:58 Sep 07 2003	1546	192	Ten digital photos transferred.			
09:01:07 Sep 07 2003	1546	195	Ten digital photos transferred.			
09:05:17 Sep 07 2003	1546	195	Ten digital photos transferred.			
09:08:00 Sep 07 2003	1546	194	Momentary break in filming to check ROPOS gauges.			
09:09:26 Sep 07 2003	1546	193	Ten digital photos transferred.			
09:13:39 Sep 07 2003	1546	194	Ten digital photos transferred.			
09:14:36 Sep 07 2003	1546	194	Worm study site on Hell.			R743-105
09:28:21 Sep 07 2003	1546	193	Continuing to video sulphide worms.			
09:46:41 Sep 07 2003	1545	194	We are finished filming. After a final look around we will take a suction sample.			
09:49:35 Sep 07 2003	1545	195	We are starting to position for suctioning.			
09:54:53 Sep 07 2003	1544	175	Suction Sample into jar#5. Sample of sulphide worms at site of Marie's filming. Temperature 0.5 to 3 degrees above ambient. Stop=0959. [Hell]	R743-SS-J5-0008	Morineaux	
09:55:43 Sep 07 2003	1544	172	Suction sample at Hell.			R743-106
10:00:42 Sep 07 2003	1544	174	Suction site.			R743-107
10:01:22 Sep 07 2003	1544	159	Two digital photos transferred.			
10:02:21 Sep 07 2003	1544	132	Two more digital photos transferred.			
10:07:04 Sep 07 2003	1545	245	Flushing into jar 8.			
10:08:02 Sep 07 2003	1545	247	Suction Sample of sediment at the base of chimney into jar#6 - below the site of Marie's filming of sulphide worms. Stop=1010. [Hell]	R743-SS-J6-0009	Morineaux	
10:08:23 Sep 07 2003	1546	247	Suction sample 6 at Hell.			R743-108
10:09:51 Sep 07 2003	1546	247	Two digital photos transferred.			
10:12:31 Sep 07 2003	1546	246	Crab grabbing worm at Hell.			R743-109
10:12:49 Sep 07 2003	1545	245	Crab eating worm.			R743-110
10:14:38 Sep 07 2003	1545	245	Crab eating worm.			R743-111

Time UTC	Z (m)	Hdg	R743 2003 Comments	Samples	Investigator	FrGrab
10:15:41 Sep 07 2003	1546	246	We caught a crab eating a Hesionid worm.			
10:15:44 Sep 07 2003	1546	245	Crab getting fat on worms.			R743-112
10:16:01 Sep 07 2003	1545	246	Biota at base of Hell.			R743-113
10:17:52 Sep 07 2003	1545	246	Biota at base of Hell.			R743-114
10:20:19 Sep 07 2003	1545	234	We are attempting to suction the crab into jar 8.			
10:23:00 Sep 07 2003	1545	200	We couldn't get the crab but now we are trying to suction another we found.			
10:23:08 Sep 07 2003	1545	199	Suctioning a crab at Hell.			R743-115
10:26:14 Sep 07 2003	1544	199	We gave up on both crabs and are looking for a site for Ray's suction samples.			
10:29:31 Sep 07 2003	1544	159	Suction Sample of palm worms and limpets into jar#8. [Hell]	R743-SS-J8-0010	Lee	
10:32:53 Sep 07 2003	1544	142	Venting at Hell.			R743-116
10:33:28 Sep 07 2003	1542	176	Top of Hell.			R743-117
10:35:36 Sep 07 2003	1542	177	We are taking a digital photo survey of the chimney at Hell. It will be a sequence of photos of the chimney from top to bottom.			
10:40:42 Sep 07 2003	1539	157	Thirteen digital photos transferred.			
10:41:18 Sep 07 2003	1544	140	We are leaving Hell for Phoenix.			
10:44:24 Sep 07 2003	1542	39	We are taking a digital photo mosaic of another chimney. We think it is Phoenix.			
10:46:13 Sep 07 2003	1543	20	We're looking for confirmation that we are at Phoenix. Taking closer look at biota in area.			
10:48:32 Sep 07 2003	1546	86	Worms on chimney side at Phoenix.			R743-118
10:49:47 Sep 07 2003	1545	83	Sulphide worms at base of Phoenix.			R743-119
10:50:59 Sep 07 2003	1546	97	Looking at the sulfide worms to see if we will get digital video and making mosaics.			
10:51:56 Sep 07 2003	1546	94	Transferring ten digital files of Phoenix.			
10:54:54 Sep 07 2003	1546	98	Fighting palmworms.			
10:57:37 Sep 07 2003	1546	94	Trying to do a white balance.			
11:00:29 Sep 07 2003	1546	88	Transferring six digital photos of sulfide worms.			
11:01:44 Sep 07 2003	1546	86	Biota at Phoenix.			R743-120
11:10:49 Sep 07 2003	1546	86	Looking for Pandora worms at Phoenix.			R743-121
11:12:19 Sep 07 2003	1545	88	Phoenix.			R743-122
11:14:04 Sep 07 2003	1546	86	Close-up viewing of worms.			
11:14:39 Sep 07 2003	1546	88	Tubeworms at Phoenix.			R743-123
11:16:02 Sep 07 2003	1546	87	Tubeworm plumes at Phoenix.			R743-124
11:16:12 Sep 07 2003	1546	87	Tubeworm plumes at Phoenix.			R743-125
11:24:00 Sep 07 2003	1545	120	Watching palm worms and what we believe to be Pandora at Phoenix.			
11:25:46 Sep 07 2003	1545	118	Done watching worms at Phoenix and we're headed towards Inferno.			
11:26:57 Sep 07 2003	1544	336	Infemo and Mushroom appear to be within 5m of each other.			
11:28:25 Sep 07 2003	1542	314	We're at Inferno. ROPOS gauge check.			

Time UTC	Z (m)	Hdg	R743 2003 Comments	Samples	Investigator	FrGrab
11:29:16 Sep 07 2003	1539	316	We're doing digital transect/mosaic of two chimneys in area. Mosaicing digital photos from top to bottom of each structure.			
11:32:49 Sep 07 2003	1542	15	16 digital photos moved of Inferno mosaic.			
11:33:11 Sep 07 2003	1541	65	Inferno.			R743-126
11:33:19 Sep 07 2003	1541	79	Looking at the west side of Inferno. Coming around and then heading towards Mushroom.			
11:34:39 Sep 07 2003	1541	100	West side of Inferno.			R743-127
11:35:40 Sep 07 2003	1543	139	Four digital photos moved - more of Inferno.			
11:36:40 Sep 07 2003	1541	346	Mushroom.			R743-128
11:36:49 Sep 07 2003	1542	353	We're at Mushroom.			
11:37:45 Sep 07 2003	1542	13	Doing a digital mosaic of Mushroom.			
11:39:44 Sep 07 2003	1544	357	11 digital photos moved of Mushroom. Now we're zooming in on the sulfide worms.			
11:41:09 Sep 07 2003	1545	339	Examining worm behavior at Mushroom.			R743-129
11:42:54 Sep 07 2003	1545	340	Focused venting on Mushroom.			R743-130
11:44:00 Sep 07 2003	1545	341	Sulphide worms at Mushroom.			R743-131
11:45:01 Sep 07 2003	1545	340	Watching sulfide worms at Mushroom for 15-20 minutes.			
12:07:20 Sep 07 2003	1545	340	Continuing to observe the worms.			
12:20:11 Sep 07 2003	1545	342	Still watching worms.			
12:26:00 Sep 07 2003	1545	341	Worm observation ended. Now we'll do video surveys of Mushroom and Inferno.			
12:29:50 Sep 07 2003	1544	351	Start video survey - headed up the base of Mushroom and around then we'll head SW to Inferno and do the same thing.			
12:31:26 Sep 07 2003	1543	278	Mushroom.			R743-132
12:33:45 Sep 07 2003	1543	281	Inferno.			R743-133
12:34:22 Sep 07 2003	1541	296	Inferno.			R743-134
12:36:55 Sep 07 2003	1541	95	Summit of Inferno.			R743-135
12:39:05 Sep 07 2003	1541	233	Skate.			R743-136
12:40:01 Sep 07 2003	1544	209	Transiting to Hell.			
12:42:24 Sep 07 2003	1544	151	Video highlights complete.			
12:44:23 Sep 07 2003	1545	141	Headed to a diffuse area near ROPOS for Gitai to sample.			
12:46:28 Sep 07 2003	1545	143	Suction sampling at ROPOS.			R743-137
12:48:33 Sep 07 2003	1546	141	Checking temperature in area (temperature ranging from 0.5-9.0) before suctioning.			
12:51:33 Sep 07 2003	1546	147	Moved about a meter to the right and found a shimmering vent. Checking out this area to sample. Temperature here is generally higher (ranging from 2.5-9.0).			
12:52:21 Sep 07 2003	1545	155	Anemones on the periphery at ROPOS.			R743-138
12:56:53 Sep 07 2003	1546	149	Suctioning and flushing jar in preparation to take triplicate SSs.			
13:02:47 Sep 07 2003	1546	149	SS Jar#1 for DOC and bacteria. [diffuse area near ROPOS]	R743-SS-J1-0011	Yahel	
13:04:16 Sep 07 2003	1546	149	SS into jar#2 for DOC; dissolved organics and bacteria. Start=1304 Stop=1307. [diffuse area near ROPOS]	R743-SS-J2-0012	Yahel	

Time UTC	Z (m)	Hdg	R743 2003 Comments	Samples	Investigator	FrGrab
13:05:01 Sep 07 2003	1546	151	Second suction sample for dissolved organics at ROPOS.			R743-139
13:08:04 Sep 07 2003	1546	151	SS into jar#3 in same area as last two samples. Suctioning for DOC and bacteria. Start=1309 Stop=1313. [diffuse area near ROPOS]	R743-SS-J3-0013	Yahel	
13:08:36 Sep 07 2003	1545	151	Suction sampling in diffuse vent flow at ROPOS.			R743-140
13:14:07 Sep 07 2003	1545	149	With remaining time we'll do video surveys of Hell and ROPOS.			
13:15:17 Sep 07 2003	1543	55	Begin digital highlight video.			
13:16:11 Sep 07 2003	1544	23	Headed to Hell vent. At Phoenix vent - oops.			
13:16:59 Sep 07 2003	1544	43	Chimney wall of Phoenix vent.			R743-141
13:17:29 Sep 07 2003	1543	14	Chimney wall of Phoenix vent.			R743-142
13:17:41 Sep 07 2003	1543	3	Summit of Phoenix.			R743-143
13:21:36 Sep 07 2003	1543	288	Phoenix.			R743-144
13:23:03 Sep 07 2003	1542	287	Phoenix.			R743-145
13:23:06 Sep 07 2003	1542	292	Now we're headed to Hell.			
13:26:15 Sep 07 2003	1541	225	At Hell.			
13:26:17 Sep 07 2003	1541	226	Hell vent.			R743-146
13:26:25 Sep 07 2003	1541	227	Hell vent.			R743-147
13:27:21 Sep 07 2003	1541	178	Summit of Hell.			R743-148
13:29:49 Sep 07 2003	1543	66	Hell vent.			R743-149
13:30:04 Sep 07 2003	1542	59	End of digital video and video survey. End of Dive 743. Headed for the elevator and to the surface.			
14:37:27 Sep 07 2003	2	226	ROPOS at surface.			
14:40:34 Sep 07 2003	2	289	ROPOS on deck.			
14:49:22 Sep 07 2003	2	272	Chief Sci and BK... well their feet.			R743-151

## **11.0 NeMO DEPLOYMENTS AND RECOVERIES: 2002 AND 2003**

### **11.1 NeMO Net SUMMARY 2002-2003**

**Bill Chadwick and Dave Butterfield**

#### **NeMO 2002**

The NeMO Net system deployed in summer 2002 consisted of three seafloor instruments all in communication with the surface buoy. The instruments included a bottom pressure recorder (BPR) located near the center of the caldera, and two interactive remote access samplers (RAS) located in the ASHES vent field, at Virgin (high-temp) and Dave's (low-temp) vents. This was the first year we had more than one seafloor node and the first year a BPR at Axial was sending back realtime data. In 2002, NeMO Net experimented with incorporating two important new technologies: omni-directional acoustic modems and the Iridium satellite telephone system. To compare these new technologies with previous proven methods, the buoy was equipped with both directional and omni-directional modems, as well as both Orbcomm and Iridium satellite receivers. The RAS samplers communicated with the older directional modems, whereas the BPR used a new omni-directional modem, allowing it to be deployed farther away from the buoy. The directional modems have a horizontal range (effective radius) of 800 m, whereas the omni-directional modems can be up to 2700 m away from the buoy.

The performance of the system was very good. The hourly BPR data were received 91% of the time during the year (via Orbcomm), and the RAS daily temperature data was received 98% of the time. The other sensor data sent from the RAS instruments were received about two-thirds of the time. Samples were collected by both of the interactive RAS, but there were hardware and clogging problems that kept us from getting a complete time series. The pump on the high-temperature sampler failed after 8 weeks and 8 consecutive samples, and the intake fluid collector on the low-temperature RAS was completely blocked by a layer of anhydrite. The low-T sampler collected four fluid samples during the deployment at irregular intervals. The 2002 NeMO Net buoy and both RAS samplers were recovered on June 4, 2003 so they could be turned around before the August-September 2003 NeMO cruise. The BPR stayed deployed, but did not have the surface buoy to communicate with from June to August.

#### **NeMO 2003**

The current NeMO Net system, deployed in summer 2003, consists of two seafloor instruments: the same BPR (it will stay down until summer 2004), and one refurbished RAS sampler deployed at Virgin vent. The titanium intake funnel and tripod for the RAS were modified to be taller, more stable, and more resistant to hot fluids leaking around the sides of the funnel. The RAS deployed in 2003 has collected every sample on schedule through December 2003. Based on last year's results, the 2003 NeMO Net system uses only omni-directional modems for all nodes and only the Iridium satellite system for communication to and from shore. Two additional BPRs were deployed at Axial in 2003, but these do not have acoustic modems, and so do not send realtime data back through NeMO Net.

## 11.2 NeMO INSTRUMENT POSITIONS 2002/2003 (includes NeMO Net and Extensometers)

2002 instrument	Long (decdeg)	Lat (decdeg)	Long (deg)	Long (min)	Lat (deg)	Lat (min)	UTM X	UTM Y	Depth
BPR-nemonet-0203	-130.0101167	45.9525167	130	0.6070	45	57.1510	421718	5089268	
Buoy-02	-130.0105500	45.9372500	130	0.6330	45	56.2350	421662	5087572	
RAS-virgin-02	-130.0134833	45.9336333	130	0.8090	45	56.0180	421430	5087173	1547
RAS-Dave's-02	-130.0137667	45.9335167	130	0.8260	45	56.0110	421408	5087160	1547
(no extensometers in 2002)									

2003 instrument	Long (decdeg)	Lat (decdeg)	Long (deg)	Long (min)	Lat (deg)	Lat (min)	UTM X	UTM Y	Depth
E1	-130.0285800	45.9925700	130	1.7150	45	59.5540	420344	5093736	1513
E2	-130.0271150	45.9928200	130	1.6270	45	59.5690	420458	5093763	1519
E3	-130.0263900	45.9927400	130	1.5830	45	59.5640	420514	5093753	1517
E4	-130.0257200	45.9927100	130	1.5430	45	59.5630	420566	5093749	1519
E5	-130.0247500	45.9928600	130	1.4850	45	59.5720	420641	5093765	1523
BPR-center-03	-130.0101667	45.9552167	130	0.6100	45	57.3130	421717	5089568	
BPR-south-03	-130.0000000	45.9333333	130	0.0000	45	56.0000	422475	5087127	
OBH-03	-129.9825350	45.9335117	129	58.9521	45	56.0107	423829	5087130	1523
BPR-nemonet-0203	-130.0101167	45.9525167	130	0.6070	45	57.1510	421718	5089268	
RAS-virgin-nemonet-03	-130.0134833	45.9336500	130	0.808998 0	45	56.0190000	421430	5087174	1547
Buoy-nemonet-03	-130.0000000	45.9458333	130	0.0000	45	56.7500	422492	5088515	1535

### 11.3 NeMO 2002/2003 SEAFLOOR EXPERIMENTS (Deployment and Recovery)

Vent/Marker	Experiment etc.	Dive Deployed	Dive Recovered	comments
Mkr-33	Amanda's racetrack	R735 ('03)	R743 ('03)	
Cloud/Mkr-N6/21	Bac Trap 59	R659 ('02)		
Cloud/Mkr-N6/21	Bac Trap 60	R629 ('01)		
Gollum Vent	Bac Trap 64	R632 ('01)	R662 ('02)	
Cloud/Mkr-N6/21	Bac Trap 65	R629 ('01)	R674 ('02)	
Cloud/Mkr-N6/21	Bac Trap 66	R659 ('02)	R674 ('02)	
Mkr-33	Bac Trp 61	R630 ('01)	R661 ('02)	
Mkr-33	Bac Trp 62	R630 ('01)	R661 ('02)	
Easy Vent	BacTrap 17	R463 ('98)		couldn't find
Castle Vent	BacTrap 24	R464 ('98)		couldn't find
Milky Vent	BacTrap 35	R475 ('98)		couldn't find
Milky/Mkr-N2	BacTrap 35	R475 ('98)		couldn't find
Cloud/Mkr-N6/21	BacTrap 58	R622 ('01)		
Gollum Vent	BacTrap 63	R632 ('01)	R662 ('02)	
Gollum Vent	BacTrap 67	R662 ('02)		
Gollum Vent	BacTrap 68	R662 ('02)		
Phoenix	BacTraps 25,26	R466 ('98)	couldn't find	
Caldera center	BPR	between (R545 and R546 -'00)	7/20 1912 UTC (between R661 and R662 -'02)	
Caldera (center)	BPR	between 740/741 ('03)		
Caldera (south)	BPR	between 740/741 ('03)		
Caldera center (more or less)	BPR - NeMO Net '02 and '03	between R661 and R662 ('02)	still there	
NRZ	Extensometers	EX 1-4 ('00); Ex5 ('99)	R673 ('02)	
NRZ caldera rim	Extensometers 1-5	R742 ('03)		
Mkr-33	Growth cage	R740 ('03)		
Marshmallow	Hobo 126	R739 ('03)		Thought this was Virgin's daughter - but it's Marshmallow
Virgin Vent	Hobo 126	R632 ('01)	R662 ('02)	
Castle Vent (near Anhydrite)	Hobo 128	R627 ('01)	R659 ('02)	
Castle Vent (near Anhydrite)	Hobo 128	R674 ('02)	R734 ('03)	
Virgin Vent	Hobo 130	R632 ('01)	R662 ('02)	
Vixen (Coquille)	Hobo 130	R734 ('03)		
Vixen (Coquille)	Hobo 132	R734 ('03)		
Castle Vent (near Anhydrite)	Hobo 151	R739 ('03)		
Vixen (Coquille)	Hobo 152	R630 ('01)	R661 ('02)	
Vixen (Coquille)	Hobo 152	R674 ('02)	R734 ('03)	
Vixen (Coquille)	Hobo 153	R630 ('01)	R661 ('02)	
Vixen (Coquille)	Hobo 153	R674 ('02)	R734 ('03)	
NW of Crack	Johnson Flow/Temp Meter 2001	R624 ('01)	R662 ('02)	
NW of Crack	Johnson Flow/Temp Meter 2002	R663 and R672 ('02)		No time to recover in 2003

Vent/Marker	Experiment etc.	Dive Deployed	Dive Recovered	comments
Cloud/Mkr-N6/21	Larval Array E	R629 ('01)	R659 ('02)	
Cloud/Mkr-N6/21	Larval Array F	R629 ('01)	R735 ('03)	
Cloud (S/SW of N6 ~8m)	Larval Array G	R629 ('01)	R659 ('02)	
Cloud (S/SW of N6 ~8m)	Larval Array H	R629 ('01)	R735 ('03)	
ROPOS Vent	Larval Array I	R632 ('01)	R737 ('03)	
Gollum Vent	Larval Array J	R632 ('01)		
Marshmallow	Larval Array K	R662 ('02)	R740 ('03)	
ROPOS Vent	Larval Array L	2002	R662 ('02)	
Virgin Vent	Larval Array M	R632 ('01)	R662 ('02)	
Virgin's Daughter	Larval Array N	R632 ('01)	R740 ('03)	
Cloud (S/SW of N6 ~8m)	Larval Array O	R659 ('02)		
Cloud/Mkr-N6/21	Larval Array P	R659 ('02)	R735 ('03)	
ROPOS Vent	Larval Array Z	R662 ('02)	R737 ('03)	
ROPOS Vent	Larval Trap 1	R624 ('01)	capped R632 ('01) recovered R662 ('02)	
Virgin Vent	Larval Trap 12	R624 ('01)	capped R632 ('01) recovered R662 ('02)	
ROPOS Vent	Larval Trap 4	R624 ('01)	capped R632 ('01) recovered R662 ('02)	
Virgin Vent	Larval Trap 9	R624 ('01)	capped R632 ('01) recovered R662 ('02)	
Mkr-33	Mkr-77	R743 ('03)		
Coquille	MTR #?	R551 ('00)	R659 ('02)	
Mkr-113	MTR 1055	R627 ('01)		couldn't find
T&S Spires	MTR 3017	R497('99)		
Bag City/Mkr-36	MTR 3029	R623 ('01)	R661 ('02)	
Mkr-33	MTR 3039	R622 ('01)	R661 ('02)	
Gollum Vent	MTR 3041	R624 ('01)	R662 ('02)	
Mkr-33	MTR 3043	R622 ('01)	R661 ('02)	
Cloud/Mkr-N4	MTR 3045	R625 ('01)	R674 ('02)	
Bag City/Mkr-36	MTR 3049	R623 ('01)	R661 ('02)	
Mkr-33	MTR 3049	R734 ('03)		in tubeworm bush near bmrk
Mkr-33	MTR 3053	R622 ('01)	R661 ('02)	
Snail/Mkr-N8	MTR 3054	R622 ('01)	R661 ('02)	
Snail/Mkr-N8	MTR 3055	R622 ('01)	R661 ('02)	
Village Vent	MTR 3087	R674 ('02)	R734 ('03)	wrong number originally (3987)
Cloud/Mkr-N6/21 (in the deep hole)	MTR 3173	R674 ('02)		Couldn't find on R734
Cloud/Mkr-N6/21	MTR 3176	R734 ('03)		MTR 3334 and 3176 tied together
Mkr-33	MTR 3185	R661 ('02)	R734 ('03)	wrong number originally (3185)
Castle Vent (near Anhydrite spire)	MTR 3201	R627 ('01)	R661 ('02)	
Mkr-33	MTR 3201	R743 ('03)		
Mkr-33	MTR 3213	R661 ('02)	R734 ('03)	
Mkr-33	MTR 3282	R734 ('03)		
Cloud/Mkr-N6/21	MTR 3292	R625 ('01)	R659 ('02)	
Bag City/Mkr-36 (near nemonet cam)	MTR 3315 (reposition R552)	R548 ('00)		lost



Vent/Marker	Experiment etc.	Dive Deployed	Dive Recovered	comments
Coquille	MTR 3317	R551 ('00)		Couldn't find in 2002. Spotted on HFS dive R741 ('03) - not picked up
Cloud/Mkr-N6/21	MTR 3334	R734 ('03)		MTR 3334 and 3176 tied together
Gollum Vent	MTR 3334	R624 ('01)	R662 ('02)	
Mkr-33	MTR 4001	R734 ('03)		
Cloud/Mkr-N6/21	MTR 4101	R625 ('01)	R659 ('02)	
Coquille	MTR 4108	R551 ('00)	R674 ('02)	
Mkr-113	MTR 4126	R551 ('00)		couldn't find
Mkr-33	MTR 4127	R661 ('02)	R734 ('03)	
Casper (Coquille)	MTR 4128	R627 ('01)	R661 ('02)	
Cloud/Mkr-N6/21	MTRs 340 and 1051	R659 ('02)	R659 ('02) 3 hr deployment	
Mkr-33 Bmrk-5	OBH	before R734 ('03)	before R743 ('03)	
Cloud/Mkr-N6/21	osmo MBARI	R627 ('01)	R674 ('02)	
Milky/Mkr-N2	OsmoSampler	R474 ('98)		?
Cloud/Mkr-N6/21	osmosampler (red)	R629		It's gone - not sure who picked it up
Cloud/Mkr-N6/21	RAS '01 (lo-temp)	R630 ('01)	between R659 and R660 ('02)	
Dave's Vent	RAS '02 (lo-temp)	R662 and R672 ('02)	pre-cruise 2003	
Virgin Vent	RAS '02 (hi-temp)	R662 and R672 ('02)	precruise 2003	
Virgin Vent	RAS '03 (hi-temp)	R737 ('03)		
Hell Vent	Transplant Cage	R662 ('02)	R737 ('03)	

## 11.4 NeMO 2002/2003 MOORINGS

NeMO Moorings 2002 and 2003	Long (decdeg)	Lat (decdeg)	Long (deg)	Long (min)	Lat (deg)	Lat (min)	Depth
<b>NeMO 2002 Mooring Info</b>							
<b>Mooring Recoveries (02)</b>							
01T58	-129.9866667	45.9250000	129	59.2000	45	55.5000	1540
00T59	-129.9866667	45.9416667	129	59.2000	45	56.5000	1540
01V116	-129.9966667	45.9133333	129	59.8000	45	54.8000	1557
<b>Mooring Deployments (02)</b>							
02T60	-129.9866667	45.9250000	129	59.2000	45	55.5000	1540
02V120	-129.9966667	45.9133333	129	59.8000	45	54.8000	1557
<b>NeMO 2003 Mooring Info</b>							
<b>Mooring Recoveries (03)</b>							
02T60	-129.9866667	45.9250000	129	59.2000	45	55.5000	1540
02V120	-129.9966667	45.9133333	129	59.8000	45	54.8000	1557

NeMO Moorings 2002 and 2003	Long (decdeg)	Lat (decdeg)	Long (deg)	Long (min)	Lat (deg)	Lat (min)	Depth
<b>Mooring Deployments (03)</b>							
03V122	-129.9966667	45.9133333	129	59.8000	45	54.8000	1537
03V123	-130.0301667	45.9699667	130	1.8100	45	58.1980	1557

## 11.5 NeMO 2002/2003 CTD OPERATIONS

Geoff LeBon

### Axial-2002 Vertical Casts

V02C01 45 55.38N 129 59.25W  
V02C02 45 55.97N 129 58.90W  
V02C03 45 56.02N 130 00.80W  
V02C04 45 54.80N 129 59.83W  
V02C05 45 55.04N 129 59.60W

### Axial-2003 Vertical Casts

V03C01 45 56.00N 130 00.86W  
V03C02 45 55.97N 129 58.97W  
V03C03 45 54.81N 129 59.81W  
V03C04 45 55.03N 129 59.62W  
V03C05 45 56.60N 129 59.14W