

NeMO 1999 - New Millennium Observatory

Axial Volcano
Juan de Fuca Ridge

1999 Cruise Report

Cruise TN094
R/V Thomas G. Thompson
June 20 - July 14, 1999
Victoria, BC - Astoria, OR

**APRIL 2014: REPORT REVISED TO CREATE PDF.
INSERTED DIVE MAPS AT END OF REPORT.**



Cruise Report compiled by Susan G. Merle,
with assistance from Robert W. Embley
and William W. Chadwick Jr.

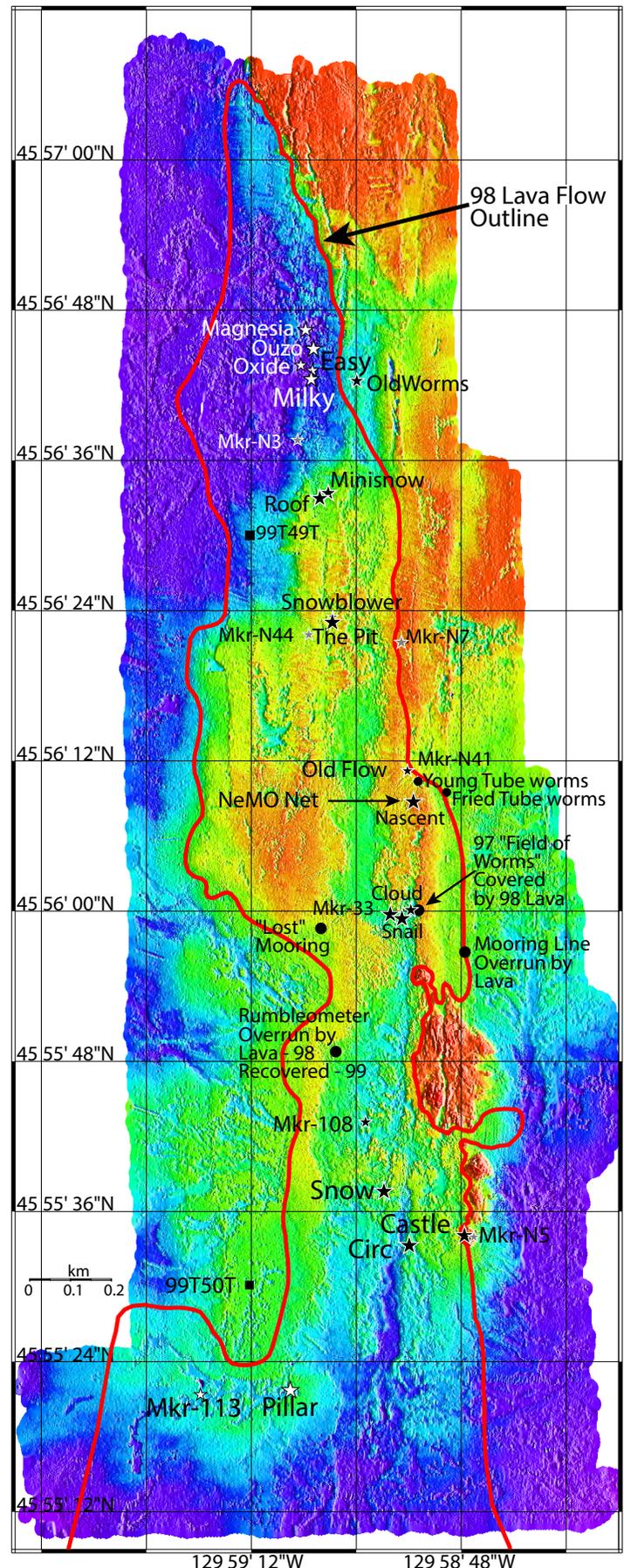


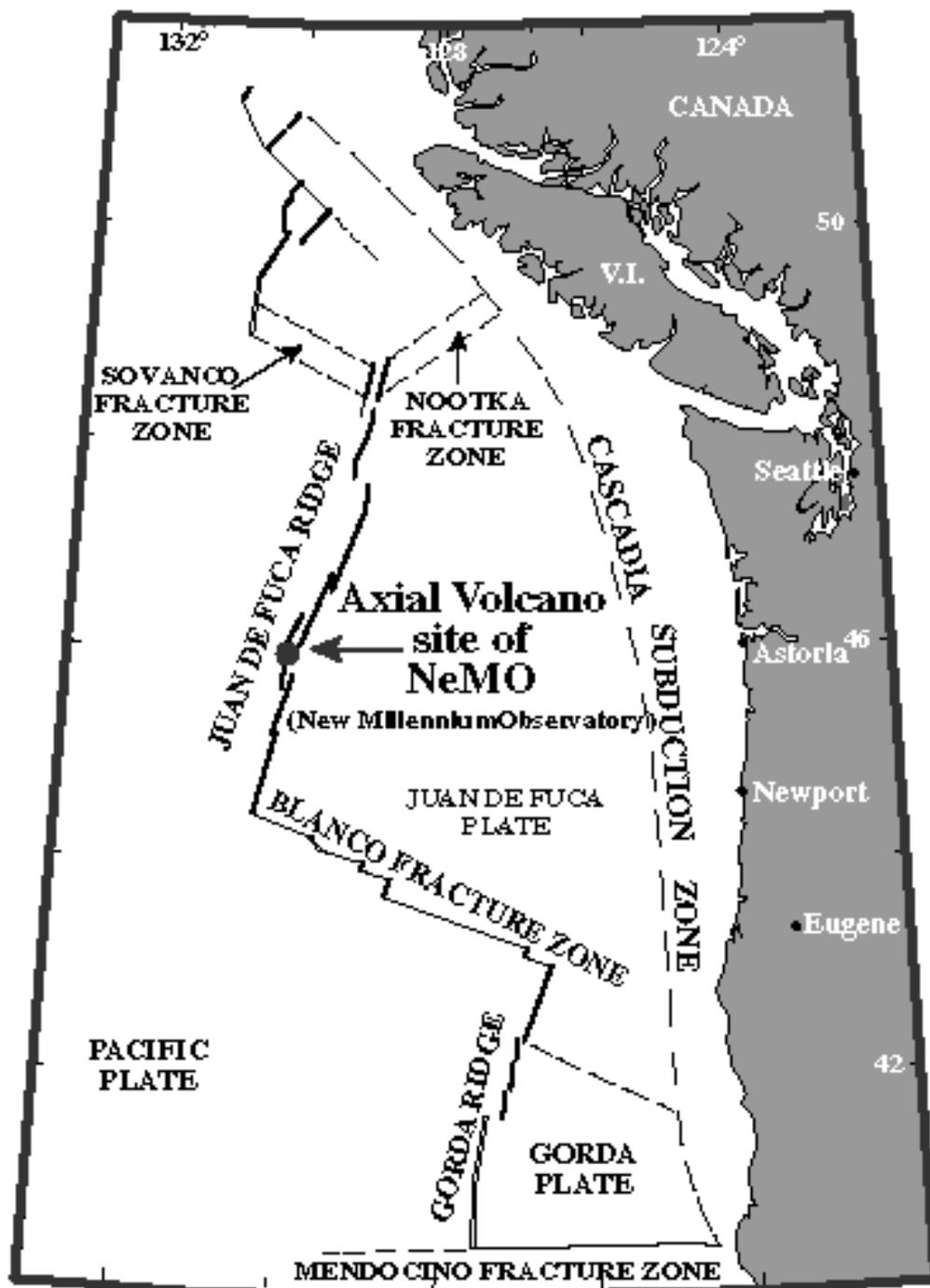
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Figure 1

Cover: Image of high resolution pencil beam bathymetry (Imagenex). Bathymetry grid cell size is 2 meters. Depths range from 1500 - 1575 meters. Orange/red colors shallowest, blues/purples deepest. Imagenex data were collected by the NOAA Vents Program using ROPOS during NeMO'98 and NeMO'99. Data were supplemented with additional bathymetry collected on the Cleft'99 cruise in September 1999. Bathymetry processing and cartography by William W. Chadwick Jr., with assistance from Robert W. Embley and Susan G. Merle.

Errata

Dive Logs:

ROPOS dive logs were saved in .html or Excel .csv (comma delimited) files. The .html files were not an option for editing, as they can only be saved as text files, and lose all their rows and columns. The .csv files were a little easier to work with so they were the files edited for the dive logs. (As you may recall, we could not edit the logs at sea.) There was a problem with the .csv **dive log files** as well. **Any double letters or double numbers were absent.** I tried to find those errors and correct them, but **be aware, especially regarding numbers, as those errors were particularly hard to spot.**

Navigation in general:

1999 navigation not as robust as 1998. 1999 nav fixes were often to the west or southwest of '98 fixes. Unfortunately this is not always the case. The farther south we went, the worse the acoustic nav. That is because the southern transponder net could not be calibrated with the ASHES net. (See section 4 for more details.) Be aware of that and use the dive plots as a guide.

Dive Plots:

- R492 Missing acoustic nav at end of dive, after JD183 2130. We weren't getting any fixes, and there were no good fixes recorded in the nav logbook to supplement the acoustic fixes. The dive continued for a couple more hours, ending about 250 meters southeast of Bag City. Will fill in last two hours of nav with adjusted ship nav, eventually.
- R494 Video went out at JD185 1810, therefore there was no bottom image from that time until ROPOS came up. 1810 official end of dive.
- R495 There are gaps in the nav from JD186 1454 - 1640 and 2236 - JD187-0000. We were getting out of the range of the ASHES net transponders. The dive plots just show a straight line connecting the times. Acoustic nav ends on JD187 0115, but the dive continued until 0158. All the nav gaps will be filled with adjusted ship nav, eventually.
- R501 No acoustic nav from JD191 2251 - JD192 0521. ROPOS on the deck or in the water column from 0230 - 0530. Need to fill in JD191 2251 - JD192 0230 with adjusted ship nav, eventually. The dive plot shows the ROPOS track from JD192 1411 - 1520, but ROPOS was transiting off the bottom at the time and there was no video.
- R494 and R497 Plots state that the nav fixes for the ship are at the stern. That is not accurate. We presume the GPS fixes were referenced to the GPS antennae, about 37 meters fore of the stern. To get actual position at stern one would have to apply a 37 meter lay-back to the ship navigation. (To confuse the matter more: Navigation fixes transcribed in the nav logbook are positions at stern, because we put the pointer in that position on the nav screen and wrote down that fix. More information than you want to know?)

Scientific Participants, Title and Affiliation:

Name	Title	Affiliation
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Bill Chadwick	Geologist	CIMRS/OSU/PMEL
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Kim Wallace	Engineer	CSSF
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Craig Elder	Engineer	CSSF
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Participating Organizations:

PMEL	Pacific Marine Environmental Laboratory
UW	University of Washington
OSU	Oregon State University
CIMRS	Cooperative Institute for Marine Resources Studies (NOAA/OSU)
JISAO	Joint Institute for the Study of Atmosphere and Oceans (NOAA/UW)
WWU	Western Washington State University
CSSF	Canadian Scientific Submersible Facility
UF	University of Florida
UQ	University of Quebec
UT	University of Toronto
UV	University of Victoria
MBARI	Monterey Bay Aquarium Research Institute

1 OVERVIEW OF NeMO'99 - Bob Embley

During the NeMO99 cruise, ROPOS recovered more than 260 geologic, biologic and chemical samples, retrieved 29 experiments and instruments, and deployed 25 experiments. ROPOS made 18 successful dives totaling 204 hours of bottom time in 21 days on site. Despite major problems with the hydraulic systems on the ROPOS, which caused us considerable downtime, the hardworking ROPOS team and the efforts of the science party were able to recover to make this year's cruise rival the success of NeMO98.

The chemical and biological effects of the 1998 diking event are still apparent on the eastern side of the caldera where the lava flow was erupted. Vigorous hydrothermal venting continues in many places (e.g. Marker 33, Cloud, and Magnesia), whereas there has been reduction or cessation in others. Although the amount of visually apparent microbial activity (such as the white floc in the water column) decreased, "snowblower" activity continued at some vents (e.g. Magnesia Vent) and hyperthermophilic microbes were again found in abundance at most of the diffuse (low temperature) sites, (whose temperature is well below their optimal growth rate). These observations show that there is still enhanced subsurface microbial growth more than a year and a half after the eruption. Of particular interest was the discovery of a hyperthermophile growing optimally at 102EC.

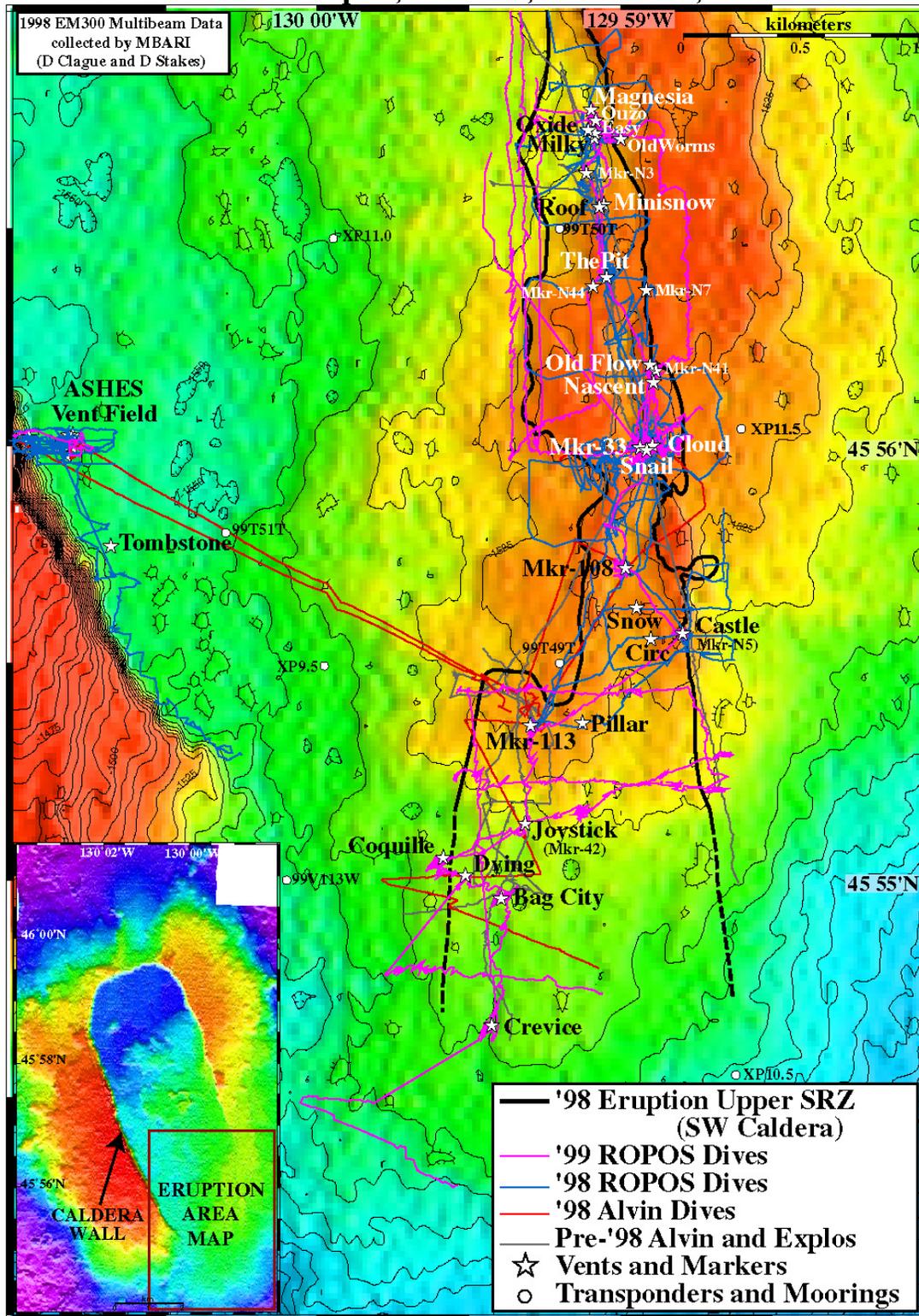
Colonization of the new vents continued. Tubeworms had arrived at Marker 33 and were present in greater densities at sites that only contained small patches in 1998 (e.g., Nascent Vent). Analyses of the water samples, biological grabs, and video observation should tell us much about the evolution of the chemical and biological systems on the summit of Axial.

Mapping of the new lava flow and associated hydrothermal system continued in 1999. We located the (probable) southern end of the lava flow about 6 kilometers south of the caldera along a spectacular fissure system that was followed for hundreds of meters. The eruption was entirely contained in the 1 to 2 meter wide fissure until it overflowed its fissure and erupted in the large mound of lava that was found in 1998 at 45E52'N. Farther north towards the caldera, the trace of the 1998 eruption became more confused as the slightly older eruptions mixed with the 1998 lava. Several new vents (Bag City, Crevice, Coquille) were found south of Marker 113 (the southernmost point investigated in 1998). The vent fluid sampler recovered 113 water and filter samples from all the (still active) major vents.

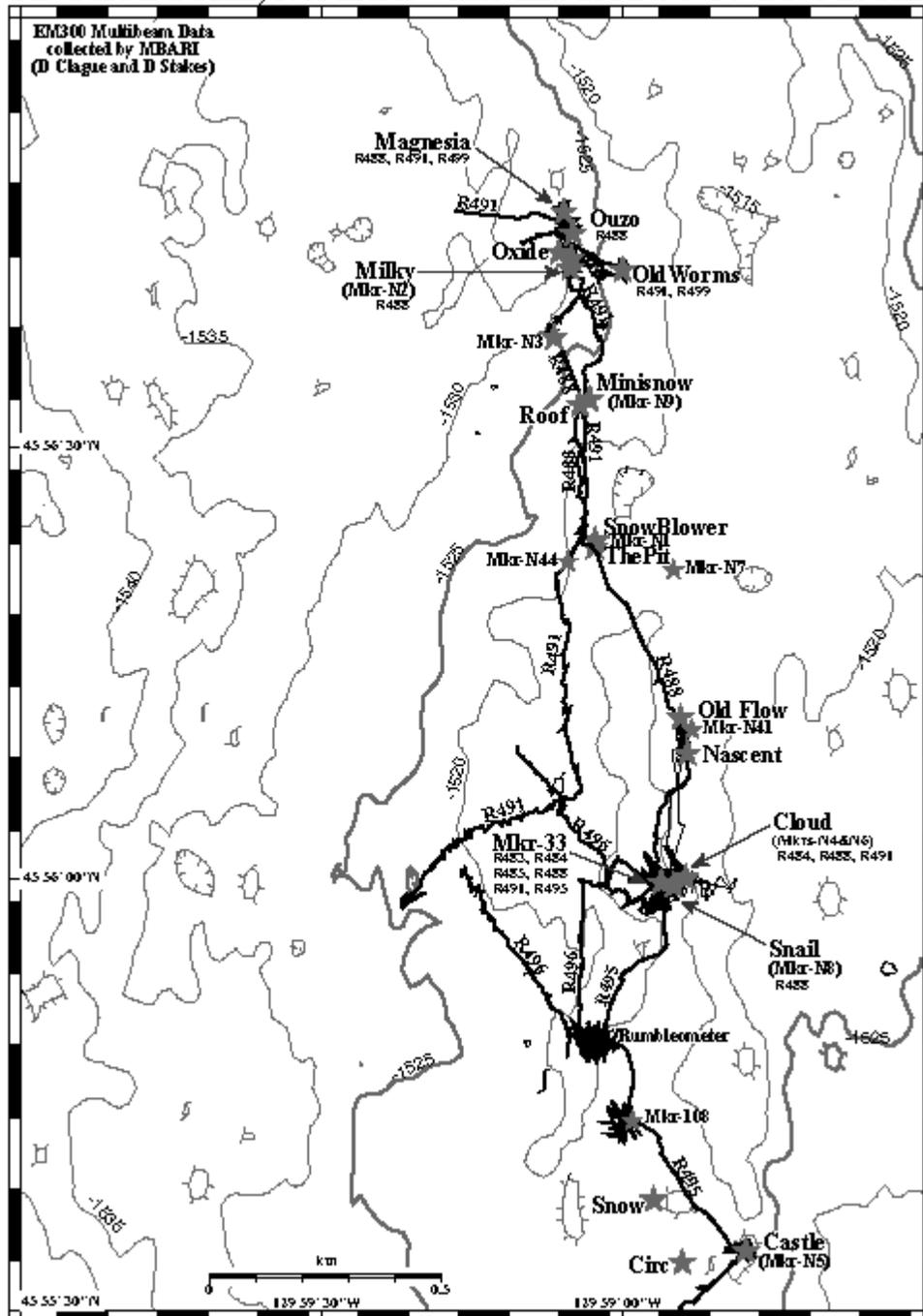
The ASHES vent field was only visited on two dives in 1999 because of the early downtime of ROPOS, and part of one dive was again spent at the CASM vent field in the northern part of the caldera.

Active hydrothermal venting was only found on the summit of Axial, probably where the underlying zone of molten lava permanently resides. The summit area contains hydrothermal systems formed during several different volcanic or tectonic (earthquake generated) events, providing a natural laboratory for studying colonization and evolution of these unique chemosynthetic ecosystems.

Dives on Axial Pre-'98 Alvin and Explos, '98 Alvin, '98 ROPOS, '99 ROPOS



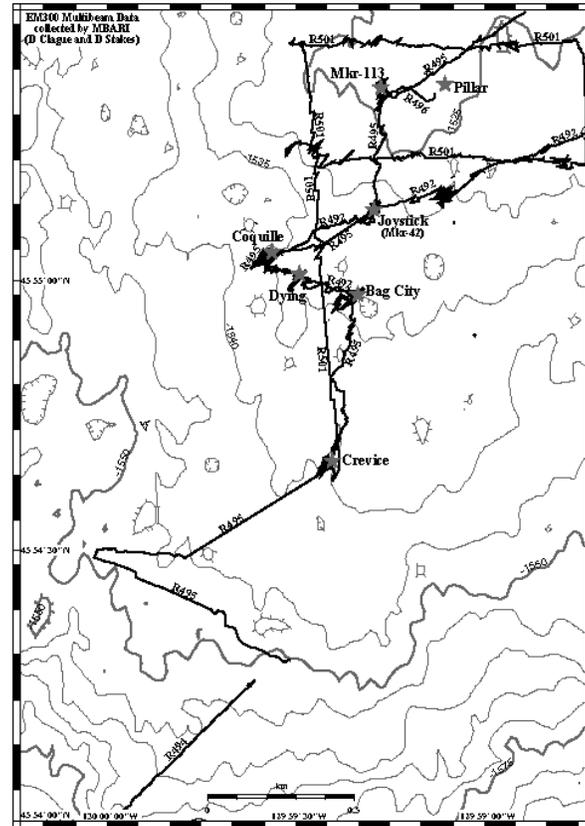
SE Caldera SRZ, Northern Vents and ROPOS '99 Dive Tracks



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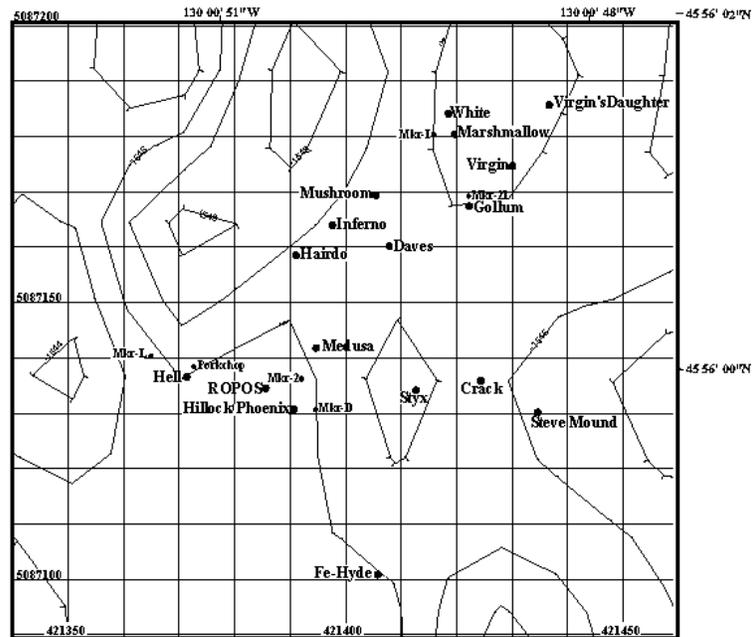
Figure 3

SE Caldera SRZ, Southern Vents and ROPOS '99 Dive Tracks



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Figure 4



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ASHES VENT FIELD

Figure 5

2 DISCIPLINE SUMMARIES

2.1 VOLCANOLOGY - Robert W. Embley and William W. Chadwick

Volcanology studies during NeMO'99 focused on, 1) continuing our instrumental monitoring efforts, 2) expanding our Imagenex sonar bathymetry of the 1998 eruption site, and 3) extending our mapping of the 1998 lava flow south to the area of the southern SeaBeam depth anomaly at 45 52' (confirmed as a new lava flow during dive R465 last year).

The extensometers that were recovered from Axial's north rift zone during NeMO'98 yielded an interesting data set. The instruments had been in place during the 1998 eruption and recorded a 4 cm contraction at the time of the eruption. This represents deflation of the entire summit area of Axial as magma intruded into the south rift zone, and is consistent with the rumbleometer instruments that recorded dramatic subsidence in Axial caldera. The extensometer and rumbleometer data can be modeled together to estimate the depth of the magma reservoir beneath the caldera and the volume of magma removed during the eruption/intrusion. These results were published in the December 1999 issue of Geophysical Research Letters. After the data was downloaded from the extensometers in 1998, they were re-deployed in the same area, and we recovered these again in 1999. Unfortunately, all 4 instruments failed during the 1999 deployment due to connector leaks and failure of components on the circuit boards. The status of these instruments for future deployments is currently being assessed.

The high-resolution bathymetry that can be collected with the Imagenex sonar was one of the highlights of NeMO'98. We were able to double the area of Imagenex coverage in 1999, mainly to the west of the area mapped in 1998. This helped define the western contact of the 1998 lava flow, and also showed many drain-out channels in the older lava to the west, suggesting that the previous eruptions from this area were more voluminous than the 1998 eruption. The Imagenex map fills a critical observational gap between multibeam bathymetry and bottom observations, and helps us understand what we see from ROPOS. It helps us map out the 1998 lava flow in unprecedented detail, including collapse areas and flow morphologies, puts the locations of vents sites and samples in a meaningful spatial context, and helps us interpret the sequence of events during the eruption. This is the first high-resolution map of a mid-ocean ridge eruption site and we will continue to expand the Imagenex coverage in future years.

During NeMO'98, our geologic mapping efforts were concentrated in the 3 km north of Marker 113. However, we know that the 1998 eruption extended at least 7 km south of Marker 113, so during NeMO'99, we extended this mapping to the south. Observations during dive R495 showed that even the large pillow mound that erupted at 45 52' was fed from a narrow fissure. Within a few hundred meters south of the pillow mound, 1998 lava can be seen filling, but not overflowing, a fissure that is 1-1.5 m wide. This extraordinary observation is essentially the surface outcrop of the 1998 dike that fed the eruption at this location, and the width of the fissure we saw is the minimum amount of seafloor spreading that occurred during this event. Between the pillow mound at 45 52' and Marker 113, the story is more complicated because there are other very young lava flows that are difficult to distinguish from the 1998 lava, except that locally they host clearly pre-1998 vent communities (mainly large, dead tubeworms). We were able to map out the distribution of lavas of at least 4 different ages during dives R492, R493, R494, R495, and R501. However, these dives only covered limited parts of this large area, and additional mapping will be necessary in future years to complete this mapping effort. In collaboration with M. Perfit and his students at the University of Florida, a careful collection of basalt samples was made during these mapping dives to determine if there are distinctive chemical differences between the 1998 lava flow and the surrounding older lavas. These results might help in the mapping effort and have implications for the evolution of Axial's magmatic system.

The geologic results from this project also aid in putting into context the remarkable changes observed in the chemical and biologic systems at Axial Volcano since the 1998 eruption. The mapping provides the geologic context for the along-strike variations in the chemical and biologic characteristics of the hydrothermal system. For example, we were able to compare the general pattern of hydrothermal flow from the new eruption with that of the

pre-eruptive system (mapped by previous camera tows and dives), suggesting that the conduit system was not dramatically changed by the dike injection and eruption. The north-south pattern appears to be similar, but there was apparently a small East-West displacement between the pre- and post-eruptive hydrothermal systems. The center of maximum hydrothermal flow appears to have remained in roughly the same place. This is also apparently where the maximum diversity in the microbial population is. The “snow blower” vents occur primarily at the northern portion of the system, where the lowest flow rates are located.

2.2 CHEMISTRY

2.2a Hydrothermal Fluid Sampling - David Butterfield

The main goals for fluid sampling for this cruise were 1) re-sample vent fluids from sites sampled last year and expand the sampling to cover a broader range of the eruption area in the SE caldera and rift zone, 2) re-sample diffuse, warm vents and hot vents in the ASHES field, and 3) sample vent fluids from CASM. The vent fluid studies are intended to use chemistry to understand the connections between volcanic activity, hydrothermal heat loss, and microbial activity in hydrothermal systems. Fluid chemistry is also an important measure of habitat conditions for studies of vent fauna colonization and species distribution.

Very few studies to date have focused intensively on the variation in diffuse fluid chemistry within a region. This work may yield new insights into the variability of sub-seafloor processes in a hydrothermal system.

Hot Fluid Sampler

We used the Hot Fluid Sampler (HFS) for the second year during this cruise, after several improvements were made over the proto-type model of last year. The sampler has a lower profile in front of the ROV so that visibility and ability to sample are not severely impaired. The plumbing layout was improved to allow more filters on the instrument. This year we were configured to take 6 piston samples (3 modified with high-vacuum valves for gas sampling), 8 collapsible bag samples with optional in-line filters, and 10 additional filters without water collection. One of the bag samplers was used as a flushing line for two titanium gas-tight samplers so that fluids of known temperature could be sampled by different types of samplers for comparison. On one dive, we can collect 10 discrete water samples for fluid chemistry, 5 water samples for gas analysis, and up to 17 filters for a variety of analytical purposes.

Several types of filters were used. Membrane filters of .45 or .2 micron pore size were used to collect particulate material for: xrf chemical analysis and SEM, particulate elemental sulfur, particulate organic carbon, lipids, and fluorescent in-situ hybridization (FISH) analysis. In addition, “Sterivex” high through-put cartridge filters were used to collect particles for DNA extraction. All of the analytical work done on the filters is designed to help us understand the chemical and microbiological variation among different types of vents. The in-situ filtration capability of the fluid sampler is an important advance over all previous vent fluid sampling instrumentation in that it allows us to concentrate particulate material from large volumes of water for multiple analyses at a given vent site, and it also allows us to separate the dissolved components from the particulate components at the time of venting, thereby eliminating uncertainty about post-sampling particle formation within the water sample containers. In many instances, we collect both filtered and unfiltered water from the same site for comparison. Overall, we have an excellent set of samples for fluid chemistry, gas chemistry, particle chemistry, and microbiology.

On-board fluid analysis:

Kevin Roe was the principal fluid analyst on this cruise, and carried out analysis for pH, alkalinity, hydrogen sulfide, dissolved silica, and ammonia. Most of our chemical analysis occurs on shore. We measured refractive index of the hotter vent fluids to estimate their salinity or chlorinity. Dave Butterfield analyzed particulate elemental sulfur by colorimetry on a subset of samples.

We were fortunate to have Andy Graham on board. Andy received cuts of most of the fluid samples for methane and hydrogen analysis by gas chromatography. In many cases, vent fluid samples arrived on deck containing a gas phase and a liquid phase. When this occurred we measured the volume of the liquid and gas portions and Andy analyzed both for gas content. In this way, the fluid sampler appears to be superior to the traditional titanium major samplers because it has much better gas retention capability, and the samplers are transparent, allowing us to separate the gas portion from the liquid. We cannot rule out some gas loss through the check valves, but comparison of the gas results from different samplers will help to evaluate this.

Initial results:

HFS was deployed on 2 short aborted dives and 3 complete dives in the 1998 eruption area, plus one complete dive at ASHES. HFS proved to be quite efficient. For example, on the first HFS dive, we had only 30 minutes of bottom time at marker 33 and took 5 samples (2 water chemistry, one gas chemistry, and two filters). For the entire cruise, we collected 43 vent fluid samples for water chemistry with HFS, 13 gas piston samples, and over 50 filters. In addition, titanium gas-tight samples were collected on many dives (see Leigh Evans report) and these will be analyzed for major element chemistry.

We have not yet processed the raw data from the last two dives, but the initial results appear similar to last year. Relative to the CoAxial eruption area, where there were large changes in composition and a decay in heat output one year after the eruption, we saw little change on the seafloor in the eruption area. Diffuse venting continued in many areas. The maximum measured temperature at marker 33 is higher than last year (78 versus 55 degrees). Looking at the ratio of hydrogen sulfide to silica (the ratio is only slightly sensitive to the amount of entrained seawater during sampling) it appears that the samples from throughout the eruption area this year are just slightly lower in sulfide relative to silica. Methane appears to be slightly higher this year than last year. We cannot say anything about the changes in salinity until we do high-precision analysis on shore.

2.2b OsmoSampler and OsmoAnalyzer Operations - Thomas Chapin

Changes in the chemical composition of hydrothermal effluent after a tectonic-volcanic event have been documented (e.g., Baker et al., 1987, 1998; Butterfield and Massoth, 1994; Von Damm et al, 1995; Massoth et al., 1995; Massoth et al., in press; Wheat et al., to be submitted) and a conceptual model has been developed that theorizes the chemical evolution of venting fluids (Butterfield et al., 1997). However, the timing of these changes is uncertain. To date observations of temporal variability in the chemical composition of hydrothermal fluids has relied on repeated submersible operations and the collection of discrete samples. While this technique provides some temporal constraints, a continuous water sampler or analyzer allows one to collect more samples with limited need for costly submersible operations. Our goal for this cruise was to deploy two short-term (two weeks) and two long-term (one year) continuous sampling systems to provide temporal constraints for observing hourly to daily and weekly to monthly chemical cycles in the hydrothermal effluent. Data from these samplers and their comparison to samples collected using traditional discrete sampling techniques will allow us to determine the temporal scale of chemical change in the hydrothermal effluent as the hydrothermal system evolves and may provide constraints for understanding the physical and chemical conditions at depth and the path for fluid circulation.

Two sampling systems were deployed, OsmoSamplers and OsmoAnalyzers. OsmoSamplers are continuous water samplers that use the osmotic pressure that is created across a semi-permeable membrane by solutions of differing salinity (Theeuwes and Yum, 1976; Jannasch et al., submitted). This pressure drives water across the membrane at a speed that is dependent on the surface area of the membrane, type of membrane, salt gradient, and temperature. An excess of salt is maintained on one side of the membrane, thus only temperature affects the flow of water in the sampler. Pumps in an OsmoSampler are used to continuously draw sample through a small bore (0.8 mm id) tubing that is attached to a 40-cm-long T-handle. An additional pump was used to add acid to the sample stream in most of the OsmoSamplers. A 1.5-m-long section of tubing separates the sample intake from the pump to allow the pump to be placed in an area void of hydrothermal influence and thus minimizes temperature (pump rate) fluctuations. A temperature recorder with a resolution of 0.0018°C is attached to the T-handle to monitor the same water that is being collected by the OsmoSampler. Chemical data are obtained by retrieving the sampler, cutting the sample

tubing into sections, extracting the seawater, and analyzing the seawater for chemical species of interest. Time-stamps for individual samples are determined assuming a uniform temperature at the pump that translates into a uniform rate of pumping.

OsmoAnalyzers, in contrast to OsmoSamplers, use osmotic pumps to deliver reagents into a sample stream for in situ analysis (Jannasch et al 1994). An iron OsmoAnalyzer was deployed at Marker 33 to continuously measure Fe at 15-minute intervals over the next 6-9 months.

Two long-term acid addition OsmoSamplers, deployed from the NeMO 1998 September cruise were recovered on this cruise. These samplers, one at Marker 33 and one at Milky vent, continuously collected sample for 9 months providing 163 0.5-mL samples. Analysis for major elements and trace metals will be performed later in our laboratory. Milky vent started at 9.5 C but dropped to 3.6 C by the time the OsmoSampler was recovered. There was no visible floc venting from Milky and the low temperatures at the end of the deployment indicate that the diffuse vent had died out. Marker 33, on the other hand, continued to vent hydrothermal fluids up to 80 C and was quite vigorous. The NeMO-98 long term acid addition OsmoSamplers deployments appear to have been a success and will provide one of the first long-term continuous records of the chemical signature of hydrothermal fluids.

During NeMO-99, four long-term OsmoSamplers were deployed. Three OsmoSamplers were deployed at the Marker 33, in the hottest section with temperatures up to 80 C. The OsmoSamplers consisted of one regular acid addition, one bio-OsmoSampler which has a sodium azide biocide to prevent bacterial growth, and a long term Cu-OsmoSampler which will collect samples for gas analysis. Another long-term acid addition OsmoSampler was deployed in 70 C water at Magnesia vent, just north of Milky vent. Tremendous clouds of white flocculent material were coming out of Magnesia and it looked like a snowstorm.

A 2-week record high temperature record from the Hell vent was recovered. Unfortunately the deployment of a long-term acid addition OsmoSampler and temperature probe was not successful.

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2.2c Gas Sampling - Lee Evans

The primary goal of gas sampling during the NeMO '99 expedition was direct sampling of vent fluids by way of Titanium Gastight bottles and modified pistons from the PMEL Hot Fluid Sampler (HFS). Approximately 30 useful samples were gathered and their available gas contents extracted and sealed in glass ampoules for chemical analysis. Analyses include helium isotopes, hydrogen and methane.

As with 1998's samples, the geographic coverage of sampling included the east side of the caldera along the region of the 1998 lava flow, Ashes vent field on the west side and Casm vent field to the north. Time series measurements will be possible at about 5 vent sites. The coverage of diffuse vent samples was extended southward on the east side in the direction of the vestige of the eruptive fissure.

This year's method modifications present a significant improvement as compared with those used to gather samples in 1998. At least some of 1998's collection were a bit more dilute than what is desirable. Both the plumbing scheme for titanium gastight bottles and the sample integrity of the gas piston samplers (HFS) were improved.

2.2d Studies of Dissolved Gases from Hydrothermal Vent Systems - Andy Graham

The main focus of our lab is the study of dissolved gases from hydrothermal vent systems. For this cruise I brought a gas chromatograph on board and analyzed fluid samples from the hot fluid sampler, suction sampler and a niskin bottle mounted on ROPOS. The main gases that I analyzed were dissolved hydrogen and dissolved methane. These gases are important in the hydrothermal vent community because certain microbes can oxidize these gases and use them as an energy source. Over 50 samples were analyzed ranging from 300 °C Inferno vent to 4 °C Magnesia vent. From an initial glance the data vent such as Marker 33 and Virgin Mound still appear to contain high concentrations of both hydrogen and methane. Further analysis and a comparison to last year's data will occur.

2.3 MICROBIOLOGY

2.3a Microbiological Sampling for Molecular Microbial Ecology Analysis Western Washington University, Biology Department: Craig L. Moyer & Karen Lynch.

Introduction

One of the greatest challenges in microbial ecology is the accurate identification and description of microbial populations within their respective communities. This information is central to determining the extent of global microbial diversity, which remains the least understood of all the biological size classes. To address this challenge, molecular biological techniques using small-subunit ribosomal RNA (SSU rRNA) gene sequences have been applied to describe the structure and diversity of different microbial communities. The current endeavor is to examine specific habitats with known biogeochemical characteristics (e.g., S, Fe, Mn) to learn more about the dominant microorganisms residing therein. The focus of this study at Axial Volcano is to estimate the microbial community structure and diversity to assess the degree of commonality and uniqueness among local hydrothermal vent habitats, (i.e., vent-associated sediments, free-living microbial mats, microbes associated with subsurface floc-ejecta), and to also compare these results with distal hydrothermal vent habitats. This study will also allow for the enhanced development of a comprehensive global perspective regarding the diversity of deep-sea microbial communities.

Selective enrichment culture has severe limitations as an approach to the cultivation of naturally-occurring microorganisms. The majority (typically >90-99%) of microbes in nature have not yet been cultivated using traditional techniques. Consequently, it is very unlikely that collections of microbial isolates are representative of *in situ* diversity and community structure. Furthermore, because relatively nutrient-rich media are generally used for isolations, "weedy" or opportunistic microorganisms may be selected rather than those dominant in the natural community. The approach, herein, is to ascertain a microbial community's primary members through molecular (i.e., cell component) means and then to attempt to further characterize their respective phylogeny or natural history. Obtaining a better representation of microbial community structure and diversity is crucial to aspects of microbial ecology where *Bacteria* and *Archaea* interact with one another and with their environment, e.g., global biogeochemical cycling of matter, succession and disturbance responses, predator-prey relationships, and trophic-level interactions. These lessons can then be used to focus enrichment culture techniques towards ecologically significant taxa. This approach has been successfully used to isolate the dominant iron-oxidizer bacterial taxon

found within the microbial community at hydrothermal systems located at Loihi Seamount, North Gorda Ridge, and other habitats (Emerson and Moyer, 1997; unpublished results).

Cell component analyses provide a culture-independent means of investigating microorganisms as they occur at hydrothermal vent systems (Moyer *et al.*, 1994;1995; 1998). While several types of cell components have been analyzed, the SSU rRNA molecule offers an amount and type of information that makes it one of the best culture-independent descriptors or biomarkers of microorganisms. In recent years a detailed theory of evolutionary relationships among the domains *Bacteria*, *Archaea* and *Eucarya* has emerged from comparisons of SSU rRNA "signature" sequences. For example, each SSU rRNA gene contains highly conserved regions found among all living organisms as well as diagnostic variable regions unique to particular organisms or closely related groups. Additionally, each SSU rRNA gene contains about 1,500 nucleotides of sequence information that can be obtained and utilized to differentiate among closely-related and distantly-related groups of microorganisms. This type of molecular approach allows the autecology of microorganisms to be studied whether or not they can be cultivated (Moyer *et al.*, 1996). In addition, the phylogenetically described taxa or "phylotypes" can be placed in a synecology context through the examination of SSU rRNA clone libraries generated from a microbial community and habitat diversity can be analyzed through rarefaction (Moyer *et al.*, 1998). These features make SSU rRNAs particularly useful for studies of molecular microbial ecology, where a broad and unknown range diversity of microorganisms is likely to exist. Currently, over 10,000 SSU rRNA sequences from both cultured isolates and environmental phylotypes have been made available for study through the Ribosomal Database Project at NSF's Center for Microbial Ecology at Michigan State University.

Experimental Design and Methods

Shipboard Processing and Storage of Samples

A dual approach was used for microbial sampling. First, 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 East-Side of Axial at (1) Marker #33 Vent, (2) Markers N6 & N4 aka Cloud Vent, and (3) Magnesia aka Whiteout Vent. We also began to investigate the phenomena of the "bag creature" this year with slurp samples collected on the East side of Axial at both Axial Gardens (Marker #113) and from a new site entitled Joystick Vent (Marker #42). This is a characteristic jelly-like residue, which looks to be composed of complex polysaccharide globules that form in and around low temperature diffuse flowing vents in conjunction with microbial mats. No suction samples used for microbiology were obtained from the vicinity of the ASHES vent area this year.

Second, the deployment and recovery of microbial traps using glass wool as a substrate for microbial growth. Microbial traps were constructed using a cluster of three 3" sections of 4"o.d. plexiglass tubing, surrounded top and bottom by a 202 μ m nylon mesh (Nytex) to exclude macrofauna and meiofauna grazing. These were placed directly into diffuse vents and were used to collect colonizing microorganisms in an effort to examine community succession. These were deployed with the idea of attempting a time-series with both short-term (days) and long-term (annual) time scales. This objective was successfully achieved with long-term recoveries from last year's NeMO98 made at both Marker #33 and Cloud Vent (Marker N4), short-term recoveries from deployments made this year were also made at Marker #33, and Cloud Vent (Marker N4) on the East-side of Axial Volcano. New long-term deployments again were made at both of these two East-side sites. Unfortunately, only a single successful recovery from the ASHES Vent Field was made. This occurred at Gollum Vent, where two long-term deployed microbial traps were heroically recovered (in spite of the onset of foul weather conditions) and a fresh trap was deployed. Short-term recoveries from the ASHES area remains illusive, but may again be attempted next year, in addition to attempting continued long-term recoveries from each of the following locations where microbial traps have been previously deployed: Gollum, ROPOS, Hillock, Mushroom Vents.

Microbial samples collected were each independently processed. Microbial biomass preservation was achieved by quick-freezing in liquid nitrogen and storing on dry ice until return to the laboratory. These samples will be used for

the direct extraction of nucleic acids. A series of sub-samples were also (i) cryo-preserved (again using liquid nitrogen quick-freezing) with 40% glycerol, and (ii) aliquots were stored at 4°C, both for enrichment culture selection. Another series of sub-samples was fixed with 2.5% EM grade glutaraldehyde for examination with SEM and epifluorescence microscopy.

Laboratory Processing and Molecular Biological Analysis

Initially, all samples will be examined by epifluorescence microscopy in an effort to ascertain biomass estimates and examine morphological diversity. A subset of these will also be examined through SEM and an analysis of extractable lipids, which provides an estimate of microbial biomass and initial clues into community structure. The overall molecular biological strategy used will be essentially that of Moyer *et al.* (1994, 1995; 1998) with a few technical and logistical improvements. The first step will be the efficient and direct extraction of high molecular weight nucleic acids from quick-frozen samples. This will be followed by PCR amplification of SSU rDNAs using previously defined conditions to maximize the equal representation from each population contained within a respective community. The concept is to proportionally amplify or make several copies using the total genomic DNA from a natural community serving as the template for oligonucleotide primers that are complementary to universally conserved SSU rDNA sequence positions. Representative SSU rDNA amplification products are cloned generating a clone library. Clone libraries will then be examined through the use of Amplified Ribosomal DNA Restriction Analysis or ARDRA and by using rarefaction as a metric for organismal diversity (Moyer *et al.*, 1998). This approach, using tetrameric restriction enzymes, has been shown to detect >99% of the taxa (i.e., phylotypes) present within a model dataset with maximized diversity (Moyer *et al.*, 1996). SSU rDNA sequences will also be subjected to phylogenetic analysis (using distance matrix and maximum likelihood algorithms) to estimate the affiliated ancestral lineage for each dominant community member thereby yielding clues as to their respective evolutionary history and potential physiology.

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2.3b Hydrothermal Fluid Microbiology - Julie Huber and Sheryl Bolton

We returned to sea this summer to continue our research on microbial communities in diffuse fluids on Axial Seamount. Along with Dave Butterfield, we are trying to quantify the diversity of microbes and their metabolisms in relation to the chemistry of the diffuse fluids over time.

We have successfully cultured mesophiles, thermophiles, and hyperthermophiles from all diffuse fluids collected during this cruise. We have over 100 positive enrichments (which require confirmation on land) at temperatures ranging from 23 °C to 110 °C in a wide variety of media, mostly anaerobic. One very exciting find was the culturing of a microbe at 110 °C from Marker 33. This hyperthermophile (or group of hyperthermophiles) was successfully transferred six times while at sea. Currently, the highest known upper temperature limit for growth of a living organism is 113 °C by a sulfur-dependent hyperthermophilic *Archaea* called *Pyrolobus*. Our microbe, growing anaerobically with elemental sulfur, was isolated from ~70 °C fluid at Marker 33. We also found that it is producing large amounts of hydrogen and some carbon dioxide, as analyzed on the gas chromatograph by Andy Graham. The fact that we have found a microbe (or group of microbes) growing at such a high temperature, yet isolated from fluids much below its temperature of growth, strongly suggests that there is a hotter subsurface environment that these microorganisms are growing and thriving in. By studying this exciting microbe, we hope to learn more about the metabolic wonders of life at high temperature and the limits on life.

Additionally, quantitative enrichments (MPNs, Most-Probable-Number technique) were performed at a variety of temperatures from several sites. The table below contains the 95% confidence interval for the abundance of microorganisms that grow in the given media, given in microbes/liter. These data are preliminary and must be confirmed by microscopy on land.

Sample Site	Incubation Temp (°C)	Fluid Temp (°C)	Media Type	Microbes/L
Marker 33	90	78.0	Anaerobic, high organics	3000-96,000
Marker 33	90	78.0	Anaerobic, low organics	600-8800
Magnesia	55	5.6	Anaerobic, low organics	80-2400
Bag City	90	23.4	Anaerobic, high organics	300-7600
Bag City	90	23.4	Anaerobic, low organics	80-2400
15m N of Nascent	90	25.8	Anaerobic, high organics	60-880
Cloud N6	23	20.0	Aerobic, low organics	≥48,000
Gollum	90	22.3	Anaerobic, high organics	In Progress
Marshmallow	90	71.8	Anaerobic, low organics	In Progress

We also obtained a number of discrete filtered fluid samples for molecular analysis using the hot fluid sampler. These filtered samples will be used in total community DNA analysis to determine microbial diversity and phylogeny, FISH (Fluorescence In-Situ Hybridization) to quantify and track certain microbes, and lipid analysis to quantify and determine the physiological state of microbes. We will also perform epifluorescent counts on all preserved fluid samples for microbial enumeration.

This combination of culturing, microscopic, and molecular techniques will help us determine how any changes in the fluid chemistry over the past year may be reflected in the microbial community structure. Additionally, we will continue to explore the microbial ecology of new diffuse sites and high temperature microbes found here at Axial Seamount.

2.3c Microbial Food Webs - UQAM Disciplinary Summary, Kim Juniper

Emphasis this year was placed on the consolidation and expansion of a study of the dynamics of microbial food webs. The overall goal of the study is to understand how the structure of vent food webs add structure and complexity as new vents and vent fields are colonized by increasing numbers of species. Particularly relevant are questions of the importance of vestimentiferan tube worms as a keystone species that create habitat for other organisms, and the relative importance of free-living and symbiotic microbial production as food sources for animals. Suites of faunal samples were collected from new vents in the East Rift Zone as well as from mature and senescent vent sites on adjacent older lava flows. Tissue samples from these organisms will be analyzed for stable carbon and nitrogen isotopes and for lipid biomarkers. Samples of microbial mat, biofilms and particulate organic material collected from each site will be similarly analyzed to permit matching of deposit and suspension feeding animals to their food sources, as well as the identification of trophic levels. The microbial and particulate samples will also be analyzed for ATP and total lipid content, as estimates of microbial biomass available for consumer organisms. Samples were also preserved for a molecular study of the diversity of microorganisms that constitute the animal food supply.

Samples collected came almost entirely from basalt-hosted diffuse vents, with the exception of samples from T&S vent at CASM and 2 collections from the sulfide worm habitat at ASHES. Planned collections of sulfide edifice tube worm communities in the ASHES field were missed because of the weather-related early termination of the dive program.

A vent-field scale study of the development of food webs was initiated at the Cloud site in the East Rift Zone. This study will examine spatial relationships between geological features, the location and intensity of venting and the colonization of individual vents, much as we have previously done for sulfide edifices. This is very much a

mapping based project that seeks to discover spatial and temporal patterns that lead to the development of testable hypotheses. Video imagery and photographs collected during two dives are being used to develop a map of the distribution of individual organisms in relation to geological features and venting. This map will be incorporated into a small-scale GIS later this summer, to facilitate quantification of organism distribution and habitat. A short Imagenex survey was also performed during the video transects. We will attempt to integrate the resulting data into the map, despite problems with imprecision of navigation along and between transects. Mapping will be repeated in subsequent years to document changes in venting and community composition.

2.4 MACROBIOLOGY

2.4a Biology of Low Temperature Sites - Maia Tsurumi and Jean Marcus

1. Introduction

This biology program focused on two major themes: 1. succession (continued colonization through senescence) of the South Rift Zone vents, and 2. The regional distribution of species and populations of Axial Seamount. An important aspect of our sampling is to couple our collections with vent fluid chemistry. We were very successful with this approach last year, and during NeMO 1999 we were fortunate to extend this coordinated sampling. Of all our samples, there were only three which had no chemistry data.

2. Succession

a) Continued colonization.

We were intrigued last year to find three types of initial colonization at new vents on the new lava. These included: i) Small vestimentiferan recruits with three or four other known species, ii) Dense snails and iii) A mix of scale worm species and other polychaetes. This year we anticipated more homogeneous communities with tube worm recruits at all new vents. This prediction mostly held true. Tube worms occurred at all vents with the exception of the northern area where venting may have subsided, based on the general lack of vent fauna. For example, we found no fauna at Milky vent, although it supported scale worms and other polychaetes last year. Although tube worms were present and of a morphotype typical of new venting, they were not found in the abundance that we anticipated. In fact, this scarcity of tube worms forced us to suction sample at many locations because grabs were not possible.

We were able to repeat sample at all locations where we had samples last year. Further, we were able to sample two new vents on the southern portion of the South Rift Zone. This sampling revealed a species of nemertean worm seen after the 1993 CoAxial eruption, but not observed on the Axial 1998 flow last year. Although the lava in this area is of uncertain age, the tube worm morphology indicates that this is new venting. Preliminary sorting of samples shows that new species have continued the colonization sequence. There also is an observed shift in the relative abundance and biomass of some of the species. Next year should be interesting...

b) Senescence

Since venting is ephemeral, we have the opportunity to see what the vent community looks like at all stages of its "lifecycle". This is next to impossible to do in many other ecosystems because of the time scales involved. Until recently, studies of vent succession have focused on the initial and intermediate stages of the communities. For the last couple of years our lab has been working on understanding the entire sequence of succession from initiation to death. This requires opportunistic sampling of dying or dead vents. We obtained video, a suction sample, and one tube worm grab at a senescent vent and anticipate that this will help us to sort out the final sequence of the vent cycle.

3. Regional Character

Axial Volcano is one of the few places on the Ridge that allows us to study discrete, well-separated communities. A current question in vent ecology is how populations interchange among sites. We are working on better describing species distributions in a regional setting. Some vent species are very patchy and we are attempting to understand in

an ecological framework why this is. To understand vent community dynamics within the caldera, it is crucial to sample as many intra- and inter-vent field assemblages as possible. To this end, we re-sampled, CASM and most of the South Rift Zone (North and South). In addition, we have selected one species of polychaete for a population genetics study.

4. A Final Comment

We would like to thank the NeMO 1999 science party for their encouragement, help, and interest. Also a big thank you to all the crew of the Thomas G. Thompson and the C.S.S.F. ROPOS gang.

Macrobiological Sample List from Low Temperature Sites

SOUTH RIFT ZONE

Suction samples

- **R483-1: Mkr 33**, Suction for larvae over tube worms of R483-6
- **R488-5: Mkr 33**, Suction for C. Levesque and J. Marcus
- **R488-6: Mkr 33**, Suction for mat by C. Moyer, picked out large fauna
- **R488-7: Mkr N8, Snail**, Suction for fauna (some animals to C. Levesque)
- **R488-14: Mkr N4 (Cloud)**, Suction for fauna
- **R488-15: Mkr N4 (Cloud)**, Suction for mat by C. Moyer, picked out large fauna
- **R488-16: Mkr N4 (Cloud)**, Suction for tube worms into flushing bottle
- **R491-5: Mkr 33**, Suction for gastropods ~ 3 m from crack (C. Levesque has most animals)
- **R491-13: Nascent**, Suction over tube worm bush for larvae
- **R491-14: Nascent**, Suction where tube worm grab was taken (C. Levesque has most animals)
- **R492-1: Joystick**, Suction because too few tube worms to grab
- **R492-2/3: Joystick**, Suction for mat and bag creatures by C. Moyer, picked out large fauna
- **R495-16/17: Mkr 113**, Suction for mat by C. Moyer, large fauna picked out
- **R495-4: Non-vent**, Suction on new lava for diatom mat
- **R495-35: Crevice**, Suction sample of old worms

Tube worm grabs

- **R483-6: Mkr 33**, area in front of Time Lapse Camera
- **R491-16: Nascent**, from spot where MTR (#4108) was and 3 other spots close by (some animals to C. Levesque)
- **R491-18: Mkr N41**, from spot where MTR (#4126) was
- **R491-20: Old Flow**, old worms on old lava
- **R491-24: Oldworms**, old worms on old lava
- **R492-6: Coquilles**, old worms on old lava
- **R492-10: Bag City**, large worms (up to 1 m), new vent?
- **R496-3: Mkr 113**, from top of pillar, where Moyer's microbial traps #20&21 were
- **R501-17: Crevice**, older worms from intermediate (?) lava

Animals from C. Moyer's microbial traps

- **R483-3/7: Mkr 33**, Animals from C. Moyer's microbial traps (#9&12)
- **R496-1/2: Mkr 113**, Animals from Moyer's microbial traps (#20&21)

CASM

- **R497-9: base of T & S**, where Vemco was recovered and MTR deployed

ASHES

- **R502-15: Mkr I**, suction sample for meiofauna and water chemistry

Water Chemistry

- Water samples from all sites listed above except Snail vent (mkr N8), Mkr N41, Old Flow and Crevice.

Time Lapse Camera

- TLC was retrieved and redeployed at Mkr 33. Tube worm grab from Marker 33 sampled the photographed area.

2.5 HYDROTHERMAL DEPOSITS - Steve Scott

There are two types of hydrothermal deposits in the caldera of Axial Volcano: Fe-oxyhydroxides and sulfide-sulfate. Both were investigated and sampled during NeMO 99.

Fe-oxyhydroxide deposits

Analyses of Fe-oxyhydroxide samples taken from Steve Mound, Gollum Vent and south of ASHES in 1998 show the material to be silica poor ferrihydrite (nominally $\text{Fe}_3\text{HO}_8 \cdot 4\text{H}_2\text{O}$) together with amorphous silica. Ferrihydrite is commonly found in soils, oxidized mine wastes and other iron-rich environments, and now also on the deep seafloor (Boyd and Scott, 1999, Can. Mineralog.). The material is essentially amorphous although it can have short-range crystallographic order. It is of biogenic origin, clearly coating bacteria as seen in SEM and STEM images.

During NeMO 99, ferrihydrite deposits were sampled at Oxide Vent (inactive); at Naaz, south of ASHES (inactive); and, at the west wall of the caldera near ASHES (active). Red iron oxides and bacterial fluff were also observed at a few other places, most notably on the new lava in the south rift zone. The Naaz site is a new discovery of clusters of 10-15 cm diameter x 20-60 cm high conical structures that look like termite mounds made of ferrihydrite and of anhydrite coated by ferrihydrite. Naaz covers an area of about 5m (east-west) x 15m (north-south) and lies about 5 m south of Crack Vent. The distribution of the mounds within a cluster and in the peripheral regions where mounds are widely dispersed appears to be controlled by fractures in the otherwise relatively smooth sheet flow surface. Both vent fluids (6°C maximum temperature) and consanguineous oxide-coated bacteria were sampled at the west caldera wall. This will enable a determination of partitioning of elements between fluid and solids, an important step in the study of this biomineralization process.

Sulfide-sulfate spires

The CASM T & S spires, discovered during the 1998 NeMO expedition, were sampled. The five samples include different mineralogical types and both actively venting and inactive areas. A short distance north of T & S, on the east wall of the CASM rift, there is a large pile of oxidizing sulfide talus whose source was not thoroughly investigated. There is also evidence (red staining) of hydrothermal activity in some of the talus blocks at the foot of the north wall of the caldera. One sample each from Castle and Flat Top were lost. The Castle sample, taken from the top of the structure, appeared to be oxidized.

Two recovered HOBOS (Hell Vent and CASM T & S Vent) had ~1 mm thick sulfide deposits on their probe sheath. By determining the mass of precipitated material/ unit area/time the HOBO was deployed, the precipitation rate can be calculated, assuming it is linear with time. Furthermore, this rate can be known as a function of fluid chemistry (the vent fluids were sampled) and temperature (from the HOBO record).

Suction sampling within the Marker 33 vent revealed the presence of sulfides (pyrite + ?chalcopyrite) and anhydrite coating a cm-size piece of basalt and impregnating the basalt=s vesicles. The anhydrite and possible chalcopyrite indicate much higher temperatures than are now observed at Marker 33. It is postulated that the vent system was much hotter just after the January 1998 eruption than it is now.

2.6 ROCK SAMPLING AND PETROLOGIC STUDIES - M. Perfit and J. Chadwick

Introduction:

The objectives of the rock sampling program were four-fold: 1. complete detailed sampling and mapping of the 1998 lava flow to aid in the identification of its boundaries and extent, 2. determine the compositional and petrologic heterogeneity of the 1998 flow and spatial variability, 3. compare the composition of the 1998 flow to that of the

surrounding older flows to evaluate temporal changes in magma source, 4. recover samples from Axial's north and south rift zones by rock corer to investigate temporal and spatial variations in magma genesis on a regional scale.

The initial sampling and subsequent chemical analyses of basalts from the 1998 flow showed that it was very similar in composition to basalts previously recovered from the caldera. In particular, the 1998 flow has a composition like that of young looking flows from the CASM site. All are normal mid-ocean ridge basalts (N-MORB) that have slightly elevated K₂O contents (and other incompatible trace elements) compared to other MORB from the Juan de Fuca Ridge. Of a total of 16 samples analyzed from the 1998 flow, fourteen have nearly identical compositions; two from the southernmost part of the flow (Recovered on dive R465) are slightly more evolved. This suggests some chemical differentiation may have occurred during the diking event or that the magma source is chemically heterogeneous.

The detailed sampling completed this year will allow us to place more rigorous constraints on the chemical composition (and variability) of the 1998 flow as well as to determine the composition of older flows in contact with the new flow. Assuming there are significant compositional differences between the 1998 flow and surrounding older flows, we plan to use the geochemical data in conjunction with the observational data and mapping efforts to generate a geological map of the 1998 flow. In addition, comparison of the major and trace element composition of the new flow to older flows can constraints on magma chamber temperature changes and magmatic evolution. Measurement of U-series isotopes (by K. Rubin) will provide information about the age the magma chamber for the different flow units in the Caldera and possibly allow us to relate young flows from CASM and ASHES to the 1998 flow.

From a regional standpoint, the 1998 flow is very important because it provides us with another 'zero age' flow from the JdF to use in comparing and contrasting the current sources and melting parameters along the ridge. Initial analyses of the 1998 flow confirm that the source of Axial magmas is slightly more enriched than the mantle source of southern JdF lavas and quite a bit more enriched compared the source for CoAxial Segment magmas. This years 55 rock cores now gives us more than 115 rock core localities along Axial's north and south rift zones. These samples, together with the samples recovered in the caldera, will be used to investigate the spatial and temporal variability of magma genesis at the entire volcanic edifice that has been created by the interaction of Axial melt anomaly and the Jdf ridge.

ROPOS Operations

During this cruise, we recovered 52 samples from ROPOS dives. Many of these samples were 'opportunistic' in that they were recovered during biological grabs or suction samples for fluids or biology. Most of these consisted of glass chips and were primarily from well documented vent sites within the 1998 flow. In order to facilitate recovery of very glassy samples which can be nearly impossible to grab with ROPOS manipulators, we developed small rock wax corers that were deployed on ROPOS for the first time. These 'chapstick' cores were quite effective in sampling the glassy surfaces of lavas and proved to be a quick, easy way to get additional rock samples. Deployed rock cores were placed into a small mesh bag ('purse') fashioned to attach to the front of the bioboxes or fluid sampler. This bag was also used to recover temperature probes and additional rock samples. The glassy crusts from all large 'whole rock' lava samples were sub-sampled to be hand-carried with core samples. The highlight of the rock sampling came during the biogeology dive R501 during which two E-W traverses were made across the 98 flow while detailed volcanological and geological observations were made. During the dive a record total of 16 rock samples were recovered using the manipulators, rock cores and suction sampler. Precisely located samples at lava flow contacts should aid us in distinguishing flow units.

Rock Coring Operations:

Rock coring during the NeMO 1999 cruise continues the effort begun during NeMO 1998, when 49 successful rock core attempts were made. An additional 61 core samples were collected this year, for a total of 109 for the two cruises. Samples were collected principally in the south rift zone of Axial Seamount (48 samples), from just off the

flank of the seamount south to approximately 45 degrees 39 minutes latitude. The remainder of the samples were collected along the Vance segment of the Juan de Fuca Ridge (3 samples), the southwest rift zone (4 samples), and the north rift zone (6 samples). The glass from this effort will be analyzed for major elements using electron microprobe and for trace elements using laser ablation inductively coupled plasma mass spectrometry (ICPMS) and X-ray fluorescence (XRF) techniques. It is hoped this study will lead to a better understanding of the relationships between the seamount, rift zones, and Juan de Fuca ridge, as well as insight into the magmatic, volcanic, and tectonic processes that have created the rift zones.

Rock coring activities took place in periods between ROPOS dives, and were undertaken on the CTD wire on the starboard side of the ship. The corer has 7 wax-tipped cups which collect small shards of basaltic glass from the ocean floor. The corer was sent down on the wire at approximately 60 meters/min. until the winch monitor tension dropped considerably, indicating contact with the floor. An additional 5-10 meters of wire was spooled out prior to reversal of the winch and retrieval of the corer, again at 60 meters/min, after a short period of slow (10 meters/min) retrieval to get the corer off the bottom. This method resulted in a successful retrieval of ocean floor materials in all attempts, although no glass was collected in 2 attempts (sediments only).

3 Non-ROPOS OPERATIONS

3.1 Mooring Deployments /CTD's /XRF Analysis - Jim Gendron

Early in the cruise, one CTD cast was completed South-East of the venting area on the new lava. The water was collected around 1300 meters as a non-plume background sample for many of the groups onboard.

During the cruise, the hot fluid sampler was used to collect 22 filters for XRF analysis. These samples will be analyzed when we return to Seattle. Also collected on the fluid sampler were about 30 samples for SEM and 5 samples for Particulate Organic Carbon (POC). A total of four, good Niskin samples were collected, one each over Castle, Magnesia, Cloud and CASM vents. Another was attempted over Hell vent, but it appears to have pre-tripped sometime during the dive.

Near the end of the cruise, three MTR moorings were deployed. One was at ASHES and two were close to the new lava vent area.

	Moorings Deployed Summer of '99			
	Lat	Long	UTM X	UTM Y
(deployed from Thompson)				
99T50	-129.9867	45.9417	423520	5088039
99T49	-129.9867	45.9250	423497	5086188
99T51	-130.0050	45.9300	422083	5086761
(deployed from Wecoma)				
99T52	-130.0245	45.9053	420536	5084039
99T53	-130.0142	45.8912	421317	5082455
99V110	-130.0000	460.550	422645	5100644
99V111	-129.9135	45.9493	429201	5088823
99V112	-130.0650	45.9205	417417	5085766
99V113	-130.0017	45.9167	422322	5085276

3.2 NeMO'99 Website and Public Outreach - Nicole Nasby, Greg Pillette, Andra Bobbitt <http://newport.pmel.noaa.gov/nemo/>

The goal was to create an educational web site that would be for use by students and teachers, primarily at the secondary level. The web site offered daily updates on the cruise and allowed interested individuals to follow the progress of the scientific expedition at Axial Volcano. The site was set up to provide daily updates that included a

scientific report on the latest activity. There was also a weekly science summary written by the Chief Scientist. The web site included a daily personal perspective section that highlighted an individual from the scientific party of ship's crew, and a daily log written by the "teacher at sea" Greg Pillette. The last component was an interactive question and answer section so that the public could interact directly with the scientific staff.

Each of these sections was coordinated by Nicole Nasby and relevant digital images were included. They were sent from the ship to HMSC and were added to the web site on a daily bases by Andra Bobbitt in Newport. This material was then presented to the general public at HMSC, each day, by the teacher on shore, Steve Babcock. Feedback and question from the public were sent to the ship to be answered by the scientific staff.

We have received positive feedback from the web site maintained this year as well as the one from NeMO '98. We have heard from teachers who have used last year's site in a classroom situation. Unfortunately classes are not in session at this time, so there is little feedback from teachers and students on the NeMO '99 site at this point, but we did get several questions posted to the web site indicating a positive reaction. As with last year, many of these questions were from family members of science and ROPOS personal.

4 NAVIGATION

4.1 Navigation Overview - Susan Merle and Bill Chadwick

All ROPOS dives were navigated using long-baseline transponder nets with the Seascope navigation software. The navigation computer had three main inputs into Seascope to aid in ROPOS navigation: P-code GPS from the R/V Thomas Thompson, ROV depth data provided by the ROPOS sensor and the PS8000 data from the range meter. Transponders were already in place for the ASHES net and the North Rift Zone (NRZ) net. Deployed last year during NeMO'98, the expendable transponders should have five year lifetimes. The transponders for those two nets only needed to be enabled. A third net, on the South Rift Zone (SRZ), was added with three recoverable transponders. Unfortunately, due to hardware problems with the NOAA PS-8000, the calibration of the SRZ Net was poor and this net was only marginally useful.

Once the cage reached its final depth and ROPOS drove to the seafloor, the cage depth was manually entered into the Seascope program and was held constant, unless the wire out for the cage changed during the dive. The range meter was attached to the top of the cage, was hard-wired to the hydro lab and triggered by Seascope on the navigation computer. Cage and ROV fixes were generally scattered with RMS errors of about 30 meters. Navigation fixes are recorded in latitude/longitude and UTM x/y (in meters) in the log files and were processed by Susan Merle in the IDL programs navedit2 and navedit3 (written by Bill Chadwick).

In 1999 navigation was somewhat less reliable than in 1998. During several dives the 11.0 transponder in the ASHES net was accidentally disabled and this caused the 1999 navigation fixes to be shifted to the west or south of the 1998. Since '98 navigation was more robust, no old vent or marker positions were changed, even if the '99 positions did not agree with those of '98. After the '99 cruise a few of the mysterious navigation problems we had were identified. The NOAA PS-8000 on El Guapo was determined to have a bad microprocessor, which created problems with the SRZ net calibration. Another mystery solved concerned the fact that it seemed that transponder 11.0 in the ASHES net would shut itself off. It was discovered on Bill Chadwick's Cleft cruise in September '99 that the 11.0 had a disable code of C, not B like all the other transponders. This would not have been a problem, if the ROPOS transponder we tried to use, unsuccessfully, had not had an enable code of C. So, we would try to enable the ROPOS transponder, unwittingly disabling the 11.0 transponder in the ASHES net.

The dive plots will be a useful guide to determine navigation gaps, bad navigation, etc. When acoustic nav was not available GPS ship nav was used. Plotted positions are for the reference point, about 37 meters forward of the stern at the GPS antennae.

4.2 FINAL CALIBRATED TRANSPONDER POSITIONS

North Rift Net

Transponder	UTM-X (m)	UTM-Y (m)	Latitude	Longitude	Depth
9.5	420814.65	5098603.9	46° 02.1857'	130° 01.3988'	1433.9
10.5	422722.92	5097596.31	46° 01.6548'	129° 59.9096'	1395.43
8.0	420055.52	5095969.44	46° 00.7580'	130° 01.9608'	1377.93
7.5	422074.85	5094971.24	46° 00.2330'	130° 00.3862'	1294.46

ASHES Net

Transponder	UTM-X (m)	UTM-Y (m)	Latitude	Longitude	Depth
11.5	424283.25	5087181.51	45° 56.0418'	129° 58.6011'	1305.4
10.5	424221.58	5084426.79	45° 54.5540'	129° 58.6227'	1340.36
9.5	422490.35	5086188.55	45° 55.4937'	129° 59.9789'	1324.67
11.0	422556.72	5088014.47	45° 56.4800'	129° 59.9453'	1330.85

South Rift Net

Transponder	UTM-X (m)	UTM-Y (m)	Latitude	Longitude	Depth
10.0	423771	5084021	45E54.33 '	129E58.968 '	1471.69
8.5	421721	5082432	45E53.46 '	130E0.54 '	1401.68
12.5	422134	5084021	45E54.324 '	130E0.234 '	1492.90

4.3 VENTS AND MARKERS LOCATION TABLE

Vents/Markers	Area	Longitude	Latitude	UTM X	UTM Y	Depth
Bag City	SRZ	-129.98926	45.91622	423284	5085214	1534
Bob	NRZ	-130.01283	46.03892	421629.2	5098870.2	1590
Castle	North SRZ	-129.97990	45.92613	424022.7	5086305.8	1520
Circ	North SRZ	-129.98165	45.92592	423887	5086283	
Cloud	North SRZ	-129.98156	45.93335	423904	5087110	1524
Coquille	North SRZ	-129.99306	45.91753	422991	5085365	
Crack	ASHES	-130.01355	45.93330	421424	5087135	1547
Crevice	SRZ	-129.99040	45.91110	423175	5084648	1538
Dave's	ASHES	-130.01377	45.93352	421408.3	5087158.6	
Dying	North SRZ	-129.99185	45.91685	423083.7	5085286.4	
Easy	North SRZ	-129.98472	45.94533	423676.5	5088443.2	1532
Fe-Hyde	ASHES	-130.01378	45.93298	421406	5087099.7	
Gollum	ASHES	-130.01358	45.93358	421422	5087166.1	1546
Hairdo	ASHES	-130.01398	45.93350	421390.7	5087156.8	1546
Hell	ASHES	-130.01423	45.93330	421372	5087135	1544
Hillock/Phoenix	ASHES	-130.01398	45.93325	421390.9	5087130.4	1544
Inferno	ASHES	-130.01390	45.93355	421397.2	5087162.2	1547
Joystick	SRZ	-129.98856	45.91884	423341.5	5085505	
Joystick2	SRZ	-129.98851	45.91875	423345	5085495	
Magnesia	North SRZ	-129.98493	45.94623	423660.7	5088544.7	1530
Marshmallow	ASHES	-130.01362	45.93370	421420.4	5087179	1547
Medusa	ASHES	-130.01393	45.93335	421394.7	5087141.1	1546
Milky	North SRZ	-129.98475	45.94514	423673	5088424	1527
Minisnow	North SRZ	-129.98422	45.94262	423711	5088141	1522
Mkr-I	ASHES	-130.01367	45.93370	421416	5087180	
Mkr-108 Vent	North SRZ	-129.98303	45.92865	423784	5086589	1520
Mkr-108b Vent	North SRZ	-129.98319	45.92881	423772	5086608	1520
Mkr-113 Vent	North SRZ	-129.98827	45.92260	423370	5085922	1524
Mkr-2	ASHES	-130.01397	45.93330	421392	5087136	
Mkr-21	ASHES	-130.01358	45.93360	421422	5087168	
Mkr-33 Vent	North SRZ	-129.98225	45.93327	423850.3	5087101.1	1524
Mkr-36	SRZ	-129.98161	45.93437	423284	5085214	
Mkr-42	Joystick	-129.98856	45.91884	423341.5	5085505	
Mkr-D	ASHES	-130.01393	45.93325	421399	5087129	
Mkr-L	ASHES	-130.01432	45.93333	421365	5087140	
Mkr-N1	North SRZ	-129.98408	45.93980	423718	5087828	1521
Mkr-N2	North SRZ	-129.98475	45.94514	423673	5088424	
Mkr-N3	North SRZ	-129.98520	45.94380	423637	5088278	

Vents/Markers	Area	Longitude	Latitude	UTM X	UTM Y	Depth
Mkr-N4	North SRZ	-129.98167	45.93342	423896	5087119	1523
Mkr-N41	North SRZ	-129.98138	45.93622	423922.4	5087428.2	1520
Mkr-N44	North SRZ	-129.98483	45.93947	423658	5087792	
Mkr-N5 (Flattop)	North SRZ	-129.97960	45.92610	424043	5086306	1516
Mkr-N6	North SRZ	-129.98160	45.93340	423901.4	5087116	1524
Mkr-N7	North SRZ	-129.98190	45.93930	423886	5087774	1520
Mkr-N8	North SRZ	-129.98190	45.93320	423877	5087088	
Mkr-N9	North SRZ	-129.98423	45.94260	423710	5088141	1522
Mushroom	ASHES	-130.01380	45.93360	421405.3	5087167.9	1548
Nascent	North SRZ	-129.98152	45.93577	423911	5087378	1520
Old Flow	North SRZ	-129.98170	45.93645	423897.5	5087454.7	1534
Old Worms	North SRZ	-129.98331	45.94510	423785	5088418	1528
Ouzo	North SRZ	-129.98468	45.94582	423679.6	5088496.8	1526
Oxide	North SRZ	-129.98508	45.94545	423647.9	5088456.4	1543
Pillar	North SRZ	-129.98542	45.92270	423591	5085929.1	
Porkchop	ASHES	-130.01422	45.93332	421373	5087136	1547
Roof	North SRZ	-129.98448	45.94250	423689.8	5088129.1	1523
ROPOS	ASHES	-130.01405	45.93328	421386.1	5087134.1	1547
Snail	North SRZ	-129.98188	45.93317	423878.6	5087089.7	1525
Snow	North SRZ	-129.98245	45.92712	423827	5086417	
Snow Blower	North SRZ	-129.98407	45.93987	423719	5087835	1521
Steve Mound	ASHES	-130.01342	45.93325	4214348	5087128.6	
Styx	ASHES	-130.01370	45.93328	421412.2	5087132.2	
The Pit	North SRZ	-129.98408	45.93975	423718.2	5087823.2	1521
Tombstone	ASHES	-130.01133	45.92948	421590	5086597	
Tunncliff	ASHES	-130.01582	45.93367	421248.7	5087178	1544
Virgins Daughter	ASHES	-130.01340	45.93375	421436	5087184	
Virgin	ASHES	-130.01348	45.93365	421430	5087174	1547
White	ASHES	-130.01363	45.93373	421419	5087182.9	
91 Vent	NRZ	-130.01242	46.03860	421661.4	5098834.3	
Shepherd	CASM	-130.02668	45.98990	420486.4	5093373.6	1583
South Casm	CASM	-130.02625	45.98870	420518.6	5093304.6	1583

5 NeMO OPERATIONS

5.1 1998 Dive Dates and Locations ROPOS Dives R460 - R480

Dive #	Date	Location
R460	JD 240-241 Aug 28-29	SE Caldera SRZ: Mkrs N3, 33; Milky, The Pit, Cloud Vents
R461	JD 241-243 Aug 29-31	SE Caldera SRZ: Rumbleometer; Mkrs 108,33,113; Cloud, Sulfide, Castle, Circular Vents
R462	JD 243 - 244 Aug 31 - Sept 1	SE Caldera SRZ: Mkr-33, Cloud Vent
R463	JD 244 - 245 Sept 1 - 2	SE Caldera SRZ: Easy, Milky Vents; (+ Imagenex survey)
R464	JD 245 Sept 2	SE Caldera SRZ: Oxide, MiniSnow, The Pit, Snail, Mkr-108, Mkr-113, Castle Vents
R465	JD 246 Sept 3	South Rift Zone: reconnaissance survey
R466	JD 247 Sept 4	ASHES: Hell, ROPOS, Hillock/Phoenix, Hairdo and Inferno Vents
R467	JD 248 - 249 Sept 5 - 6	North Rift Zone: Extensometers; Bob Vent: (+Imagenex survey)
R468	JD 250 Sept 7	ASHES: Gollum, Hell, ROPOS, Hillock/Phoenix, Crack Vents
R469	JD 250 - 251 Sept 7 - 8	ASHES: Medusa, Mushroom, Marshmallow, Gollum, Daves Styx and Fe-Hyde Vents; (+Imagenex survey)
R470	JD 251 Sept 8	North Rift Zone: Extensometers
R471	JD 252 Sept 9	ASHES: Gollum, Mushroom, White, Inferno, Hell Vents
R472	JD 252 Sept 9	ASHES: Steve Mound, Hell, Phoenix, Medusa, Inferno Vents
R473	JD 253 - 254 Sept 10 - 11	SE Caldera SRZ: Easy, Milky, Roof, The Pit, Snowblower, Mkr-33, Mkr-108, Cloud, Castle Vents; (+Imagenex survey)
R474	JD 255 Sept 12	SE Caldera SRZ: The Pit, Milky Vents; Rumbleometer; Lava Flow Mapping Traverses

R475		Dive aborted
R476	JD 256 - 257 Sept 13 - 14	SE Caldera SRZ: Magnesia, Easy, Old Worms, Milky Vents; Lava flow traverses; (+ Imagenex survey)
R477	JD 258 Sept 15	SE Caldera SRZ: Rumbleometer; Mkr-33 Vent
R478	JD 258 Sept 15	SE Caldera SRZ: Mkr-33, Mkr-n4, Cloud, Nascent Vents
R479	JD 259 - 260 Sept 16 - 17	Northern traverse along caldera wall: ASHES: Hell, Virgin, Mushroom, Medusa, Inferno Vents; (+Imagenex survey)
R480	JD 261 - 262 Sept 18 - 19	North Rift Zone and Northern Caldera Wall: Extensometers; CASM (Shepherd?) Vent

5.2 1999 Dive Dates, Locations and Tasks

ROPOS Dives R482 - R503

R491	(6-30) JD181 - 0145	JD182 - 1914	41 hr 29 min	38 hr 55 min	Mkr-33, Cloud, Nascent, Old Flow, Old Worms, Magnesia, Imagenex - 28 Samples: Suction, bio, gastight, rocks. Video/photo survey of Cloud, Deployed BioOsmo Mkr-33, MTR & Vemco Mkr-N6, MTR Mkr-N41. Recovered MTR Nascent, bactraps Mkr-N4. (Dive finished)
R492	(7-2) JD183 - 0855	JD183 - 2324	14 hr 29 min	11 hr 18 min	Joystick, Coquilles, Bag City - 14 Samples: Suction, Rocks, gastight, bio. Geology reconnaissance dive of '98 lava flow, south of area surveyed in '98. Eastern and western extents surveyed. Elevator recovered. (Dive ended to recover the elevator)
R493	(7-3) JD184 - 0635 - on btm	JD184 - 1158	5 hr min	23 2 hr 13 min	Extension of Dive R492 - 2 Samples: rocks. Didn't go to any vents. (Dive aborted, lost telemetry, snap-loading on umbilical)
R494	(7-4) JD185 - 0227	JD185 - 1930	17 hr 2 min	14 hr 11 min	Started south of SeaBeam anomaly, moving north to map limits of ,98 lava flow. Samples: 7 rock samples, bio, suction. No acoustic nav this dive - south net not working with north net. Fissure discovered! (Dive aborted, lost telemetry)
R495	(7-5) JD186 - 0330	JD187 - 0158	22 hr min	28 21 hr	Mkr-33, Mkr-109, Mkr-113, Castle, Joystick, Coquilles, Bag City, Fissure on SRZ - 37 Samples: HFS, Suction, gastight, sulfides, nissen. Recovered Vemco and deployed Osmo at Mkr-33. Geological traverse of SRZ. (Dive aborted, telemetry problems)
R496	(7-6) JD187 - 1820	JD188 - 1705	22 hr min	45 19 hr 18 min	Mkr-113, Rumbleometer freed from lava, Imagenex - 4 Samples: Bactraps, biology, rumbleometer. Recovered bactraps at Mkr-113, bio sample at Mkr-113, rock chips from rumbleometer. (Dive ended normally)

R497	(7-8) JD189 - 0010	JD189 - 1939	19 hr 29 min	10 hr 9 min	Extensometers at NRZ, CASM - 21 Samples: suction, sulfide, bio, gtb. Elevator was recovered. At CASM collected 17 samples, VEMCO, hobo probes. One extensometer placed in elevator. (Dive aborted, sub lost power)
R498	(7-8) JD189 - 2215	JD190 - 0349	5 hr 39 min	3 hr 34 min	Extensometer Recovery on NRZ - 3 remaining extensometers deployed in 98 were placed in elevator and all four were recovered. (Normal end of dive)
R499	(7-9) JD190 - 1509	JD190 - 2100	5 hr 51 min	4 hr 4 min	Magnesia, Old Worms - 6 Samples: HFS, niskin. Also deployed osmosampler at Magnesia. (Dive aborted, Leak in HFS followed by hydraulic leak in ROPOS)
R500	(7-9) JD190 - 2314	JD191 - 1440	15 hr 26 min	13 hr 20 min	Old Worms, FeO, Mkr-N41, Cloud, Mkr-33, Imagenex - 25 samples: HFS, suction gtb, niskin. Video mapping of Cloud. (Normal end of dive)
R501	(7-10) JD191 - 2140	JD192 - 1711	19 hr 31 min	14 hr 14 min	Mkr-33, Crevice Vent ,and geologic traverse - 17 Samples: 13 rocks, suction, bio, Niskin. Deployed TLC at Mkr-33. (Normal end of dive)
R502	(7-12) JD193 - 0030	JD193 - 1520	14 hr 50 min	12 hr 17 min	ASHES - 38 Samples: HFS, suction, gtb, niskin. Recovered HOBO at Hell and deployed one. Retrieved MTR at Gollum. Also recovered HOBO at Inferno. (Normal end of dive)
R503	(7-12) JD193 - 2015	JD194 - 0150	5 hr 35 min	3 hr	ASHES - 3 Samples: bactraps and 2 hobos. Osmosampler deployed and melted at Inferno, Hobo deployed at Inferno and Virgin. Bactraps recovered and deployed at Gollum. Hobo recovered at Inferno. (Dive ended due to weather)
R491	(6-30) JD181 - 0145	JD182 - 1914	41 hr 29 min	38 hr 55 min	Mkr-33, Cloud, Nascent, Old Flow, Old Worms, Magnesia, Imagenex - 28 Samples: Suction, bio, gastight, rocks. Video/photo survey of Cloud, Deployed BioOsmo Mkr-33, MTR & Vemco Mkr-N6, MTR Mkr-N41. Recovered MTR Nascent, bactraps Mkr-N4. (Dive finished)
R492	(7-2) JD183 - 0855	JD183 - 2324	14 hr 29 min	11 hr 18 min	Joystick, Coquilles, Bag City - 14 Samples: Suction, Rocks, gastight, bio. Geology reconnaissance dive of '98 lava flow, south of area surveyed in '98. Eastern and western extents surveyed. Elevator recovered. (Dive ended to recover the elevator)
R493	(7-3) JD184 - 0635 - on btm	JD184 - 1158	5 hr 23 min	2 hr 13 min	Extension of Dive R492 - 2 Samples: rocks. Didn't go to any vents. (Dive aborted, lost telemetry, snap-loading on umbilical)
R494	(7-4) JD185 - 0227	JD185 - 1930	17 hr 2 min	14 hr 11 min	Started south of SeaBeam anomaly, moving north to map limits of ,98 lava flow. Samples: 7 rock samples, bio, suction. No acoustic nav this dive - south net not working with north net. Fissure discovered! (Dive aborted, lost telemetry)
R495	(7-5) JD186 - 0330	JD187 - 0158	22 hr 28 min	21 hr	Mkr-33, Mkr-109, Mkr-113, Castle, Joystick, Coquilles, Bag City, Fissure on SRZ - 37 Samples: HFS, Suction, gastight, sulfides, niskin.
					Recovered Vemco and deployed Osmo at Mkr-33. Geological traverse of SRZ. (Dive aborted, telemetry problems)

R496	(7-6) JD187 - 1820	JD188 - 1705	22 hr 45 min	19 hr 18 min	Mkr-113, Rumbleometer freed from lava, Imagenex - 4 Samples: Bactraps, biology, rumbleometer. Recovered bactraps at Mkr-113, bio sample at Mkr-113, rock chips from rumbleometer. (Dive ended normally)
R497	(7-8) JD189 - 0010	JD189 - 1939	19 hr 29 min	10 hr 9 min	Extensometers at NRZ, CASM - 21 Samples: suction, sulfide, bio, gtb. Elevator was recovered. At CASM collected 17 samples, VEMCO, hobo probes. One extensometer placed in elevator. (Dive aborted, sub lost power)
R498	(7-8) JD189 - 2215	JD190 - 0349	5 hr 39 min	3 hr 34 min	Extensometer Recovery on NRZ - 3 remaining extensometers deployed in 98 were placed in elevator and all four were recovered. (Normal end of dive)
R499	(7-9) JD190 - 1509	JD190 - 2100	5 hr 51 min	4 hr 4 min	Magnesia, Old Worms - 6 Samples: HFS, niskin. Also deployed osmosampler at Magnesia. (Dive aborted, Leak in HFS followed by hydraulic leak in ROPOS)
R500	(7-9) JD190 - 2314	JD191 - 1440	15 hr 26 min	13 hr 20 min	Old Worms, FeO, Mkr-N41, Cloud, Mkr-33, Imagenex - 25 samples: HFS, suction gtb, niskin. Video mapping of Cloud. (Normal end of dive)
R501	(7-10) JD191 - 2140	JD192 - 1711	19 hr 31 min	14 hr 14 min	Mkr-33, Crevice Vent ,and geologic traverse - 17 Samples: 13 rocks, suction, bio, Niskin. Deployed TLC at Mkr-33. (Normal end of dive)
R502	(7-12) JD193 - 0030	JD193 - 1520	14 hr 50 min	12 hr 17 min	ASHES - 38 Samples: HFS, suction, gtb, niskin. Recovered HOBO at Hell and deployed one. Retrieved MTR at Gollum. Also recovered HOBO at Inferno. (Normal end of dive)
R503	(7-12) JD193 - 2015	JD194 - 0150	5 hr 35 min	3 hr	ASHES - 3 Samples: bactraps and 2 hobos. Osmosampler deployed and melted at Inferno, Hobo deployed at Inferno and Virgin. Bactraps recovered and deployed at Gollum. Hobo recovered at Inferno. (Dive ended due to weather)

5.3 Experiments Deployed and Recovered - 1998 and 1999

Vent/Marker	Experiment/Instrument	Dive Deployed	Dive Recovered
Mkr-33	MTR 4130	R461	R483
Mkr-33	BacTrps#9&12	R462	R483
Mkr-33	OsmoSampler	R477	R483
Mkr-33	Time Lapse Camera	R478	R484
Mkr-33	BacTrps#40,41,42,43	R484	R491 (40, 43)
Mkr-33	Grn&Cu OsmoSampler	R483	n/a *
Mkr-33	2 Fe OsmoAnalyzers	R483	R491
Mkr-33	BioOsmoSampler	R491	n/a *
Mkr-33	OsmoAnalyzer	R495	n/a *
Mkr-33	Time Lapse Camera	R501	n/a *
Mkr-113	VEMCO	Alvin 3245(deployed). R461(repositioned)	R495

Mkr-113	BacTrap#4	R461	n/a *
Mkr-113	BacTraps#19,20,21	R464	R496 (20,21)
Mkr-N2 Milky	OsmoSampler	R474	99 dive#?
Mkr-N2 Milky	BacTrap#35	R476	n/a *
Mkr-N4 Cloud	BacTraps#14,15	R462	R484
Mkr-N4 Cloud	BacTraps#36,37,38,39	R484	R491
Mkr-N4 Cloud	MTR 0942	R461	R484
Mkr-N6 Cloud	MTR 3157 & VEMCO 1108 (taped together)	R491	n/a *
Mkr-N41	MTR 4126	R474	R491
Mkr-N41	MTR 3041 ?	R491	n/a *
Bag City Vent	MTR	R495	n/a *
Castle Vent	BacTraps#22,23,24	R464	n/a *
Crack Vent	VEMCO	Alvin 3245(deployed) R461(repositioned)	n/a *
Easy Vent	BacTrap#17	R463	n/a *
Gollum Vent	MTR 4128	R471	R502
Gollum Vent	BacTrap #45	R503	n/a *
Gollum Vent	BacTraps#32,33,34	R471	R503 (2 -#'s?)
Hell Vent	Hobo	R502	n/a *
Hell Vent	Hobo	98 dive #? on osmo	502
Hillock/Phoenix	BacTraps#25,26	R466	n/a *
Inferno Vent	Hobo 128	R503	n/a *
Inferno Vent	Osmosampler (didn't work)	R503	n/a *
Inferno Vent	HOBO 137	Alvin 3245	R502
Inferno Vent	VEMCO 98-223	Alvin 3245	n/a *
Magnesia	OsmoSampler	R499	n/a *
Milky Vent	BacTrap#35	98 dive #?	n/a *
Mushroom Vent	BacTraps#29,30,31	R471	n/a *
Nascent Vent	MTR 4108	R478	R491
Nascent Vent	MTR 3175	R491	n/a *
ROPOS Vent	BacTraps#27,28	R466	n/a *
Shepherd Vent CASM	VEMCO 98-1113-214	R480	R497
Virgin Vent	Hobo 130	R503	n/a *
Virgin Vent	HOBO 129	Alvin3246	R503
T&S Spires CASM	HOBO 130	R480	R497
T&S Spires CASM	MTR 3017	R497	n/a *
	* non applicable - experiment not recovered yet.		

5.4 1999 ROPOS Samples - Dives R483 - R503

Dive R483 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	UTCT ime	Description	Investigator	Subsamp
SS-j1_dfl_R483-1	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	1257	Fluid over tube worms - for about 1h	Tunncliffe/Marcus	
SS-j2_bio_R483-2	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	1423	polynoids - gastros - rock	Juniper/Levesque	Levesque/Perfit
Bactrp_R483-3	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	1515	Bacteria trap #9 retrieved - rock	Moyer	Tunncliffe/Marcus/ Perfit
SS-j3_bio-R483-4	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	15:43	suction stopped - maybe nothing in sample - rock	Juniper/Levesque	Perfit
Bactrp_R483-5	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	15:48	Bacteria trap #12 retrieved - rock	Moyer	Tunncliffe/Marcus/ Perfit
Bio_R483-6	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	16:10	Tube worm grab	Marcus	McHugh/Levesque
Gtb-6_R483-7	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	16:38	Gas tight bottles #6 fired	Evans	Butterfield/Lilley
Gtb-7_R483-8	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	16:38	GTB #7 fired	Evans	Butterfield/Lilley
MTR_R483-9	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	16:50	MTR#4130 recovered	Embley	Butterfield/Lilley
Osmo_R483-10	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	18:03	1998 osmosampler recovered	Chapin	
	Mkr-33 V	33	-129.9822	45.9333	423850	5087101		Deployed Green & Copper OsmoSampler	Chapin	
	Mkr-33 V	33	-129.9822	45.9333	423850	5087101		Deployed 2 Fe OsmoAnalyzers	Chapin	
Dive R484 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamples
SS_mat_R484-1	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	1155	Bacterial mat - rock	Moyer	Feely/Huber/Perfit
Bio_R484-2	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	1234	Crab	Juniper	

Bactrp_R484-3	Cloud	N4	-129.9817	45.9334	423896	5087119	1414	Bacterial trap #14, deployed in 1998	Moyer	
MTR_R484-4	Cloud	N4	-129.9817	45.9334	423896	5087119	1425	MTR #0942, deployed in 1998	Embley	
Bactrp_R484-5	Cloud	N4	-129.9817	45.9334	423896	5087119	1430	Bacterial trap #15, deployed in 1998	Moyer	
TLC_R484-6	Mkr-33 V	33	-129.9822	45.9333	423850	5087101	1155	Time Lapse Camera, deployed in 1998	Tunncliffe	
	Mkr-33 V	33	-129.9822	45.9333	423850	5087101		Deployed bactraps # 40 - 43	Moyer	
	Cloud	N4	-129.9817	45.9334	423896	5087119		Deployed bactraps # 36 - 39	Moyer	
Dive R485 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamples
HFS2_dfl_R485-1	Mkr 33	33	-129.9822	45.9333	423850	5087101	11:17	Filtered diffuse flow for XRF - T1=55 T2=37 to 49 - 566ml	Butterfield	Gendron
HFS23_dfl_R485-2	Mkr 33	33	-129.9822	45.9333	423850	5087101	11:23	Gas piston of diffuse flow for gases - T1=53 T2=42-50 - 113ml	Evans	Butterfield/ Lilley
HFS12_dfl_R485-3	Mkr 33	33	-129.9822	45.9333	423850	5087101	11:26	Filtered diffuse flow for DNA - T1=49 T2=37 Tmax=54.6 -1223ml	Huber	
HFS14_dfl_R485-4	Mkr 33	33	-129.9822	45.9333	423850	5087101	11:35	Bag with filter of diffuse flow. Tmax=48.8 1110ml	Butterfield	Graham
HFS17_dfl_R485-5	Mkr 33	33	-129.9822	45.9333	423850	5087101	11:43	Bag sample without filter. Tmax=48.8	Butterfield	Huber/ Graham/ Levesque
HFS_dfl_R485-6	Mkr 33	33	-129.9822	45.9333	423850	5087101		Sample interrupted. Dive aborted		
Dive R487 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamples
HFS-12_plume _R487-1	Mkr 33	33	-129.9822	45.9333	423850	5087101	17:18	Depth 1476m - Plume particles visible - DNA - 1502 ml	Butterfield/ Huber	
HFS-15_plume _R487-2	Mkr 33	33	-129.9822	45.9333	423850	5087101	17:34	Depth 1476m - Plume particles visible - Lipids -1050 ml	Butterfield/ Huber	
HFS-17_plume _R487-3	Mkr 33	33	-129.9822	45.9333	423850	5087101	17:45	Bag sample - no filter - plume particles visible - mirco & chem - 650 ml	Butterfield /Huber/	

HFS-19_plume _R487-4	Mkr 33	33	-129.9822	45.9333	423850	5087101	17:52	Bag sample-with filter -plume particles visible - micro & chem - 675 ml	Butterfield/ Graham	
HFS-16_plume _R487-5	Mkr 33	33	-129.9822	45.9333	423850	5087101	17:59	Bag sample without filter - 598 ml	Butterfield/ Huber/	
HFS-3_plume _R487-6	Mkr 33	33	-129.9822	45.9333	423850	5087101	18:07	Filter for Sulfur - 1300 ml	Butterfield	
GTB_plume _R487-7	Cloud		-129.9816	45.9334	423904	5087109	18:47	port gastight #6 - 160 ml	Evans	Butterfield/ Lilley
HFS-23_plume _R487-8	Cloud		-129.9816	45.9334	423904	5087109	18:49	gas piston - 170 ml	Evans	Butterfield/ Lilley
HFS-20_plume _R487-9	Cloud		-129.9816	45.9334	423904	5087109	18:53	piston - 730 ml	Butterfield/ Huber/	
HFS-21_plume _R487-10	Cloud		-129.9816	45.9334	423904	5087109	19:01	filter sulfur - 730 ml	Butterfield/ Huber	
HFS-22_plume _R487-11	Cloud		-129.9816	45.9334	423904	5087109	19:11	piston - 730ml	Butterfield/ Huber/	
HFS-18_plume _R487-12	Cloud		-129.9816	45.9334	423904	5087109	19:18	Bag sample with filter - 600ml	Butterfield	
HFS-7_plume _R487-13	Cloud		-129.9816	45.9334	423904	5087109	19:25	Filter for XRF - 411 ml	Butterfield/ Gendron	
HFS-2_plume _R487-14	Cloud		-129.9816	45.9334	423904	5087109	19:29	Filter for XRF - 423ml	Butterfield/ Gendron	
HFS-11_plume _R487-15	Cloud		-129.9816	45.9334	423904	5087109	19:37	Bag with filter - integrated sample - stop at 1338 ml	Gendron/ Graham	
Dive R488 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamples
HFS-14_dfl_R488-1	Mkr 33	33	-129.9822	45.9333	423850	5087101	6:28	Bag with filter T=65-70 Tmax=70.4. 655 ml	Butterfield	Graham
HFS-6_dfl_R488-2	Mkr 33	33	-129.9822	45.9333	423850	5087101	6:35	Filter#6 - Tmax=73.2 - 1 liter	Huber	
HFS-15_dfl_R488-3	Mkr 33	33	-129.9822	45.9333	423850	5087101	6:50	Lipid filter#15 at 0.45um - Tmax=78 1.5 liters	Huber	
GTB-7_dfl_R488-4	Mkr 33	33	-129.9822	45.9333	423850	5087101	7:06	Stbd gas Tight - T=68.8	Evans	Butterfield/ Lilley
SS-J1_bio_R488-5	Mkr33	33	-129.9822	45.9333	423850	5087101	7:15	Palm worms - rock	Juniper/ Levesque	Perfit/ Marcus

SS-3_mat_R488-6	Mkr33	33	-129.9822	45.9333	423850	5087101	7:53	Jar#3 - bacterial mat in the crack - rock	Moyer	Perfit/ Marcus/
SS-J4_bio_R488-7	Snail	N8	-129.9819	45.9332	423879	5087090	8:39	Jar#4 - snails - Tmax=13	Marcus	Levesque
HFS-7_dfl_R488-8	Cloud	N4	-129.9816	45.9334	423901	5087111	9:44	Bag#17 no filter - Tmax=18.7 700 ml - DIDN'T WORK	Butterfield/ Huber/	
HFS-22_dfl_R488-9	Cloud	N6	-129.9816	45.9334	423901	5087111	10:19	Piston#22 - Tmax=20.3 615 ml	Butterfield/ Huber/	Levesque
HFS-24_dfl_R488-10	Cloud	N6	-129.9816	45.9334	423901	5087111	10:25	Gas piston#24 - Tmax=20.3 130 ml	Evans	Butterfield/ Lilley
HFS-3_dfl_R488-11	Cloud	N6	-129.9816	45.9334	423901	5087111	10:28	Bottle#3 filter - Tmax=20.2 672 ml	Gendron	
GTB-2_dfl_R488-12	Cloud	N6	-129.9816	45.9334	423901	5087111	10:39	Port gas tight - T=20.3	Evans	Butterfield/ Lilley
HFS-7_dfl_R488-13	Cloud	N6	-129.9816	45.9334	423901	5087111	10:42	Filter#7 for sulfur - Tmax=20.4	Butterfield	
SS-J3_dfl_R488-14	Cloud	N4	-129.9818	45.9334	423888	5087111	11:22	Jar#3 - fauna - snails mat and scale worms	Levesque/Mar cus	
SS-1_dfl_R488-15	Cloud	N4	-129.9818	45.9334	423888	5087111	11:32	Jar#1 - bacterial mat and rock	Moyer	Perfit/ Marcus
SS-4_dfl_R488-16	Cloud	N4	-129.9818	45.9334	423888	5087111	12:25	Flushing bottle - worms and other fauna	Marcus/ Levesque/ Tsurumi	Perfit
SS-2_dfl_R488-17	Cloud	N6	-129.9816	45.9334	423901	5087111	12:48	Jar#2 - particulates	Levesque	
HFS-11_dfl_R488-18	Nascent		-129.9815	45.9358	423911	5087378	13:55	Bag with filter - at MTR 4108. Tave=10-11 Tmax=15.5	Butterfield	
HFS-18_dfl_R488-19	MiniSnow	N9	-129.9842	45.9426	423710	5088141	15:43	Bottle#18 - varying temp Tmax=4 720 ml	Butterfield	
HFS-20_dfl_R488-20	n/a	N3	-129.9852	45.9438	423637	5088278	16:16	Piston#20 - Tmax=16 650 ml	Butterfield/ Huber/	
HFS-2_dfl_R488-21	n/a	N3	-129.9852	45.9438	423637	5088278	16:26	Filter#2 for XRF - Tmax=17.3 800 ml	Gendron	
HFS-5_dfl_R488-22	n/a	N3	-129.9852	45.9438	423637	5088278	16:37	Gas Piston #5 - Tmax=16.5 112 ml	Evans	Butterfield/ Lilley
HFS-19_dfl_R488-23	Milky	N2	-129.9847	45.9451	423679	5088420	17:36	Bag#19 with filter Tmax=3.4 700 ml	Butterfield/ Graham	
HFS-16_dfl_R488-24	Ouzo		-129.9847	45.9458	423680	5088497	18:37	Bag without filter - Tmax=3.5 in sample T=3.8 degrees before sample -189 ml - DIDN'T WORK	Butterfield	

HFS-23_dfl _R488-25	Magnesia		-129.9849	45.9461	423665	5088526	19:52	Piston#23 - Tave=4 Tmax=5.6 full piston, oops	Butterfield/ Evans/	
HFS-12_dfl _R488-26	Magnesia		-129.9849	45.9461	423665	5088526	20:02	DNA filter set, Tmax=5.1 1020 ml	Huber	
HFS-9_dfl _R488-27	Magnesia		-129.9849	45.9461	423665	5088526	20:12	Bag#9 with POC filter Tmax=4.3 681 ml	Butterfield	
HFS-1_dfl _R488-28	Magnesia		-129.9849	45.9461	423665	5088526	20:19	Filter#1 for FISH - Tmax=5.1 1005 ml	Huber	
HFS-10_dfl _R488-29	Magnesia		-129.9849	45.9461	423665	5088526	20:30	Filter for Isulfur - T=4.8 820 ml	Butterfield	
HFS-21_dfl _R488-30	Magnesia		-129.9849	45.9461	423665	5088526		Filter#21 0.45 micron lipids filter - Tmax=5.0 1542 ml	Huber	
HFS-4_dfl _R488-31	Magnesia		-129.9849	45.9461	423665	5088526	20:56	Piston#4 - Tmax=4	Butterfield/ Huber	
HFS-13_dfl _R488-32	Magnesia		-129.9849	45.9461	423665	5088526	21:04	DNA filter set#13 - Tmax=4.9 1789 ml	Huber	
SS-j2_dfl _R488-33	Magnesia		-129.9849	45.9461	423665	5088526	21:26	Jar#2 - flocc	Juniper/ Levesque	
Dive R491 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamples
Osmo_R491-1	Mkr-33	33	-129.9822	45.9333	423850	5087101	4:43	FeOsmoAnalyzer#1 to elevator - deployed Dive R483	Chapin	
Bactrp-40_R491-2	Mkr-33	33	-129.9822	45.9333	423850	5087101	4:54	Deployed on Dive R484	Moyer	
Bactrp-43_R491-3	Mkr-33	33	-129.9822	45.9333	423850	5087101	4:55	Deployed Dive R484	Moyer	
Osmo-R491-4	Mkr-33	33	-129.9822	45.9333	423850	5087101	5:19	FeOsmoAnalyzer#2 to elevator - deployed Dive R483	Chapin	
SS-j1_bio_R491-5	Mkr-33	33	-129.9822	45.9333	423850	5087101	6:01	3 meters from Mkr-33 crack - limpets snails and mat	Levesque	Marcus
GTB-6_dfl_R491-6	Cloud	N6	-129.9816	45.9334	423901	5087111	6:56	Gastight in hole - very vigorous flow - previously measured T=20.3	Evans	Butterfield/ Lilley
SS-1_mat_R491-07	Coud	N6	-129.9816	45.9334	423901	5087111	7:17	microbial mat	Moyer	
Bactrp-36_R491-08	Cloud	N4	-129.9818	45.9334	423888	5087111	7:42	Deployed Dive R484	Moyer	

Bactrp-37_R491-09	Cloud	N4	-129.9818	45.9334	423888	5087111	7:48	Deployed Dive R484	Moyer	
Bactrp-39_R491-10	Cloud	N4	-129.9818	45.9334	423888	5087111	7:51	Deployed Dive R484	Moyer	
Bactrp-38_R491-11	Cloud	N4	-129.9818	45.9334	423888	5087111	7:54	Deployed Dive R484	Moyer	
GTB-7_dfl_R491-12	Nascent		-129.9815	45.9358	423911	5087378	10:08	Gastight fired near MTR	Evans	Butterfield/ Lilley
SS-j3_bio_R491-13	Nascent		-129.9815	45.9358	423911	5087378	10:13	Over tube worm bush - gastropods and other little animals	Tunnicliffe	
SS-j4_bio_R491-14	Nascent		-129.9815	45.9358	423911	5087378	10:48	Gastropods and other small animals near MTR	Juniper/ Levesque	Marcus
MTR-4180 _R491-15	Nascent		-129.9815	45.9358	423911	5087378	11:12	MTR deployed 1998 Dive R478	Embley	
Bio_R491-16	Nascent		-129.9815	45.9358	423911	5087378	11:16	Four tube worm grabs in diffuse flow	Levesque/ Marcus	
MTR-4126 _dfl_R491-17		N41	-129.9814	45.9362	423922	5087428	12:46	Deployed 1998 Dive R474	Embley	
Bio_R491-18		N41	-129.9814	45.9362	423922	5087428	12:55	Tube worm grab in diffuse flow	Marcus	
SS-j2_FeO _R491-19a	not at vent		-129.9816	45.9344	423899	5087414	13:41	FeO sample + white tentacled bacteria	Scott	
SS-j2-FeO _R491-19b	not at vent		-129.9816	45.9344	423899	5087414	14:00	FeO and white tentacled bacterial mat - switched from jar2 to jar4 - wasn't logged as a sample	Scott	
Bio_R491-20	Old Flow		-129.9817	45.9364	423898	5087455	14:34	Tube worm grab in diffuse flow - worms look dead or at least not very healthy	Tsurumi	
Rck_R491-21	Old Flow		-129.9817	45.9364	423898	5087455	15:15	Shell of hollow lobate rock with about 10cm crust - in area of diffuse flow on old lava	Perfit	Scott
Rck_R491-22	not at vent		-129.9816	45.9344	423902	5087224	16:11	New lava flow sample from roof structure about 100m away from Mkr-33 in area of diffuse venting	Perfit	
Bio_R491-23	Old Worms		-129.9833	45.9451	423785	5088418	5:10	Tube worm grab in diffuse flow on old lava - also sampled small rock	Levesque	
Bio_R491-24	Old Worms		-129.9833	45.9451	423785	5088418	5:30	Tube worm grab in diffuse flow on old lava	Tsurumi	
Rck_R491-25	Old Worms		-129.9833	45.9451	423785	5088418	5:40	Rock sample in diffuse flow on sedimented old lava - a couple of rocks	Perfit	
SS-2_mat _R491-26	Magnesia		-129.9849	45.9462	423661	5088545	8:18	White and orange mat (bacterial and sulfur)	Moyer	Huber

SS-3_mat _R491-27	Magnesia		-129.9849	45.9462	423661	5088545	8:31	White and orange mat (bacterial and sulfur)	Moyer	
SS-4_FeO _R491-28	n/a		-129.9816	45.9344	423902	5087224	9:21	Sampled earlier at Oxide - in flushing bottle	Scott	
	Cloud	N6	-129.9816	45.9334	423901	5087111		Deployed VEMCO 1108 & MTR3157 (taped together)	Embley	
	Nascent		-129.9815	45.9358	423911	5087378	12:25	Deployed MTR 3175	Embley	
	n/a	N41	-129.9814	45.9362	423922	5087428	13:03	Deployed MTR 3041	Embley	
	Mkr-33 V	33	-129.9822	45.9333	423850	5087101		Deployed BioOsmaSampler	Chapin	
Dive R492 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamples
SS-j1_bio_R492-1	Joystick	42	-129.9886	45.9188	423342	5085505	1351	Tube worms - bag creatures - nemartean? - and other fauna on a rock	Marcus	
Rck_492-2	Joystick	42	-129.9886	45.9188	423342	5085505	14:50	Orange oxidized rock - few meters southwest of Mkr-42 - rock corer	Perfit	
SS-6_mat_R492-3	Joystick	42	-129.9886	45.9188	423342	5085505	15:04	Bacterial mat and bag creatures	Moyer	
SS-8_mat_R492-4	Joystick	42	-129.9886	45.9188	423342	5085505	15:24	Suction of white filamentous material off rock	Moyer	
SS-7_bio_R492-5	Coquilles		-129.9931	45.9175	422991	5085365	16:48	Clams - holothurians - background fauna	Levesque	
Bio_R492-6	Coquilles		-129.9931	45.9175	422991	5085365	17:28	Tube worm bush containing lots of other organisms	Tsurumi	Levesque
SS-j4_bio_R492-7	Coquilles		-129.9931	45.9175	422991	5085365	17:46	Sample in middle of tube worm bush for small animals	Levesque	
Rck_R492-8	near Dying		-129.9919	45.9168	423080	5085277	18:36	New lobate flow sample at contact - 7 function arm	Perfit	
Rck_R492-9	near Dying		-129.9919	45.9168	423080	5085277	18:43	Old flow sample at same contact point - rock corer	Perfit	
Bio_R492-10	Bag City		-129.9816	45.9344	423284	5085214	19:49	Tube worm grab	Marcus	McHugh
GTB-2_dfl _R492-11	Bag City		-129.9816	45.9344	423284	5085214	20:13	Gastight at site where tube worms were sampled	Evans	Butterfield/ Lilley

SS-j3_dfl_R492-12	Bag City		-129.9816	45.9344	423284	5085214	20:17	Suction diffuse flow - same site - T=22	Butterfield	Huber
SS-4_FeO_R492-13	Bag City		-129.9816	45.9344	423284	5085214	20:30	Iron oxides (red) sample in flush bottle	Scott	
Rck_R492-14	near Bag City		-129.9893	45.9162	423281	5085209	21:28	Lava rubble on old flow in area of old and new lava - over 200m southeast of Bag City -rock corer	Perfit	
Dive R493 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamp
Rck_R493-1	n/a	n/a	-129.9944	45.9134	422880	5084908	7:38	Few pieces of old lava at contact - rock corer - ContactW5	Perfit	
Rck_R493-2	n/a	n/a	-129.9942	45.9135	422899	5084917	7:57	piece of drip structure - new lava flow - 7 function arm	Perfit	
Dive R494 SAMPLES (position at GPS antennae on ship - no acoustic nav)										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamples
Rck_R494-1	n/a	n/a	-130.0042	45.8583	422042	5078796	4:30	Old folded sheets - depth 1723 - rock corer (purple)	Perfit	
SS-j2_R494-2	n/a	n/a	-130.0042	45.8583	422042	5078796	5:00	Thin yellowish pelagic or hydrothermal sediment on top of lobate - brittle stars - background water - Sample	Juniper	
Rck_R494-3	n/a	n/a	-130.0037	45.8621	422087	5079221	5:50	Piece of thick sheet flow slab at fissure - about 10cm wide - reddish staining	Perfit	
Rck_R494-4	n/a	n/a	-130.0041	45.8624	422056	5079244	6:15	Rock from bottom of fissure - glassy new flow - end of lava tube - 7 function arm	Perfit	
Rck_R494-5	n/a	n/a	-130.0041	45.8624	422056	5079244	6:25	Second rock sample from same spot - glassy new flow - 7 function arm	Embley	Perfit
Rck_R494-6	n/a	n/a	-130.0041	45.8624	422056	5079244	6:30	Third rock - old slab - only got small piece of glassy top of sheet flow - depth 1724m - rock corer	Perfit	
Bio_R494-7	n/a	n/a	-129.9992	45.8772	422455	5080891	10:51	Crab leg - depth 1702m	Juniper	
Rck_R494-8	n/a	n/a	-129.9958	45.8782	422727	5080994	11:29	Small piece of new flow at east contact	Perfit	
Rck_R494-9	n/a	n/a	-129.9929	45.8894	422965	5082238	14:20	Sample from jumbled new lava - rock corer (black stripes)	Perfit	
Dive R495 SAMPLES										

Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Sub-samps
HFS-17_dfl_R495-1		108b	-129.9832	45.9288	423772	5086608	8:09	Unfiltered bag #17 - diffuse venting at base of pillar - Tmax=13.6 - 500 ml	Butterfield/ Huber/	
HFS-5_dfl_R495-2		108b	-129.9832	45.9288	423772	5086608	8:16	Gas piston - Tave=13.2 - 125 ml	Evans	Butterfield/ Lilley
HFS-10-dfl-R495-3		108b	-129.9832	45.9288	423772	5086608	8:18	filtered bag for xrf - 0.45 um - Tmax=13.3 - 600 ml	Gendron	
SS-j1_sed_R495-4	near Mkr-108		-129.9834	45.9283	423759	5086555	8:50	Sediment sample of diatom mat near Mkr 108	Tunnicliffe	
SS-j4_sed_R495-5	near Mkr-108		-129.9834	45.9283	423759	5086555	8:58	Sediment sample of diatom mat near Mkr 108	Juniper	
HFS-4_htfl _R495-6	Castle		-129.9799	45.9261	424023	5086306	10:16	Piston - T1=274 - T2=175 - Tmax=275 - 460 ml	Butterfield/ Huber/	
HFS-2_htfl _R495-7	Castle		-129.9799	45.9261	424023	5086306	10:22	Filtered bag for xrf - 0.45 um - Tmax=255 - 507 ml	Gendron	
HFS-18_htfl _R495-8	Castle		-129.9799	45.9261	424023	5086306	10:31	Filtered bag -0.45 um - Tmax=262 - about 375 ml	Butterfield/ Graham	
GTB_htfl_R495-9	Castle		-129.9799	45.9261	424023	5086306	10:40	Gastight - Tmax=245	Evans	Butterfield/ Lilley
Niskin_htfl _R495-10	Castle		-129.9799	45.9261	424023	5086306	10:52	Niskin bottle for xrf	Gendron	
SF_R495-11	Castle		-129.9799	45.9261	424023	5086306	11:00	Sulfide chimney spire placed in purse - SAMPLE LOST (purse tore)	Scott	
FeO_R495-12	FlatTop	N5	-129.9796	45.9261	424043	5086306	11:26	FeO from top of Flattop placed in purse - SAMPLE LOST (purse tore)	Scott	
HFS-11_dfl _R495-13	Mkr-113	113	-129.9883	45.9226	423370	5085922	13:03	Filter bag 11 - T2=11.8 Tmax=22,6	Butterfield/ Graham	
GTB_dfl_R495-14	Mkr-113	113	-129.9883	45.9226	423370	5085922	13:13	Gastight	Evans	Butterfield/ Lilley
HFS-16_dfl _R495-15	Mkr-113	113	-129.9883	45.9226	423370	5085922	13:15	Unfiltered bag - T=27	Butterfield/ Huber	
SS-01_mat _R495-16	Mkr-113	113	-129.9883	45.9226	423370	5085922	13:29	Sucking mat and bag creatures?	Moyer	
SS-02_mat_ R495-17	Mkr-113	113	-129.9883	45.9226	423370	5085922	13:29	Sucking mat bag creatures? Hose broke on sampler	Moyer	
VEMCO&bio _R495-18	Mkr-113	113	-129.9883	45.9226	423370	5085922	6:52	Recovered VEMCO-MTR and tube worms attached	Embley/ Marcus	

HFS-22_dfl _R495-19	Joystick		-129.9886	45.9188	423342	5085505	15:03	Piston - Tmax=9.6 - 630 ml	Huber/ Butterfield/	
HFS-14_dfl _R495-20	Joystick		-129.9886	45.9188	423342	5085505	15:11	Bag with filter .45um - collecting sulfur - Tmax=8.7 degrees - 643 ml	Butterfield/ Graham	
HFS-12_dfl _R495-21	Joystick		-129.9886	45.9188	423342	5085505	15:18	3 micron/sterivex filter for DNA - T=8.5 - 1500 ml	Huber	
HFS-6_dfl _R495-22	Joystick		-129.9886	45.9188	423342	5085505	15:35	0.2 micron filter/FISH - Tmax=9 - 1000 ml	Huber	
HFS-24_dfl _R495-23	Joystick		-129.9886	45.9188	423342	5085505	15:46	Gas piston - Tmax=9.9 - 100 ml	Evans	Butterfield/ Lilley
HFS-15_dfl _R495-24	Joystick		-129.9886	45.9188	423342	5085505	15:49	0.45 micron filter for lipids - Tmax=9.8 - 820 ml	Huber	
HFS-3_dfl _R495-25	Joystick		-129.9886	45.9188	423342	5085505	16:01	0.45 micron filter of XRF - Tmax=10.1 - 570 ml	Gendron	
HFS-19_dfl _R495-26	Coquilles		-129.9931	45.9175	422991	5085365	17:12	Bag with filter 0.45 microns - Tmax=20.7 - 650 ml	Butterfield/ Graham	
HFS-20-_dfl _R495-27	Bag City	36	-129.9816	45.9344	423284	5085214	18:17	Piston - T1=22 Tave=22.6 Tmax=23.2 - 683 ml	Butterfield/ Graham/	
HFS-23_dfl _R495-28	Bag City	36	-129.9816	45.9344	423284	5085214	18:23	Gas piston - Tmax=23.4 - 128 ml	Evans	Butterfield/ Lilley
HFS-21_dfl _R495-29	Bag City	36	-129.9816	45.9344	423284	5085214	18:28	0.45 micron filter for XRF - Tmax=23.3 - 500 ml	Gendron	
HFS-13_dfl _R495-30	Bag City	36	-129.9816	45.9344	423284	5085214	18:30	3 micon/sterivex filter for DNA - Tmax=23.4 - 1000 ml	Huber	
HFS-9_dfl _R495-31	Bag City	36	-129.9816	45.9344	423284	5085214	18:40	Bag with POC filter - Tmax=23.5 - 533 ml	Butterfield/ Gendron	
HFS-7_dfl _R495-32	Bag City	36	-129.9816	45.9344	423284	5085214	18:45	0.45 micron filter for lipids - Tmax=23.2 - 1000 ml	Huber	
HFS-1_dfl _R495-33	Bag City	36	-129.9816	45.9344	423284	5085214	18:56	0.2 um FISH filter - Tmax=23.4 - 1000 ml	Huber	
Rck_R495-34	Crevice		-129.9904	45.9111	423175	5084648	21:35	New flow lobate lava from little collapse - SAMPLE LOST (purse tore)	Perfit	
SS-j3_FeO _R495-35	Crevice		-129.9904	45.9111	423175	5084648	22:00	Sediment which is partly composed of some sort of iron oxide - probably basalt glass too	Scott	Perfit
SS-j2_bio _R495-36	Crevice		-129.9904	45.9111	423175	5084648	22:16	Small patch of dead tube worms shaken for any other small organisms - FeO among tubes	Tsurumi	Perfit
SS-04_fl_R495-37	n/a		-129.9913	45.9052	423107	5083994		Background water collected while ROPOS coming up - depth 1300m - location is just a guess	Juniper/ Levesque/	

	BagCity		-129.9816	45.9344	423284	5085214	19:35	Deployed MTR	Embley	
	Mkr-33 V	33	-129.9822	45.9333	423850	5087101		Deployed OsmoAnalyzer	Chapin	
Dive R496 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamps
Bactrp-20_R496-1	Mkr-113	113	-129.9883	45.9226	423370	5085922	7:59	Bacteria trap #20 recovered (deployed in 98 - Dive R464)	Moyer	
Bactrp-21_R496-2	Mkr-113	113	-129.9883	45.9226	423370	5085922	7:59	Bacteria Trap #21 recovered (deployed in 98 - Dive R464)	Moyer	
Bio_R496-3	Mkr-113	113	-129.9883	45.9226	423370	5085922	8:08	Tube worm grab - (total of 3 grabs)	Marcus	Perfit
Rumble_R496-4	n/a		-129.9840	45.9302	423711	5086763	16:05	Recovered rumbleometer stuck in the 98 lava flow - Perfit grabbed rock chips from flow	Fox	Perfit
Dive R497 SAMPLES (No acoustic nav at CASM - positions at ship GPS antennae)										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamp
SS-j3_dfl_R497-1	n/a	n/a	-130.0264	45.9890	420506	5093338	7:44	Water sample over palm worms, about 15 m east of fissure - log file 2 - T=11-16	Butterfield/ Huber/	
Sf_R497-2	T&S	n/a	-130.0272	45.9890	420447	5093343	9:32	Little piece of sulfide spire	Scott	Levesque
Sf&Bio_R497-3	T&S	n/a	-130.0272	45.9890	420447	5093343	9:39	Top of sulfide chimney and crab	Scott	Juniper
SS-j4_dfl_R497-4	T&S	n/a	-130.0272	45.9889	420446	5093322	10:09	Water sample - log file 3 at Vemco and Maya's tube worm sample site - Tave=21 Tmax=25	Butterfield/ Huber/	
GTB_R497-5	T&S	n/a	-130.0272	45.9889	420446	5093322	10:22	Gastight (portside)	Evans	
Sf_R497-6	T&S	n/a	-130.0272	45.9889	420446	5093322	10:25	Sulfide sample where port gas tight was taken (broke up a lot)	Scott	
VEMCO_R497-7	T&S	n/a	-130.0272	45.9889	420446	5093322	10:32	VEMCO 98-1113-214 placed in stbd side biobox	Embley	
SS-j1_bio_R497-8	T&S	n/a	-130.0272	45.9889	420446	5093322	10:40	Particles over tube worms - log file 4;- resumed at 10:58 inside tube worm clump Tmax=10	Juniper/ Levesque	
Bio_R497-9	T&S	n/a	-130.0272	45.9889	420446	5093322	10:50	Tube worm grab	Tsurumi	

SS-1_mat_R497-10	T&S	n/a	-130.0272	45.9889	420446	5093322	11:22	Suction of mat - Tmax=6.1	Moyer	
GTB_R497-11	T&S	n/a	-130.0272	45.9889	420446	5093322	11:44	Gas tight bottle near top of chimney - Tspike=28	Evans	
Sf_R497-12	T&S	n/a	-130.0272	45.9889	420446	5093322	11:48	Sulfide sample - lots of tube worms attached	Scott/ Perfit/	
SS-2_dfl_R497-13	T&S	n/a	-130.0272	45.9889	420446	5093322	12:13	Fluid sample over lush tubes worms - Tave=26 Tmax=38,5	Butterfield/ Huber/	
SS-j2_bio_R497-14	T&S	n/a	-130.0272	45.9889	420446	5093322	12:30	100 micron mesh over lush tube worms for larvae (suspended particles) - 16 minutes	Levesque/ Juniper	
SS-3_bio_R497-15	T&S	n/a	-130.0272	45.9889	420446	5093322	12:53	Small animals and other material from within community of lush tube worms	Levesque/ Juniper/	
Hobo_R497-16	T&S	n/a	-130.0272	45.9889	420446	5093322	13:12	Recovery of hobo deployed in 98 on DiveR480	Embley	
Niskin_dfl_R497-17	T&S	n/a	-130.0272	45.9889	420446	5093322	13:36	Niskin about 6 inches from top of spire - diffuse flow	Gendron	
Sf_R497-18	T&S ?	n/a	-130.0272	45.9889	420446	5093322	?	Decimeter piece of sulfide chimney caught in ROPOS - found on recovery.	Scott	
Sf_R497-19	T&S	n/a	-130.0272	45.9889	420446	5093322		Sulfide (chalcopyrite with minor ?anhydrite) scraped off HOBO probe - Ppt is ~1 mm thick, 50 mm long and OD		
Rck_R497-20	NRZ	n/a	-130.0219	46.0198			18:03	Lobate flow top from NRZ in area of extensometers	Perfit	
Sf_dfl_R497-21	T&S	n/a	-130.0272	45.9889	420446	5093322		Scraping from Vemco near tubeworm grab R497-10 - appears to be mostly anhydrite.	Scott	
	T&S	n/a	-130.0272	45.9889	420446	5093322		Deployed MTR 3017	Embley	
Dive R498 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	
Exten_R498-1			-130.0180	46.0194	421203	5096708		Recover '98 extensometer E1	Chadwick	
Exten_R498-2			-130.0203	46.0110	421026	5096739		Recover '98 extensometer E2	Chadwick	
Exten_R498-3			-130.0212	46.0197	420956	5096745		Recover '98 extensometer E3	Chadwick	

Exten_R498-4			-130.0241	46.0202	420732	5096799		Recover '98 extensometer E4	Chadwick	
Dive R499 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	
HFS-3_dfl_R499-1	Magnesia		-129.9849	45.9462	423661	5088545	17:08	Filter #3 for XRF - Tmax=7.3 - 500 ml	Gendron	
HFS-4_dfl_R499-2	Magnesia		-129.9849	45.9462	423661	5088545	17:13	Piston #4 - Tmax=7.4 - 600 ml	Butterfield/ Huber/ Graham	
HFS-5_dfl_R499-3	Magnesia		-129.9849	45.9462	423661	5088545	17:20	Gas piston #5 - Tmax=7.1 - 125 ml	Evans	
HFS-18_dfl_R499-4	Magnesia		-129.9849	45.9462	423661	5088545	17:26	Bag #18 - Tmax=7.3 - 613 ml	Butterfield/ Graham	
niskin_dfl_R499-5	Magnesia		-129.9849	45.9462	423661	5088545	18:18	Niskin diffuse flow	Gendron	
HFS-24-dfl-R499-6	Old Worms		-129.9833	45.9451	423785	5088418	20:20	Gas piston #24 - area of lush growth and good flow - Tmax=7.8 - about 150 ml	Evans	
	Magnesia		-129.9849	45.9462	423661	5088545		Deployed OsmoSampler	Chapin	
Dive R500 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamp
HFS-99_dfl_R500-1	Old Worms		-129.9833	45.9451	423785	5088418	0:47	Bag #9 with POC filter - isothermal flow under tube worms - T1=9.5 T2=7.5 Tmax=9.7 - 600 ml	Butterfield	
HFS-17_dfl_R500-2	Old Worms		-129.9833	45.9451	423785	5088418	0:59	Bag #17 unfiltered - no valve - Tmax=9.8 - 700 ml	Butterfield/ Huber/	
HFS-23_dfl_R500-3	Old Worms		-129.9833	45.9451	423785	5088418	1:06	Gas piston #23 - Tmax=9.8	Evans	Butterfield/ Lilley
SS-j3_dfl_R500-4	Old Worms		-129.9833	45.9451	423785	5088418	1:28	64 micron mesh - Larval collection over old tube worm bush	Tunncliffe	
SS-j1_bio_R500-5	Old Worms		-129.9833	45.9451	423785	5088418	1:50	100 micron mesh - Small animal and biofilm sample in old tube worm bush	Levesque/ Charpentier	
SS-j2_bio_R500-6	Old Worms		-129.9833	45.9451	423785	5088418	2:20	Clams and other fauna	Levesque/ Charpentier	Perfit

HFS-19_dfl_R500-7	NE of FeO		-129.9816	45.9362	423904	5087423	5:48	Bag #19 with 0.45 um XRF filter (will analyze small particles on filter with STEM) - Tmax=4.8 Tinlet=4.5	Butterfield/ Gendron/	
GTB-6_dfl_R500-8	NE of FeO		-129.9816	45.9362	423904	5087423	6:07	Port gastight #6 - Tmax=5	Evans	Butterfield/ Lilley
HFS-16_dfl_R500-9	15m S of N41		-129.9815	45.9359	423911	5087391	6:22	Bag #16 unfiltered - no valve - Tmax=25.9 - 600 ml	Butterfield/ Huber/	
GTB-7_dfl_R500-10	15m S of N41		-129.9815	45.9359	423911	5087391	6:30	Stbd gastight #7 - Tmax=26	Evans	Butterfield/ Lilley
HFS-11_dfl_R500-11	15m S of N41		-129.9815	45.9359	423911	5087391	6:43	Bag #11 with 0.45 um filter - no valve - Tmax=22.7 Texit=14 - 620 ml	Butterfield	
HFS-10_dfl_R500-12	15m S of N41		-129.9815	45.9359	423911	5087391	6:50	Filter #10 for lipids - Tmax=24.4 - 1 liter	Huber	
HFS-13_dfl_R500-13	15m S of N41		-129.9815	45.9359	423911	5087391	7:00	Filter #13 - 3 um and sterivex for DNA - Tmax=24.2 - 1200ml	Huber	
HFS-4_dfl_R500-14	n/a		-129.9814	45.9352	423918	5087310	8:05	Piston #4 - Tmax=11.3 - 600 ml	Butterfield/ Huber/	
HFS-6_dfl_R500-15	Cloud	N6	-129.9816	45.9334	423901	5087116	9:26	Filter #6 - 0.2 um for FISH - Tmax=19.9 - 1 liter	Huber	
HFS-12_dfl_R500-16	Cloud	N6	-129.9816	45.9334	423901	5087116	9:36	Filter #12 - 3 um sterivex for DNA, - Tmax=20 - 1005 ml	Huber	
HFS-15_dfl_R500-17	Cloud	N6	-129.9816	45.9334	423901	5087116	9:47	Filter #15 for lipids - Tmax=19.9 - 1002 ml	Huber	
HFS-20_dfl_R500-18	Cloud	N6	-129.9816	45.9334	423901	5087116	9:58	Piston #20 - Tmax=19.9 - 675 ml	Butterfield/ Huber/	
Niskin_dfl_R500-19	Cloud	N6	-129.9816	45.9334	423901	5087116	10:22	Niskin bottle over the hole at Mkr-N6	Gendron	
HFS-1_dfl_R500-20	MK33	33	-129.9822	45.9333	423850	5087101	12:24	Filter #1 for FISH - Tmax=75.5 T2=43 - 1 liter	Huber	
HFS-2_dfl_R500-21	MK33	33	-129.9822	45.9333	423850	5087101	12:34	Filter #2 for XRF - Tmax=77.5 - 500 ml	Gendron	
HFS-7_dfl_R500-22	MK33	33	-129.9822	45.9333	423850	5087101	12:40	Filter #7 - sterivex for DNA - Tmax=75.7 T1=66 T2=43	Moyer	
HFS-21_dfl_R500-23	MK33	33	-129.9822	45.9333	423850	5087101	12:58	Filter #21 for lipids - Tmax=73.2 - 1200 ml	Huber	
HFS-22_dfl_R500-24	MK33	33	-129.9822	45.9333	423850	5087101	13:09	piston #22 for water chemistry - Tmax=74.6 - 623 ml	Butterfield/ Huber/	
HFS-14_dfl_R500-25	MK33	33	-129.9822	45.9333	423850	5087101	13:16	Bag #14 with filter - Tmax 73.5 - 525 ml	Butterfield/ Graham	

Dive R501 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamp
SS-1_mat_R501-1	Mkr 33	33	-129.9822	45.9333	423850	5087101	23:40	Bacterial mat in venting crack - piece of basalt that jammed in carousel	Moyer/ Lynch	Scott
SS-j3_rck_R501-2	n/a		-129.9924	45.9206	423050	5085709	5:37	Slurp of glass from intermediate? age top of pillow	Perfit	Scott
SS-j7_rck_R501-3	n/a		-129.9914	45.9207	423126	5085715	5:55	Younger of two flows at contact - small tube/toe in lobates - couldn't do a grab so have to slurp	Perfit	
Rck_R501-4	n/a		-129.9899	45.9203	423238	5085670	6:32	Intermediate flow? - near the collapse in some broken lobes - blocky chunk with good layer of glass	Perfit	
Rck_R501-5	n/a		-129.9877	45.9204	423411	5085680	7:01	Sample from crust of hollowed lobe - stubby with thin glass and angular edges - age hard to tell - 98 flow?	Perfit	
SS-j8_rck_R501-6	n/a		-129.9867	45.9206	423492	5085695	7:25	Glass from lineated sheet flow, intermediate age (?)	Perfit	
Rck_R501-7	n/a		-129.9818	45.9204	423865	5085668	8:15	Slab of rock from shallow collapse jumbled area	Perfit	
Rck_R501-8	n/a		-129.9777	45.9202	424183	5085645	9:48	Chunk of lava from old flow - small, glassy	Perfit	
SS-4_rck_R501-9	n/a		-129.9777	45.9201	424188	5085637	10:08	Little pieces of basalt glass from newer flow	Perfit	
Rck_R501-10	n/a		-129.9823	45.9240	423831	5086069	11:29	Big plates (2) of mat covered ropey sheets	Perfit	
SS-j4_mat_R501-11	n/a		-129.9823	45.9239	423837	5086063	11:35	Mat on rocks - same spot as last rock sample	Juniper	
Rck_R501-12	n/a		-129.9876	45.9240	423427	5086072	12:30	Lava from chaotic collapse area- older with sponges	Perfit	
Rck_R501-13	n/a		-129.9886	45.9240	423348	5086075	12:45	Contact area - black glassy newer lava - black striped corer	Perfit	
Rck_R501-14	n/a		-129.9886	45.9240	423348	5086075	13:05	Contact area - more sediment and brittle stars - yellow striped corer	Perfit	
Niskin_R501-15	n/a		-129.9886	45.9240	423348	5086075	13:18	Niskin sample at contact	Juniper	
Rck_R501-16	n/a		-129.9922	45.9240	423065	5086078	13:45	Older? lava with sponges and more sediments - purple core	Perfit	
Bio_501-17	Crevice		-129.9905	45.9109	423177	5084629	15:57	Tube worm grab within hole near crevice -diffuse venting	Tsurumi	

	Mkr 33	33	-129.9822	45.9333	423850	5087101		Deployed Time Lapse Camera	Tunncliffe	
Dive R502 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamp
HFS-5_dlf_R502-1	Gollum		-130.0136	45.9336	421422	5087166	2:41	Gas piston #5 - max=22.5	Evans	Butterfield/ Lilley
HFS-6_dlf_R502-2	Gollum		-130.0136	45.9336	421422	5087166	3:16	0.2um filter for FISH - T1=9 T2=16 Tmax=22 - pump shut down for 15min in middle of sampling - 1020 ml	Huber	
HFS-7_dlf_502-3	Gollum		-130.0136	45.9336	421422	5087166	3:27	Sterivex DNA filter #7- Tmax=20.2 T2=16 - 1450ml pumped	Moyer	
HFS-13_dlf_R502-4	Gollum		-130.0136	45.9336	421422	5087166		3 micron + sterivex filters for DNA - Tmax=23.5 - 1029mL	Huber	
HFS-15_dlf_R502-5	Gollum		-130.0136	45.9336	421422	5087166	3:49	0.45 micron lipid filter #15 for DNA - Tmax=24 - 1426 ml	Huber	
HFS-22_dlf_R502-6	Gollum		-130.0136	45.9336	421422	5087166	3:56	Gas piston #22 - Tmax=22.3 - 640ml	Butterfield/ Huber/	
SS-j4_bio_R502-7	Gollum		-130.0136	45.9336	421422	5087166	4:00	Slurp sample for palm worms et al - also for fluid	Juniper/ Levesque	
MTR_dlf_R502-8	Gollum		-130.0136	45.9336	421422	5087166	4:30	Recover MTR deployed on Dive R471 1998	Embley	
HFS-24_htfl_R502-9	Marsh-mallow		-130.0136	45.9337	421420	5087179	4:35	Gas piston#24 - Tmax=74.3	Evans	Butterfield/ Lilley
HFS-21_htfl_R502-10	Marsh-mallow		-130.0136	45.9337	421420	5087179	4:45	Lipid filter #21 - Tmax=74.4 - 1200 ml	Huber	
HFS-12_htfl_R502-11	Marsh-mallow		-130.0136	45.9337	421420	5087179	4:55	3 micron + sterivex filters for DNA - Tmax+75.8 - 1000 ml	Huber	
HFS-9_htfl_R502-12	Marsh-mallow		-130.0136	45.9337	421420	5087179	5:09	Bag with POC filter #9 - Tmax =73.6 - 599 ml	Butterfield	
HFS-4_htfl_R502-13	Marsh-mallow		-130.0136	45.9337	421420	5087179	5:10	Piston sample #4 - Tmax 71.8 - 601 ml	Butterfield/ Huber/	
HFS-1_htfl_R502-14	Marsh-mallow		-130.0136	45.9337	421420	5087179	5:15	FISH filter #1 - Tmax 80.7 - 1000 ml	Huber	
SS-j3_bio_R502-15	Marsh-mallow	I	-130.0136	45.9337	421420	5087179	5:27	Suction sample of fauna (tubes and snails) - fluid	Marcus	
GTB-7_htfl_R502-16	Virgin		-130.0135	45.9336	421430	5087174	6:00	Sttbd gastight - Tmax=306	Evans	Butterfield/ Lilley

HFS-18_htfl _R502-17	Virgin		-130.0135	45.9336	421430	5087174	6:02	Bag #18 with filter - Tmax=309 T2=145	Butterfield/ Graham	
HFS-14_htfl _R502-18	Inferno		-130.0139	45.9335	421397	5087162	6:54	Bag #14 with 0.45 filter - Tmax 289.9 - 406 ml	Butterfield/ Graham	
HFS-16_htfl _R502-19	Inferno		-130.0139	45.9335	421397	5087162	6:59	Unfiltered bag #16 - Tmax 293 - 500 ml	Butterfield/ Graham/	
GTB-2_htfl _R502-20	Inferno		-130.0139	45.9335	421397	5087162	7:08	Port gas tight #2	Evans	Butterfield/ Lilley
HFS-2_htfl _R502-21	Inferno		-130.0139	45.9335	421397	5087162	7:10	0.45 micron filter #2 for XRF - Tmax=289.6 - 476 ml	Gendron	
HOBO_htfl _R502-22	Inferno		-130.0139	45.9335	421397	5087162	7:34	Retrieved HOBO 137 deployed on Alvin dive 3245 in '98 - scrapings for Scott	Embley	Scott
HFS-20_htfl _R502-23	Crack		-130.0136	45.9333	421424	5087135	8:09	Piston #20 - Tmax=89.7 - 628 ml	Butterfield/ Huber/	
HFS-10_htfl _R502-24	Crack		-130.0136	45.9333	421424	5087135	8:16	Filter #10 for lipids - Tmax=90 - 1100 ml	Huber	
Niskin_htfl _R502-25	Hell		-130.0142	45.9333	421372	5087135	8:42	Niskin bottle, 1 meter above Hell	Gendron	
HFS-3_htfl_ R502-26	Hell		-130.0142	45.9333	421372	5087135	9:04	0.45 micron filter #3 for XRF - Tmax=294.7 -300 ml	Gendron	
HFS-17_htfl _R502-27	Hell		-130.0142	45.9333	421372	5087135	9:07	Unfiltered bag #17 - Tmax=294.3 - 575 ml	Huber	
HFS-19_htfl _R502-28	Hell		-130.0142	45.9333	421372	5087135	9:11	Bag with 0.45 filter, - Tmax 293.1 - 574 ml	Butterfield/ Graham	
HFS-23_htfl _R502-29	Hell		-130.0142	45.9333	421372	5087135	9:16	Gas piston #23 - Tmax=291.9 - 156 ml	Evans	Butterfield/ Lilley
SS-j1_bio_R502-30	Porkchop		-130.0142	45.9333	421373	5087136	10:00	Sulfide worms - (scale worms and copepods?)	Juniper/ Levesque	
SS-j2_bio_R502-31	Phoenix		-130.0140	45.9332	421391	5087130	10:39	Sulfide worms - palm worms - tube worms	Juniper/ Levesque	
SS-4_bio_R502-32	Medusa		-130.0139	45.9334	421395	5087141	10:56	Three anemones - rock - clams	Juniper/ Levesque	
SS-1_FeO_R502-33	n/a		-130.0139	45.9332	421395	5087128	11:31	Fe Oxide from mounds - (15 m south of Medusa) - BAD NAV	Scott	
SS-4_sf_R502-34	n/a		-130.0139	45.9332	421395	5087128	11:55	Greyish white mat - small chunks of anhydrite Fe- (15 m south of Medusa)	Scott	Perfit
HFS-11_dfl _R502-35	n/a		-130.0153	45.9334	421287	5087152	13:15	Bag #11 with filter - no valve, - Tmax=6.2 - 601 ml (west wall)	Huber	

SS-2_df 1_R502-36	n/a		-130.0153	45.9334	421287	5087152	13:23	Iron oxides and bacteria (west wall)	Scott	
SS-3_dfl_ R502-37	n/a		-130.0153	45.9334	421287	5087152	13:36	Same sample as previous because bottle was contaminated by previous sample (west wall)	Scott	
HOBO_R502-38	Hell		-130.0142	45.9333	421372	5087135	14:08	Collected hobo deployed 1998??	Moyer	
	Hell		-130.0142	45.9333	421372	5087135		Deployed HOBO	Embley	
Dive R503 SAMPLES										
Sample	Vent	Mkr	Long	Lat	UTM X	UTM Y	Time	Description	Investigator	Subsamp
Bactrps_R503-1	Gollum		-130.0136	45.9336	421422	5087166	0:15:00	Recovered 2 bactraps deployed in 1998 on Dive R471 - still one there	Moyer	
HOBO_R503-2	Inferno		-130.0139	45.9335	421397	5087162	0:32:00	THIS IS A MISTAKE, ACTUALLY IS SAMPLE 502-22. (FOR SOME REASON HAD IT DOWN TWICE)	Embley	
HOBO_R503-3	Virgin		-130.0135	45.9336	421430	5087174	0:02:41	Recovered HOBO 129 deployed on Alvin Dive 3245 '98	Embley	
	Inferno		-130.0139	45.9335	421397	5087162		Deployed HOBO 128 - Top of Inferno	Embley	
	Inferno		-130.0139	45.9335	421397	5087162		Deployed OsmoSampler - melted it	Chapin	
	Gollum		-130.0136	45.9336	421422	5087166		Deployed Bactrp #45	Moyer	

5.5 Dive Map Nomenclature

The dive maps depict all Vents and Markers visited, samples collected on each dive, in addition all instruments deployed and recovered are also cited.

Nomenclature Example: SS-12_dfl_R503-4

The first letters indicate the sample type. The sample type may be followed by a hyphen and a number, which indicates the number for that specific sample type (could be a HFS filter number, suction sample jar number, etc.)

The letters following the underscore give more information about the sample:
_dfl indicates that the sample was in diffuse flow.

The final number, following the hyphen, designates the dive sample number.
-4 indicates that it was sample number 4 for the dive.

Sample type abbreviations		More sample information:	
SS	Suction Sample	mat	bacterial mat
HFS	Hot Fluid Sampler	dfl	diffuse flow
Niskin	Niskin bottle	hfl	high temp flow
Gtb	Gas Tight Bottle	flc	bacterial flock
Bactrp	Bacteria Trap	osmo	osmo (sampler or analyzer)
Bio	Biological sample	HOBO	temperature probe (152 - 419EC)
Sf	sulfide	MTR	temperature probe (2 - 34EC)
Rck	rock	VEMCO	temperature probe (0 - 50EC)
FeO	iron oxide	TLC	time lapse camera

Red stars represents vent locations.

Smaller white stars represents marker locations.

NOTE: 2014 REVISION – DIVE MAPS AT END OF DOCUMENT

5.6 ROPOS Dive Logs, Dives R483 - R502

							Dive R483	
							Dive Plan: High resolution survey of Mkr-33 using the Sit camera and Imagenex. Elevator will be used to gather experiments from Mkr-33. Suction sampling will be done there and at other active vents to the north.	
							Time-lapse camera will be brought up in the arm of ROPOS.	
							ROPOS Configuration: Biobox, Slurp Sampler, Gas Tights, Imagenex, and the other cameras.	
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples	
						Elevator of the deck and into the water.		
10	8	1	46	414094	5095636	ROPOS is in the water!		
10	24	457	231	414094	5095636	Trying out the frame grab	R483-7	
10	56	1001	23	414094	5095636	Ropos outside of cage		
11	2	1000	232	414094	5095636	Fixes are still bad		
11	2	1000	232	414094	5095636	Ropos back in cage.		
11	11	1105	214	414094	5095636	Working on problem with video color.		
11	31	1472	327	414094	5095636	Ropos is leaving cage. Near the bottom. Still no navigation.		
11	36	1500	305	423890	5087089	Stopping navigation. Switch channels for transponders.		
11	39	1518	336	423890	5087089	Elevator is on the bottom.		
11	41	1495	65	423802	5087074	Good fix.		
11	45	1491	13	423802	5087074	Elevator deployed. About 20m S of Mkr-33		
11	48	1515	42	423802	5087074	At target called elevator. X=3849 Y=7082		
11	57	1520	217	423802	5087074	Near bottom at Mkr-33. Camera in view.		
11	59	1522	203	423802	5087074	Highlights tape on.		
12	1	1523	206	423802	5087074	Highlights off.		
12	14	1523	119	423849	5087081	Sitting on bottom at Mkr-33. No good sub fixes.		
12	20	1523	123	423849	5087081	Navigation off.		
12	23	1523	117	423848	5087086	Good ROV fix.		
12	25	1523	125	423849	5087086	Time lapse camera and ozmo sampler.	R483-8	
12	34	1523	131	423848	5087086	Good Fix		
12	35	1521	128	423847	5087102	Highlights on. Doing mosaic		
12	43	1522	282	424108	5087314	Highlights off. Doing mosaic.		
12	45	1523	184	424102	5087915	Still photo of time lapse camera.		
12	46	1523	191	423849	5087082	Still photo 2.		

12	46	1523	193	424244	5087755	Time lapse and crack.	R483-12
12	49	1523	197	424422	5086745	Highlights on.	
12	50	1523	196	423852	5087097	Tube worms, palms worms, and scale worms.	R483-14
12	51	1523	196	423853	5087097	Same as last framegrab	R483-15
12	51	1523	194	423853	5087098	Palm worms, gastropods, tube worms, etc.	R483-16
12	53	1523	197	423890	5087617	Same as as last FG	R483-18
12	57	1523	204	423889	5087617	Hi	
13	5	1523	186	423853	5087097	Highlights on. Beginning sampling.	
13	5	1523	190	424453	5087458	Sampling J1. Mkr-33	R483-19
13	7	1523	187	423855	5087083	Slurp sample J1. Begin sampling.	
13	9	1523	186	424325	5087985	Slurp sampling J1 for particulates at Mkr-33. First sample J1.	R483-20
13	10	1523	190	423847	5087099	Highlights off.	
13	10	1523	189	423852	5087096	Slurp probe sampling J1.	R483-21
13	17	1523	188	423854	5087095	Possible samples of worms collected during particulate sampling in J1.	
13	26	1523	192	423842	5087055	Still collecting sample J1.	
13	49	1523	196	423854	5087079	Still sampling J1.	
14	0	1524	190	423853	5087096	VCR tapes changed. Still sampling J1.	
14	6	1523	185	423852	5087098	End sampling J1.	
14	10	1522	185	423852	5087099	Sample area.	R483-22
14	10	1521	177	423850	5087094	Still photo.	
14	10	1520	180	423850	5087094	Still photo.	
14	11	1521	203	423855	5087099	Still photo 3rd	
14	12	1520	219	423852	5087098	Camera postion.	R483-23
14	12	1521	218	423857	5087082	Photo 4.	
14	12	1522	241	423857	5087082	Photo 5.	
14	13	1522	251	423856	5087096	Photo 6.	
14	13	1522	244	423856	5087096	photo 7.	
14	13	1523	246	423855	5087097	camera position.	R483-24
14	19	1523	113	423853	5087099	Picking up time lapse camera to move.	
14	19	1524	109	423854	5087081	Picking up time lapse camera.	R483-25
14	23	1525	231	423857	5087095	Camera positioned near elevator anchor.	
14	28	1524	173	423854	5087081	Flush slup sampler.	
14	31	1523	175	423849	5087096	Slup sampling J2 (start).	
14	37	1523	170	423853	5087099	Slurping gastropods. J2	R483-27
14	44	1524	164	423853	5087097	bacterial box from 98	R483-28
14	44	1524	165	423842	5087051	ROPOS reaching in to pick up their box	R483-29
14	50	1524	174	423854	5087080	view of vent site, Christian's suction J2 site	R483-30
15	7	1523	142	423854	5087095	Finished suction sample J2.	
15	15	1524	201	423848	5087093	Started suction sample J3 - suction top of slab for more polynoids and gastropods	
15	17	1524	196	423854	5087080	Frame grab of suction sample J3 location	R483-31
15	47	1524	194	423847	5087098	Bacterial trap collected #12	R483-32
15	54	1524	170	423854	5087082		R483-33

[Type text]

15	59	1524	227	423854	5087080	Tube worm grab sample #1(Marcus) at Mkr-33	R483-34
16	29	1524	203	423845	5087059	Fluid sample of vent at Mkr-33(Evans) sample #1	R483-35
16	37	1524	256	423851	5087099	GTB#6-#7 (Evans)	R483-36
16	51	1525	264	423850	5087089	MTR from Mkr-33 (Embely) Probe #4130	R483-37
16	59	1519	228	423843	5087099	Elevator in position above Mkr-33 carrying payload of bacterial traps, bioboxes, osmosamplers and analyzers	R483-38
17	1	1516	232	423859	5087094		R483-39
17	2	1516	245	423861	5087096	Elevator positioned above Mkr-33 with payload to be deployed - (bacterial traps, bioboxes, osmosampler and analyzer).	R483-40
17	5	1520	240	423853	5087092	Bioboxes for Dr. Moyer	R483-41
17	8	1524	246	423852	5087084	Osmo (Fe) analyzer deployment (chapin) set of the vent site for deployment within the vent later at Mkr-33	R483-42
17	23	1524	311	423840	5087045	Fe Osmo Analyzer (Chapin) Mkr-33	R483-43
18	11	1524	262	423847	5087099	Green Osmo sampler and Copper osmo sampler (Chapin) deployed at Mkr-33	R483-44
18	36	1524	203	423851	5087076	Sampler and analyzer probes w/in the vent fluid(Chapin)	R483-45
18	39	1522	192	423850	5087091	Green osmo sampler with Copper osmo sampler in foreground with the the Fe Osmo Analyzer in the background at Mkr-33	R483-46
						Dive Summary: Went to Mkr-33 where 8 samples were collected (Suction samples, bactraps, bio, and gas-tights). Recovered MTR and Osmo from NeMO '98 cruise. Two Fe OsmoAnalyzers were deployed. Dive was aborted due to a kink in the tether.	

							Dive R484	
							Objectives: 1) Deploy other osmosampler from elevator at northern end of Mkr-33. 2) Collect basalt sample at Mkr-33. 3) Suction sample bacterial mats at Mkr-33 for Moyer, gastropods and mat for Levesque.	
							Suction sample bacterial mats at Cloud for Moyer, vent fauna larvae for Tunnicliffe. Suction sample for diatom mat on new lavas for Tunnicliffe. 4)Tube worm grab at Cloud. 5)Short Imagenex survey at Mkr-33 and vicinity.	
							6) Recover Time Lapse Camera . 7) Recover elevator with OsmoSamplers and microbial traps.	
							ROPOS Configuration: 7 function arm, 5 function arm, Biobox, Suction samplers (7 jars), Gas tights (2), Imagenex and other cameras.	
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples	
10	21	0	0	0	0	On the way down, the navigation people are trying to find a bug in the nav program and so the heading, depth, X, and Y will not be updated until we are near the bottom.		
10	27	0	0	0	0	ROPOS went in the water at 10:15.		
11	36	1490	253	423846	5087083	ROPOS leaving the cage.		
11	37	1522	267	423847	5087092	ROPOS is on the bottom		
11	43	1523	272	423843	5087086	Frame grabber locked up.		
11	44	1522	14	424199	5086776	Navigation still not good.		
12	18	1523	270	423858	5087087	Logging off since 11:55. Begin ss1 at 11:55, target is mat material. Video bad. Nav bad. Sampling stopped to flush at 12:11. 12:16 repositioning sub and trying to fix clog in the line. x=423860 y=5087105	SS_mat_R484-1	
12	23	1523	256	423869	5087103	still flushing slurp system into bottle 4.		
12	27	1520	181	423860	5087093	ROPOS moving to attempt to capture a crab.		
12	29	1522	165	423471	5086545	Target crab.	R484-1	
12	29	1524	174	423860	5087091	Target crab.	R484-2	
12	31	1522	156	423630	5086828	Into the box.	R484-4	
12	33	1523	123	423865	5087089	Final solution.	R484-5	
12	34	1524	126	423899	5086698	Crab collected.	Bio_R484-2	
12	35	1524	121	424126	5087648	Crab escaped. Sample lost.		
12	39	1524	84	423868	5087093	Second attempt to collect same crab.		
12	40	1524	74	423871	5087114	Crab escaped for the second time.		
12	42	1524	61	423865	5087100	Crab capture completed. Crab in port bio-box.		
12	43	1523	359	423864	5087088	ROPOS returning to cage.		
12	51	1520	2	423595	5086465	Retrieving a bacterial trap from the elevator.		
12	52	1522	114	423861	5087095	Bacterial trap was #42. Moving to deploy it.		
12	56	1523	304	423857	5087097	#42 deployed.	R484-7	
12	56	1522	308	423858	5087097	Bacterial trap 42 deployed at the end of the crack at Mkr-33.		

13	0	1519	78	423860	5087082	Collecting another bacterial trap #41 from the elevator.	
13	4	1522	171	423858	5087086	Deploy #41 at the same site as #42.	
13	9	1520	155	423860	5087098	Collecting bacterial trap #40 from the elevator.	
13	11	1523	267	423856	5087103	Location of bacterial trap #40.	R484-8
13	12	1521	14	423853	5087097	Bacterial trap #40 deployed near OsmoSampler, middle of the crack.	
13	17	1519	160	423865	5087100	Opening Moyer bio-box inside elevator.	
13	19	1520	23	423859	5087083	Collected bacterial trap #43 from elevator.	
13	21	1523	280	423856	5087097	Position of bacterial trap 43.	R484-9
13	22	1523	243	423856	5087097	Bacterial trap #43 deployed.	
13	23	1523	245	423860	5087103	Attempting to clear the clogged suction sampler.	
13	28	1520	88	423855	5087092	Back at the elevator collecting 4 bacterial traps.	
13	36	1520	310	423861	5087081	Moving bactrp 36 from the elevator to the strb sub bio-box.	
13	38	1520	268	423862	5087091	Transferring bactrp #39 to sub strb bio-box.	
13	40	1520	203	423860	5087095	Transferring bactrp #38 to sub strb bio-box.	
13	40	1519	194	423857	5087099	Begin changing VCR tapes.	
13	42	1519	193	423862	5087094	Finish changing VCR tapes.	
13	43	1520	282	423860	5087093	Transferring bactrp #37 to sub strb bio-box.	
13	45	1517	24	423937	5086713	Moving to Cloud vent.	
13	45	1522	71	423937	5086713	Nav fixes bad.	
13	51	1517	54	423899	5087123	Nav fixes good.	
13	52	1520	125	424740	5086697	Still looking for Cloud vent. Fixes not good. Found area with worms and warm water.	
13	55	1523	137	423901	5087114	Nav fixes good.	
13	56	1523	137	423909	5087120	Worms and warm water just north of Cloud Vent. Fixes bad.	R484-10
13	58	1523	134	423901	5087114	Fixes are good. Cloud 5 meters away.	
14	2	1525	92	423644	5086924	Looking for Mkr-N4, trying to find bactrps.	
14	4	1519	92	424532	5088000	Collapsed area. Fixes are bad.	
14	5	1520	99	423924	5087108	Good Fix.	
14	5	1523	267	423914	5087115	Tube worms. Good fix.	R484-11
14	6	1522	275	423904	5087108	Cloud vent Mkr-N4.	
14	6	1524	282	423901	5087116	Mkr-N4. Cloud vent. Tube worms and scale worms.	R48412
14	8	1523	274	423901	5087115	Deploy bactrp # 37 at Cloud	
14	10	1524	281	424429	5087476	Deploy bactrp #36 at Cloud vent Mkr-N4. x=423896 y=5087119	
14	14	1524	272	423901	5087111	Recover bactrp #14 into strb bio-box	bactrp_R484-3
14	21	1524	260	423625	5086916	Remove bactrp #39 from box and deploy next to Mkr-N4.	
14	25	1524	262	423893	5087118	Attempting to recover an MTR sample.	MTR_R484-4
14	28	1524	244	423899	5087114	Finish MTR recovery. Into strb bio-box.	
14	30	1524	252	423898	5087116	Recovering bactrp (can't read number) into strb bio-box.	bactrp_R484-5
14	36	1524	253	423897	5087102	Deploying bactrp #38 at Mkr-N4.	
14	39	1523	267	424434	5087448	Moving around to survey for worms.	
14	42	1524	262	423970	5086736	Working to clear suction sampler.	
14	45	1524	262	424049	5087913	Mkr- N4 positions of bactraps.	R484-13
14	47	1522	307	423997	5087171	Moving around to look for worms.	

14	48	1522	257	424403	5087529	Nav fixes bad.	
14	49	1522	200	423891	5087118	Nav fix good.	
14	53	1486	237	423965	5087100	ROPOS back to cage.	
14	55	1490	87	424082	5087584	ROPOS going back to bottom.	
14	58	1524	102	423844	5087084	Good fix. First good one in awhile. Heading SW to start of Imagenex line.	
15	1	1518	204	424438	5087440	Stopped, trying to get a fix, bad fixes right now.	
15	2	1518	203	423838	5087002	Good fix, 40 m south of beginning of 1st imagenex transect, moving to start point	
15	55	1479	281	423932	5087100	Still maneuvering for start of line. Problem with bow thruster. Imagenex survey aborted. Weather not good enough to recover elevator. Will pick up time-lapse camera and come to surface.	
16	34	1384	284	423875	5087107	Decided not to reattempt imagenex survey; heading to bottom to get time-lapse camera	
16	44	1523	228	424360	5087689	At elevator, about to recover the time-lapse camera (TLC)	
16	46	1523	153	423854	5087090	Quickly flying back over Mkr-33 to make sure osmosampler intakes are correctly positioned	
16	55	1524	16	423856	5087073	Nav has been bad for around 10 minutes	
16	56	1524	337	423852	5087087	Good fix	
17	4	1524	235	424449	5087467	While checking out the osmosamplers, the bacteria traps #42 and # ? got dislodged, so we are now repositioning them. The ship is drifting to the NE, trying to reposition ship.	
17	9	1514	253	424426	5087486	ROPOS going back to cage. Waiting for ship to reposition.	
17	12	1465	114	424376	5087657	Back at cage. Waiting.	
17	18	1453	206	423926	5087108	Ship repositioned. Going to get Time Lapse Camera.	
17	24	1515	285	424482	5087421	Waiting for a good fix.	
17	24	1517	285	423890	5087082	Good fix.	
17	25	1520	315	424491	5087438	At Mkr-23. Going to get TLC at base of elevator.	
17	26	1523	283	423964	5087122	Disregard previous comment - NOT at Mkr-33, but came down at Mkr-N8.	
17	27	1520	308	424711	5086887	At the elevator. SEE TLC!	
17	30	1525	307	423810	5086523	Picking up the Time Lapse Camera - bad fix.	
17	35	1525	291	423846	5087093	FG of grabbing the Time Lapse Camera.	R484-14
17	39	1525	283	424442	5087475	The Queen says NAV SUCKS!	
17	40	1526	283	424441	5087473	Trying to jettison the 65 lbs from ROPOS in order to pick up camera.	
17	42	1526	282	423849	5087346	Weight released!	
17	48	1526	284	425147	5086738	Picking up TLC. x=423850 y=5087101	R484-15
17	48	1526	283	424443	5087473	TLC being positioned in claws to come up.	
17	51	1526	283	424445	5087476	TLC ready to come up - positioned in claws properly. The jettison weight is still attached to ROPOS on port side.	
17	57	1525	309	424889	5087523	WE just lost sub power.	
17	58	1525	309	424889	5087523	Sub power on then off again.	
18	0	1525	307	424889	5087523	Power and lights back on - video up. Sitting on the bottom with TLC in claws. Discussing what to do.	
18	1	1525	305	424889	5087523	Power off, back up again.	
18	4	1524	291	424889	5087523	Flying backward trying to dislodge jettison weight.	

18	6	1514	241	423892	5087061	Lost lights again. Coming up to try to dislodge weights.	
18	7	1505	230	423887	5087047	Weights gone. Coming up to the surface.	
18	13	1445	241	423914	5087082	Time lapse camera recovery should have the sample number R484-6.	TLC_dfl_R484-6
20	15	108	155	424102	5086984	Puled ROPOS into the cage with the tether winch in first attempt. Great driving by Keith Shepherd. Bringing cage up fast.	
20	27	1	172	424230	5087291	ROPOS on deck at 1323h.	
20	47	1	160	424230	5087291	Time lapse camera appears to be OK. Crab is dead. Stainless steel bolt in a bacstrap was almost eaten through. END OF DIVE R484	
						Summary of Dive R484: For about the first half hour of the dive the log entry program was shut down. During the collection of the first suction sample it was rebooted.	
						Mkr-33: SS of mat; one nearly whole crab captured, TLC recovered, deployed bacraps. Cloud: Two bacraps and one MTR recovered, deployed bacraps, short worm survey.	
						Suction sampler clogged on first sample. Color balance on frame grabs was poor. The sub lost hydraulic fluid which forced the end of the dive.	

UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
						Dive R485	
						Dive Objectives: Primary objective of the dive is to obtain vent fluids/filtered samples along eruptive line. Dive will begin at Mkr-33 and end at the Milky Vent area. Suction samples will also be done at some of the sites.	
						Elevator will be recovered (weather permitting) sometime during the dive.	
						ROPOS Configuration: Vent Fluid Sampler, Suction Sampler, Gas Tights, Imagenex, and cameras.	
						Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
						ROPOS in the water	
7	6	88	22	424231	5087291	This is the real launch time, the previous entry was wrong.	
8	10	1315	140	423873	5087133	A line got caught in the cage, preventing ROPOS from leaving the cage, and we're going to start back up.	
8	13	1239	156	423853	5087110	Correction. A line connecting the vehicle to the cage on deck was not removed, preventing ROPOS from leaving its cage. We're still coming up. Slight delay.	
9	13	1	156	423814	5088795	ROPOS came back up in order to remove the rope attaching it to the cage.	
9	36	0	123	423814	5088795	ROPOS in water again.	
10	53	1520	234	423682	5087227	ROPOS is on the bottom. Two fish. Near Mkr-33.	
10	55	1521	110	424415	5087823	Fixes no good.	
10	57	1518	8	423858	5087078	Looking for Mkr-33. ROPOS is about 24 m away from Mkr-33 according to nav.	
10	59	1523	331	423765	5087178	Fixes still no good.	
11	0	1521	17	424488	5086783	Arrive at Mkr-33. Good fix.	
11	2	1522	344	423856	5087103	Good fix. Frame grab color is good.	
11	8	1522	248	423856	5087105	Positioning HFS (Hot Fluid Sampler) probe for sampling.	R485-1
11	9	1522	248	424412	5087823	Temp up to 63C during probe positioning for HFS.	
11	12	1522	228	423850	5087572	Repositioning sub. Trying to find probe position with highest Temp reading.	
11	14	1523	211	423853	5087104	Temp at about 58C	
11	15	1523	211	423861	5087105	Position of probe during sampling.	R485-2
11	16	1523	210	423859	5087083	Starting sample HFS2	HFS2_dfl _R485-1
11	17	1523	213	423842	5087728	temp 5 intake 40 on manifold. Good temps.	
11	19	1523	212	424399	5086596	Range on T2 is 37 to 49.	
11	20	1523	210	423888	5087631	Stop HFS2. Volume sampled was 56ml.	
11	22	1523	213	423857	5087108	HFS23 Piston sample for gas tight started. T1 53	HFS23_dfl _R485-2
11	23	1523	210	423890	5087613	Done T2 42-50. vol 13 ml.	

11	25	1523	213	424443	5087470	HFS12 DNA sample. T1 = 49 T2 is 37.	HFS12_dfl _R485-3
11	34	1523	211	424410	5087494	Sample finished. max T 54.6 vol = 123ml	
11	35	1523	213	423852	5087105	HFS14 started. Bag sample.	HFS14_dfl _R485-4
11	41	1523	212	423574	5087340	Sample done vol = 10ml.	
11	43	1523	213	423860	5087082	HFS17 bag sample, no filter. Max T on last bag sample was 48.8C.	HFS17_dfl _R485-5
11	45	1523	214	424490	5088046	Video has gone bad due to bright input to overlay.	
11	45	1523	214	424287	5086270	Video OK.	
11	46	1523	212	423858	5087093	Video bad.	
11	46	1523	211	423844	5087062	Sample done. Vol = 650ml. Max T 52.5C	
11	48	1522	218	423856	5087104	Lost position. Alarm for oil reservoir empty suddenly. Shut down.	
11	50	1522	230	424104	5087602	ROPOS returning to surface due to loss of oil. Ship moving forward in order to stream ROPOS behind cage.	
11	55	1492	252	425326	5086999	VCR tapes turned off.	
13	56	186	3	422757	5088424	Begin returning ROPOS to cage.	
14	55	107	216	422710	5089068	Still having great difficulty getting the sub back into the cage.	
16	25	89	112	422710	5089068	The cage is being brought to the surface. An attempt will be made to get the sub into the cage just below surface. The earlier attempts to get the sub in the cage at around 20m did not work.	
16	49	128	123	422710	5089068	ROPOS was driven back into the cage at 128 meters, not at the surface.	
16	59	0	115	422710	5089068	ROPOS is back on deck.	
						Dive Summary for R485: ROPOS was in the water at 0706, 25 June 9. When the cage reached 1315m it was determined that ROPOS was still tied to the cage by a rope. ROPOS returned to the surface and the rope was removed. Dive was restarted at 0936.	
						ROPOS reached the bottom at 1053 and Mkr-33 was located at 1100. The sampling probe for the fluid sampler was positioned in the crack, based on the highest temperature measurement. This also appeared to be the area of highest flow.	
						Five HFS samples were collected. At 1148 the sub was shut down due to a loss of hydraulic oil. ROPOS returned to the surface, after some difficulty getting the sub back into the cage.	

							Dive R486	
							Dive objectives: Continue the dive plan from dive R485. More fluid sampling, slurp sampling, reposition bacterial traps, recover animals. Imagenex survey at end of dive.	
							ROPOS configuration: Vent fluid sampler, Slurp sampler, gas tights, Imagenex, cameras.	
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples	
3	6	6	50	424231	5087291	ROPOS in the water		
3	19	172	317	423702	5087374	Overlay on video turned on. Press "Super" for superimpose.		
3	21	212	319	423985	5087583	going down		
3	30	378	40	424411	5087396	narf, what am I doing here?	R486-1	
4	38	1448	332	423897	5087219	Drove ROPOS back in cage. Pulling up. Going through pretty thick plume. Water is cloudy. Lost oil pressure before made it to the bottom.		
4	41	1379	327	424376	5086680	Bringing ROPOS back up. Abort dive.		
5	36	1	162	421199	5087374	ROPOS on deck		
5	37	2	156	421199	5087374	Dive Summary: ROPOS descended within 10 meters of the bottom when it was forced to return to the surface due to a problem with the hydraulics.		

UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
						Dive R487	
						Dive Plan: Same as for R485 and R486. Primary objective is to obtain vent fluids/filtered samples along eruptive line. Will begin at Mkr-33 and end at Milky Vent area. Suction sampling will also be done at some of these sites.	
						Elevator will be recovered (weather permitting) sometime during the dive.	
						Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
15	32	1	133	421199	5087374	ROPOS in the water.	
15	43	85	256	421199	5087374	test	Dive 487-1
17	6	1519	87	424091	5087593	On the bottom. At Mkr-33. Viewing osmosampler.	Photos 2 - 5
17	7	1521	39	424091	5087593	Osmo Sampler at Mkr-33	Dive 487-2
17	8	1521	126	424091	5087593	Taking pictures of Mkr-33. Right at the marker - viewing bacteria trap 40 and green/copper osmosampler. Took Photos 7 - 10	
17	10	1524	231	423856	5087075	Checking out ROPOS gauges - making sure all is ok. Hydraulic fluid down, talk of going back to the cage.	
17	12	1503	227	424345	5087694	Slowly going back to cage.	
17	16	1492	176	423852	5087102	Taking a plume sample with the HFS - filter #12.	
17	18	1482	206	423852	5087102	ROPOS in the cage. Staying here to take some samples of the plume. Plume filter sample for DNA with HFS - starting filter #12.	HFS12_plume _R487-1
17	23	1475	178	424653	5086900	Going to stay here for around 15 minutes to take a few samples. Still pumping HFS filter #12.	
17	30	1475	226	424860	5087225	Something in water column - a jellyfish I think.	Photo-13
17	32	1474	116	423852	5087100	Stopped pumping filter #12 - 1502 ml pumped. Starting to pump filter #15 on HFS.	HFS15_plume _R487-2
17	44	1475	256	423869	5087113	Stopped pumping HFS filter #15 - pumped 1050 ml.	
17	45	1475	301	423890	5087611	Starting HFS bag sample #17.	
17	51	1476	300	425149	5086724	Stopped pumping #17 - 650 ml pumped. Start pumping HFS #19 - bag with filter.	HFS19_plume _R487-4
17	58	1475	207	424342	5087672	Stopped pumping #19 - 675 ml. Note that the flush pump was not on for the first half of the sample. Start to sample HFS bag #16 with no filter.	HFS16_plume _R487-5
18	2	1475	226	423937	5087439	Good nav. x=3846, y=7105 - location of plume fluid sampling.	
18	5	1474	212	424117	5087620	Finished pumping #16 - 598 ml pumped. Start pumping HFS filter #3, for sulfur.	HFS3_plume _R487-6
18	9	1477	290	423859	5087130	Fluid volume was not recording for a few minutes - now working again.	
18	19	1475	227	424340	5087684	Stopped pumping filter #3 - 130 ml pumped. Going to move the ship to a position over Cloud Vent to sample particulates in plume.	
18	27	1476	217	425095	5087131	The Queen says BAD FIXES!	
18	28	1476	248	423872	5087114	Moving towards Cloud - still no good fixes.	
18	34	1476	205	423874	5087096	We are about half way to Cloud.	

18	39	1476	275	423882	5087105	Ship finished moving - waiting for the position to settle.	
18	40	1474	257	423900	5087099	Good fix at x=3898, y=7110. Between Mkr-N4 and Mkr-N6.	
18	42	1474	202	424440	5086790	x=3900, y=7110 - good fix on ROPOS in cage. We are stopping here to take fluid and gas tight samples. We are flushing the gas line now.	
18	44	1476	205	423907	5087096	Right over Mkr-N6.	
18	46	1474	352	423900	5087100	The gas line in flushed. Preparing to trigger port gas tight - triggered port GTB at 18:47.	gtb_plume _R487-7
18	48	1475	205	423897	5087098	Going to trigger the gas piston on the HFS, pump position #23. Starting to pump. Good fix x=3901, y=7111.	HFS23_plume _R487-8
18	53	1476	280	423894	5087116	Triggering piston #20.	HFS20_plume _R487-9
19	0	1474	198	423902	5087123	Sample R487-9 finished. 730 ml.	
19	3	1476	222	423936	5087610	X = 3908, Y = 7109	
19	5	1474	278	423898	5087100	Filter #21 for sulfur analysis started at 19:01.	HFS21_plume _R487-10
19	10	1476	127	424385	5087640	X = 3902, Y = 713. Sample #21 finished. Piston sample #2 started.	HFS22_plume _R487-11
19	17	1476	202	424442	5086790	Sample piston #2 finished. Start bag sample #18 with filter. Still at Cloud Vent.	HFS_plume _R487-12
19	24	1475	267	423902	5087115	Sampler #18 finished. 60 ml.	
19	25	1476	331	424385	5086607	Sampler #7 with filter started.	HFS7_plume _R487-13
19	29	1474	136	423907	5087096	#7 finished. 41 ml.	
19	29	1475	140	424444	5086797	Sampler #2 with filter started.	HFS2_plume _R487-14
19	33	1476	323	423898	5087098	Sampler #2 finished. Ready to come to surface. Will take samples on the way up.	
19	35	1474	285	423904	5087099	Starting integrated bag sampler #1 during rise through the plume because it is "fun" (Butterfield)	HFS11_plume _R487-15
19	44	1254	274	423910	5087482	Stopped sampler at 19:41. Continuing to surface.	
20	32					ROPOS on deck.	
						Dive summary: Hydraulic failure shortly after ROPOS reached bottom. ROPOS put back into its cage from where it sampled the plumes at about 1475 m depth above Mkr-33 Vent and Cloud Vent. Returned to surface for repairs.	

							Dive R488	
							Dive Objectives: Same objectives as dives R485 - R487. To Mkr-33 for HFS and suction sampling, then on to Cloud and vents to the north on the '98 lava flow. Biology samples will also be collected.	
							At the end of the dive and Imagenex data will be collected at the western edge of the '98 lava flow.	
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples	
4	27	1	138	423861	5087236	ROPOS in the water		
5	38	1094	22	423822	5087115	Grape Jellyfish		
5	59	1485	89	423822	5087132	On the way down, near bottom, in the hydrothermal plume. Water is cloudy.		
6	1	1509	90	423812	5087119	On bottom. Glassy looking lobate flows.		
6	3	1517	173	423826	5087129	Lava whorl		
6	3	1522	262	423830	5087130	Lava whorl in sheets	R488-3	
6	4	1521	134	424662	5087328	Sheet flow with bacterial mat between cracks. Ropy sheets some lineations. Some fractures and steps in more or less continuous flow surface. Yellowish sed. thinly coats surface of flow but white mats concentrated on some cracks.		
6	7	1520	133	423886	5087090	Looks like a possible contact with more pillowed forms in distance.		
6	9	1523	276	423876	5087090	Heading west along flat sheets. Elevator in distance. Photo taken. First 4 photos were not logged here.	Photo	
6	11	1521	248	423867	5087067	wandering around elevator.(3 photos of elevator)		
6	15	1525	190	423841	5087113	All bad fixes since we got to the bottom. More photos here and frame grab. (photo of osmoanalyzer)	R488-3	
6	17	1519	135	423829	5087115			
6	18	1521	212	423831	5087122	Mkr-33 FG	R488-5	
6	18	1520	213	423831	5087122	Mkr-33 crack in pushup in lava.	R488-6	
6	18	1523	210	423839	5087114	Crack at Mkr-33	R488-7	
6	18	1524	213	423839	5087114	Getting close to vent in crack. Photo of vent, close up photo of venting in fissure.		
6	19	1525	217	423573	5087074	Fluid sample site at Mkr-33	R488-8	
6	19	1524	215	423839	5087108	Close up of vent.	R488-9	
6	22	1525	216	423852	5087097	Putting the fluid sampler in the vent. Temp up to 24 C. 32, 34, 35.40 max. White coating on sides of flow, scale worms and tube worms on edges and under flow. Temps going up. 68, 70. Sampling bag 14	HFS-14_dfl _R488-1	
6	27	1525	215	423837	5087112	When sample 1 HFS was taken. 70 C water T.	R488-10	
6	28	1525	215	423756	5087359	Diffuse flow hot water sampling, temps in upper 60's.		
6	34	1525	218	423838	5087110	Sample stopped at 6:34. Max temp 70.4		

6	35	1524	217	423838	5087111	Another sample from same site. Filter 6.	HFS-6_dfl _R488-2
6	38	1525	216	423832	5087121	Temp as high as 73.2 C at this site during sampling. frame grab taken here. Sampling filter 6	
6	39	1525	218	423717	5087586	Sampling At Mkr-33 with the old HFS	R488-11
6	42	1525	217	424658	5087313	Bad tearing on the video.	
6	45	1525	214	423838	5087108	lost video signal	
6	48	1525	216	424662	5087314	Stopping sampling, max 73.2 degrees.	
6	49	1525	218	423832	5087109	Going to sample filter 15 of fluid sampler starting at 6:50 max temp 73.9 C.	HFS-15_dfl _R488-3
6	51	1525	218	423291	5087263	Worms galore at Mkr-33	R488-12
6	52	1525	214	423838	5087112	Sampling temp rising up to 78.	
6	56	1525	218	425062	5086927	More worms at Mkr-33	R488-13
7	3	1524	215	423849	5087100	Stopping sampling. 1.5 liters. Taking stb. gas tight. Same diffuse vent site. 68.8 C.	gtb-7_dfl_R488-4
7	5	1525	216	423837	5087112	Yet more worms at Mkr-33	R488-14
7	5	1525	216	423836	5087112	Ended gas tight.	
7	10	1525	214	423829	5087128		R488-15
7	10	1525	215	423836	5087113	Photo of palm worms at Mkr-33. Now we're looking at the honey bear in the slurp sampler - I'm sorry I gave you bad MOJO.	Photo-13
7	13	1525	220	423840	5087111	Slurping up palm worms from the crack at Mkr-33. Started sample at 07:15.	SS-j1_bio _R488-5
7	19	1524	211	423837	5087113	Frame Grab of suction sampler sucking up palm worms at Mkr-33.	R488-16
7	19	1524	213	423837	5087113	Suction of worms at Mkr-33	R488-17
7	22	1525	214	423890	5087319	Looking at bottle J4 at the palm worms-suctioning more.	
7	27	1525	218	423838	5087114	Still trying to get more worms and bacterial mat in bottle J1.	
7	30	1524	216	423838	5087110	Honey Bear in J1 at Mkr-33	R488-18
7	32	1525	222	423838	5087111	Still sucking palm worms into bottle J1.	
7	41	1525	218	423838	5087112	Spewing rocks out of the suction sampler hose.	
7	42	1524	217	423838	5087113	Done with Jar J1. Flushing the line.	
7	43	1524	214	423830	5087140	Oops, honey bear is in jar #4	R488-19
7	44	1525	218	423823	5087105	Checking the suction sampler for a possible problem-trying to flush.	
7	48	1525	218	423827	5087120	We are successfully flushing - the bear is dancing.	
7	52	1525	215	423837	5087115	We're in bottle #3 to suction bacterial mat in the crack of Mkr-33.	SS-3_mat_R488- 6
7	55	1525	231	423826	5087135	Suction sample of bacterial mat at Mkr-33	R488-20
7	56	1525	229	423826	5087135	Suctioning up bacterial mat and a few worms at Mkr-33	R488-21
8	2	1524	244	423839	5087106	Because we're not getting our fourth transponder, we're getting good fixes but they're offset from the real position by 20 m to the northwest.	
8	2	1524	243	423840	5087113	Jar #3 with bacterial mat from Mkr-33	R488-22
8	3	1524	245	423834	5087113	Still sucking on bottle 3.	

8	6	1524	216	423837	5087107	Moving elsewhere along the crack to get more bacterial mat in Jar 3. Moved 1 m to the side.	
8	11	1524	226	423820	5087110	Suction bottle 3 full of bacterial mat and worms.	R488-23
8	11	1524	225	423820	5087110	Now we're getting ready to go to Snail Vent to collect snails! 30 m at 110 will take us there.	
8	13	1524	226	423829	5087137	Saw a scale worm (Lepidonotopodium) covered in bacterial mat- it has no gills.	
8	15	1523	89	423838	5087122	Ropy sheet flows.	
8	17	1523	91	423718	5087582	Sheet flows sort of like broken up shelf steps, covered in orangey iron rich sediment/bacterial goop. Looks primarily inorganic.	
8	19	1523	354	423846	5087122	We can see some more venting in a crack here - looking for Snail still, but we are investigating this crack with diffuse flow coming out. There are lots of gastropods and tube worms.	
8	21	1524	328	423852	5087127	Problems with video.	
8	21	1525	328	423851	5087128	Photo of snail vent. The sulfide worm is here- sorry, they're not tube worms.	Photo-14
8	22	1524	319	423558	5087585	Snail vent w/ worms.	R488-24
8	22	1524	319	423558	5087585	Worms at Snail vent	R488-25
8	23	1524	313	423855	5087126	Same worms at Snail vent	R488-26
8	23	1525	312	423856	5087122	We see Paralvinella sulfincola or pandorae? We're not sure.	Photo-16
8	24	1525	307	423845	5087143	Photos of worms. We're pretty sure this isn't Snail, it's just further down the crack from Mkr-33.	Photo-17
8	26	1525	304	423857	5087124	We're going to take a few minutes to look for the real Snail Vent now since we don't have the right mesh for this.	
8	27	1526	350	423855	5087124	Dead tube worms covered with bacteria near Snail vent.	R488-27
8	27	1524	64	423852	5087133	Lumpy lavas - looks pretty lobate. We're seeing some dead tube worms overgrown with bacterial white gooey mat. There is orange stuff floating around. Looking at some of these cool lava arches. Very cool. Photos 18 - 20	
8	28	1524	79	423857	5087127	Still searching for Snail. We think we've found it.	
8	28	1524	79	423857	5087127	Still searching for Snail. We think we've found it.	
8	30	1520	109	423856	5087147	Drained lava lake, lava pillars, lots of neat lava structures.	
8	31	1523	110	423858	5087142	We are at Snail! Right near Mkr-N8. There are tons of snails and scale worms too.	Photo-21 Photo-22
8	32	1525	73	423872	5087105	We can see some pretty intense webby mat, bag creatures, snails, scale worms.	
8	33	1524	64	423872	5087112	We will be suction sampling fauna into Jar J4.	SS-j4_bio_R488-7
8	36	1525	43	423776	5087656	Preparing to sample from Snail Vent.	
8	37	1525	14	423851	5087145	Suctioning snails from Snail Vent.	R488-28
8	39	1525	357	423851	5087153	Commencing suctioning at Snail Vent.	
8	40	1525	3	423848	5087148	Suctioning Snails at Snail Vent	R488-29
8	43	1525	63	424463	5086862	Sample R488-7 is looking good.	
8	45	1525	68	423884	5087067	The lava is quite flimsy - lots of bacterial action. Note: Julie is using sound effects.	
8	48	1525	74	423776	5087352	Still suctioning and spewing at Snail Vent.	

8	50	1525	77	424160	5088133	Filter on J4 looks clogged. Trying for a few more snails.	
8	52	1525	76	423853	5087141	Suctioning snails at Snail Vent	R488-30
8	58	1525	76	423852	5087150	Finished sampling Jar J4.	
9	2	1525	78	423842	5087049	Taking a temperature measurement at Snail Vent with the Fluid Sampler temperature probe.	
9	3	1525	79	423845	5087056	Max temp is 13.0 C	
9	7	1525	77	424571	5087286	We are now making our way to Cloud Vent for Fluid Sampling and Suction Sampling.	
9	9	1524	13	423842	5087048	Just finished suction sampling at Snail, and are heading to Cloud vent.	
9	11	1522	59	423491	5087529	At Cloud vent. Photos of the approach.	Photo-23 Photo-24
9	12	1524	331	424902	5086973	Fixes are still NOT good. We're on the west side of Cloud.	
9	14	1526	336	423868	5087049	At Cloud. There are tube worms (small clumps and sparse individuals) and very dense aggregations of polynoids. Will probe for temperature at this location to decide whether to sample here or at the marker location (mkr N4)	
9	17	1526	330	423844	5087048	Worms at Cloud vent	R488-31
9	18	1525	341	424119	5086879	Lots more tube worms sparsely distributed in the cracks. Don't see any good grabbable clumps yet though.	
9	21	1522	256	423870	5087053	We found Mkr-N4 - there are traps, worms, mat, polynoids and scale worms.	
9	22	1525	246	423904	5087109	Mkr-N4	R488-34
9	22	1525	252	423870	5087053	Bacteria traps at Cloud vent, Mkr-N4	R488-32
9	23	1525	245	423841	5087043	We're at the western edge of this vent.	
9	24	1525	246	423710	5087512	Take it back- we're looking west. Temp around 8 and 9 C.	
9	25	1525	245	423742	5087112	The temperature near the bacterial traps is 18 C. The traps already have grazers on them and they were put down a mere 3 days ago! We just saw the new species of worm!	
9	28	1524	258	423839	5087056	Photo of mkr N4.	Photo
9	31	1524	355	423841	5087053	Probing for temperature right in between bacteria traps at Mkr-N4. Polynoids in view, and the 'unknown polynoid'. Temps up to 18 degrees C.	
9	36	1523	259	423839	5087058	Cloud vent (N4) with traps and worms	R488-35
9	35	1523	271	423839	5087058	Mkr-N4. Swimming polynoid. Took several photos	
9	38	1524	243	423844	5087042	Still probing for temperature trying to find a good place to fluid sample. Up to 18.4 degrees C.	
9	43	1524	243	423486	5087525	Taking a fluid sample - bag #17 with no filter. Starting to sample at 09:4. Took Photo-29	HFS-17_dfl _R488-8
9	50	1524	243	424560	5087266	stopped filter sample	
9	58	1524	242	423844	5087051	Scream mask at N4?	R488-39
9	59	1524	243	423844	5087051	View of new scale worms. Lots o' flow and heat - 19.1 degrees C.	
10	1	1524	243	423824	5087095	New species of worm at Mkr-N4 (Cloud vent)	R488-41
10	1	1524	242	423824	5087095	GREAT close up of new scale worm!	
10	2	1524	241	423907	5087074	Distant view of new species of worm at Mkr-N4	R488-42

10	5	1523	249	423907	5087073	Going to look for the 'hotter hole' in the vicinity of Mkr-N4. Photos 30 - 33	
10	8	1524	242	423774	5087292	Lots of sparse tube worms. Jumbled lava. Photos 32 and 33.	
10	11	1525	354	424006	5086794	Cloud abyss	R488-43
10	10	1522	70	423795	5087166	At a different hot spot in Cloud area now, can't say exactly where. A big hole with lots of venting. Sparse tube worms. Stopping to take a temperature reading.	Photo-34
10	15	1525	326	423846	5087052	The pit at Mkr-N6	R488-44
10	14	1525	327	423841	5087051	Temperature up to 20 degrees C. We are at Mkr-N6. Some kind of lava drainage pit.	Photo-35
10	21	1526	332	423827	5087036	Started piston sample #2 at 10:10. Temperature up to 20.3 degrees C.	HFS-2_dfl l_R488-9
10	23	1526	329	424480	5087601	Navigation has moved position of Mkr-N4 from where it was last year to x=423905.9, y=5087109.6 - based on big Keith's piloting.	
10	25	1526	334	423536	5086617	Stopping pumping into piston #2- 615 ml pumped . Starting gas piston #24 in same spot.	HFS-24_dfl _R488-10
10	27	1526	330	423712	5087520	Stopped pumping #24 - 130 ml pumped. Starting to pump bottle #3 with a filter on HFS at 10:28.	HFS-3_dfl _R488-11
10	30	1526	332	423868	5087511	Tube worm at N6	R4845
10	34	1526	332	423714	5087518	Sample #3 stopped - 672 ml pumped.	
10	35	1526	330	423871	5087062	Flushing the line for a GTB sample - planning to fire the port GTB.	
10	38	1525	331	424718	5087025	Firing port side gas tight bottle. Temperature 20.3 degrees C.	gtb_dfl_R488-12
10	42	1525	335	424691	5087066	Start pumping filter #7 on HFS - for sulfur. Still in same spot at Mkr-N6.	HFS-7_dfl _R488-13
10	48	1525	331	423956	5087073	Highlight on	
10	48	1525	328	423956	5087073	Scale worms	R488-47
10	48	1525	334	423956	5087073	Worms at N6 (Cloud)	R488-46
10	49	1525	333	423717	5087515	Scale worms: high density at N6: eranchintogluma (genus)	R488-48
10	50	1525	329	423806	5087148	Stopping sample, 80ml volume.	
10	51	1525	329	423845	5087046	Still photo of scale worms in high density and tube worms.	Photo
10	51	1525	330	424689	5087060	scale worms at N6	R488-49
10	53	1525	331	423859	5087062	Completed fluid sampling, now going to maker N4 to do suction sampling.	
10	55	1525	335	423843	5087047	No good nav. It's getting worse.	
11	1	1521	92	423862	5086990	Heading back to N4 to do suction sampling.	
11	7	1522	44	423453	5086878	Nav still bad.	
11	7	1522	163	423453	5086878	Still photo	Photo
11	10	1519	354	423453	5086878	Still photo	Photo
11	11	1521	306	424409	5087694	Positioning at N4 to begin particle sampling.	
11	13	1522	243	423910	5087074	Flushing the suction sampler bottle with honey bear.	
11	18	1523	243	423845	5087051	Temp 18.2 from earlier reading. Positioning suction sampling probe.	
11	19	1523	245	424586	5087587	Starting suction sample J3	
11	21	1523	246	423470	5086849	Repositioning probe.	
11	22	1523	244	423470	5086849	Position of suction probe.	R488-50

11	23	1523	245	423470	5086849	suction sample	SS-j3_dfl _R488-14
11	29	1523	243	423887	5087133	Stopping J3 but will come back to it later on.	
11	35	1523	263	425230	5086788	Begin suction sampling in 1 for mat material for Moyer. Sucked some rocks.	SS-1_mat _R488-15
11	42	1523	288	424695	5087420	Still sampling for mat but adding in a new worm or two as well. Sampler is reversed periodically to back flush rocks.	
11	48	1523	285	424958	5087258	Still sampling for mat material.	
11	52	1523	287	423885	5087127	Finished sampling on bottle 1. Mats and worms.	
11	53	1523	285	423888	5087134	Returning to jar J3 to continue sampling for snails, mat, etc.	
11	56	1523	247	423886	5087137	Repositioning to sample for J3 to sample for animals.	
11	58	1523	246	423874	5087582	Probe arm dislodged a large rock and caused a debris storm.	
11	59	1523	246	424953	5087259	Begin sampling scale worms into J3	
12	4	1523	239	423894	5086984	Mkr-N4	R488-51
12	4	1523	239	423894	5086984	Trying to collect snails.	
12	10	1523	235	423870	5087118	Still collecting animals in J3.	
12	13	1523	234	423889	5087127	ROPOS is repositioning, will continue with J3.	
12	16	1523	270	423890	5087126	Resume sampling J3.	
12	19	1523	260	423889	5087126	Finished with J3. Going to the bear bottle (J4) for tube worm. Bottle 2 will be particulate.	
12	21	1523	260	423888	5087126	Correction the bear is in bottle 4 not J4.	
12	21	1523	261	423889	5087123	VCR tapes were changed at 1204	
12	22	1523	260	423889	5087123	Honey Bear	R488-52
12	22	1523	260	423891	5087127	Still photo.	Photo
12	23	1523	268	424953	5087255	ROPOS is repositioning.	
12	24	1523	261	423890	5087126	Begin worm sampling in flushing bottle.	SS-4_bio _R488-16
12	25	1523	278	423890	5087126	ROPOS is repositioning.	
12	28	1522	281	423890	5087125	Continuing to sample worms.	
12	30	1522	300	424334	5086908	ROPOS made a short reposition move. Sampling more worms.	
12	35	1522	246	423891	5087125	ROPOS repositioned for last attempt at worms.	
12	37	1522	266	423890	5087126	Sample completed. Will go back to N6 to do a particulate sample.	
12	40	1522	218	423890	5087127	ROPOS is repositioning to N6. Highlights on.	
12	44	1524	339	423888	5087136	Still photo back at N6	Photo
12	45	1524	349	423887	5087142	Highlights off.	
12	47	1524	354	423904	5087113	Start sample J2 at Mkr-N6 for particulates.	SS-j2_dfl _488-17
12	56	1524	1	423892	5087121	We have a problem. The fluid sampler probe has been broken off. Suction sampler is stopped. Probe is broken off at support plate.	
12	58	1524	4	423894	5087128	Broken probe for fluid sampler.	R488-53
13	0	1524	1	423889	5087128	Testing the 7 function arm to see if it has been damaged. So far it looks ok. It may be possible to still sample with the probe. Probe itself still looks functional.	
13	4	1524	1	423892	5087122	Highlights on.	

13	6	1524	4	423894	5087128	Tube worms and large Pandoraae at N6.	R488-54
13	6	1524	6	423893	5087129	Finished sampling at N6 and will move back to the cage before moving north.	
13	7	1522	24	423894	5087128	Still photo of worms at N6.	Photo
13	9	1517	218	423889	5087128	Heading back to the cage.	
13	10	1488	256	423889	5087128	Navigation is still not good.	
13	11	1492	294	423884	5087043	Back at the cage.	
13	13	1521	4	423853	5087096	ROPOS is on the bottom, heading north about 30m to Nascent vent. Highlights on.	
13	15	1521	4	423839	5087117	Still photo of bottom near Mkr-33.	Photo
13	16	1521	360	423839	5087117	Photo of bottom near Mkr-33	photo
13	16	1522	3	423839	5087117	Orange stain on bottom.	Photo
13	17	1521	4	423839	5087117	same as above	photo
13	17	1520	4	424838	5086690	photo of dead tube worm group	photo
13	18	1519	3	424838	5086690	No fixes	
13	18	1517	6	425154	5087185	bottom	Photo
13	19	1518	3	423834	5087138	Lava pillars.	photo
13	21	1516	2	423846	5087134	Stopping highlights.	
13	23	1519	4	424973	5087277	Photo of collapsed area with pillars.	photo
13	24	1518	6	423653	5087813	Pillar	Photo
13	24	1518	4	423841	5087120	bacterial mat on pillar	photo
13	25	1518	7	423843	5087160	Edge of collapse area.	photo
13	25	1517	7	423843	5087160	collapse pit	photo
13	26	1518	2	423843	5087160	Highlights on and photo	photo
13	27	1518	6	423836	5087175	collapse area	Photo
13	29	1518	1	423840	5087203	photo of rattail.	photo
13	31	1517	12	423840	5087214	Photo of lobates	Photo
13	31	1517	32	423848	5087239	Rat tail	R488-55
13	33	1518	33	423850	5087261	Photo of edge of collapse area. Maybe with crab.	photo
13	34	1516	32	423851	5087259	Just changed the dive # on sit overlay from 487 to 488.	
13	36	1517	29	423872	5087293	Signs of venting.	
13	36	1516	34	423872	5087293	photo of area near Nascent vent.	photo
13	37	1518	38	424187	5086782	Bottom showing signs of wear, hydrothermal activity.	photo
13	38	1516	38	423901	5087309	Bottom. Getting some fixes.	photo
13	39	1518	31	423877	5087352	Bacterial stain near edge of collapse area.	photo
13	41	1517	3	423910	5087354	Bottom showing staining.	photo
13	42	1518	359	423910	5087354	photo of live worms (but stressed?)	photo
13	42	1518	6	423905	5087359	Bottom showing circular marks.	photo
13	44	1518	357	423903	5087378	MTR line, shimmering water at Nascent	photo
13	44	1518	340	423903	5087378	photo	photo
13	45	1517	31	423904	5087388	Nascent	photo
13	45	1517	31	423904	5087388	Nascent Vent	R488-56
13	46	1518	68	423902	5087380		photo

13	46	1518	99	423902	5087380		photo
13	46	1518	107	423905	5087384	I think we just took 4 photos of Nascent.	photo
13	46	1518	110	423904	5087387	position of MTR	photo
13	46	1518	114	423904	5087387	Nascent Vent	R488-57
13	47	1518	113	423905	5087389		photo
13	47	1518	113	423905	5087389	Positioning probe of fluid sampler (detached from arm.)	
13	48	1518	113	423894	5087376	Checking water temp = 4C	
13	49	1518	115	423910	5087372	Highlights off. Temp up to 10C	
13	50	1518	114	424110	5086989	Up to 12C on temp.	
13	52	1518	113	423894	5087376	HFS1 bag with a filter on it ready to start.	
13	53	1518	115	423894	5087376	start HFS11 488-18 at Nascent vent next to MTR	HFS-11_dfl _488-18
13	55	1519	112	423894	5087492	Highlights of. Temp is 10-1C during sampling.	
13	57	1518	115	423875	5087532	Highlights.	
13	57	1518	113	423875	5087532	Nascent Vent near MTR	R488-58
						Tube worms at Nascent. Scale worms.	R488-59
14	0	1519	115	423907	5087395	Sample HFS1 is complete.	
14	0	1519	110	423908	5087396	Max T during sampling was 15.5C.	
14	4	1519	112	423906	5087381	Position of MTR with critters at Nascent.	R488-60
14	6	1516	355	424900	5087534	Photo of bottom before moving	photo
14	6	1519	349	425126	5087098	same	photo
14	7	1518	356	423904	5087392	photo of bottom	photo
14	7	1517	356	423904	5087392	photo	photo
14	8	1518	357	423990	5086180		photo
14	5	1519	114	423905	5087383		R488-61
14	8	1519	5	423990	5086180	bags on rope fish	photo
14	8	1518	4	423990	5086180	Nascent Vent	R488-62
14	9	1519	7	423905	5087407	VCR tapes changed.	
14	9	1519	9	423905	5087409	Rat tail at Nascent vent	R488-63
14	9	1519	10	423904	5087412	feeding rat tail w/ worms MTR at Mkr-N41	photo
14	10	1519	13	423908	5087409	Highlights off and photo	photo
14	13	1517	3	423905	5087413	Getting ready to move to pit. Fe staining	photo
14	13	1518	2	424683	5087400	Photo of Fe staining	photo
14	14	1519	20	423893	5087418	Highlights on.	
14	16	1517	7	423895	5087423	Heading to pit vent.	
14	16	1516	358	423895	5087423	Highlights off.	
14	21	1518	344	423894	5087427	photo of 1998 lava flow during traverse between Nascent and The Pit. Lobate uncollapsed part of flow. Few vents now, but lots of tan iron staining.	2 photos
14	24	1517	346	423628	5087169	lobate flow. small pockets of white mats between lobes. sparse crabs	3 photos
14	26	1519	345	423880	5087477	lobate roof. some pillows. few vent pockets	photo
14	27	1519	345	423872	5087481	lobate lavas - mostly black now (little staining or venting). some collapsed lobes	photo

14	29	1518	340	424951	5087500	lobate lava. sea star. ophuriids.	2 photo
14	30	1518	342	424394	5087609	seemed like we went over a contact into newer-looking glassy lava. maybe a kipuka of older lava?	photo
14	31	1518	341	423849	5087537	remnants of brown mat on lava	
14	33	1519	337	423851	5087538	2 calanoid copapods on clump of flock	R488-64
14	34	1518	345	423852	5087552	black shiny lobate lava. minor brown staining.	
14	35	1518	348	423845	5087569	photo	photo
14	36	1518	347	423823	5087607	Good fix	
14	37	1518	344	423823	5087607	photo of collapse area	photo
14	37	1518	341	423823	5087607	photo bottom with crab	photo
14	39	1518	345	423816	5087608	collapse area	photo
14	40	1518	343	423816	5087608	collapse area	photo
14	40	1520	344	423816	5087608	collapse area	photo
14	41	1517	340	423786	5087698	good fix	
14	44	1518	349	423746	5087736	Arrived at pit	
14	44	1518	344	423746	5087736	photo of pillars at Pit	photo
14	46	1519	345	423737	5087754	Highlights on.	
14	47	1518	348	423742	5087774	Lava pillar.	photo
14	54	1518	334	424881	5087801	At Mkr-N1 - 'The Pit'. Lobate flows. Lots of orange floc in water and in cracks. Sunken collapsed pit with white mat. Looks like venting has reduced from last year.	photo
14	56	1519	287	423707	5087831	Putting the temperature probe in the pit to test for anomalies.	
15	1	1517	302	424678	5087832	Only a 0.2 degrees C anomaly. Will not fluid sample here.	
15	1	1518	356	424678	5087832	Collapsed area.	photo
15	2	1518	330	424678	5087832	Heading north from Pit towards Roof vent.	
15	3	1518	360	423692	5087831	Lobate flow with orange iron oxides. photo of crab.	photo
15	5	1519	2	423680	5087855	Rattail.	
15	5	1519	3	423680	5087855	Rat tail fish observed during move from N1 to Roof	R488-65
15	13	1519	346	424755	5087872	Lava pillars.	photo
15	14	1518	357	423693	5087877	Uncollapsed roof on lobate flow held up by pillars observed on route to the Roof location.	R488-66
15	14	1519	356	424755	5087872	Collapsed area - pillars and caverns. Old lava flow supported by pillars.	
15	17	1518	2	423703	5087899	Zoarcid fish swimming away from us. Stopped and is sinking in the water column.	
15	19	1518	358	423690	5087931	Still heading north towards Roof - about 20 m to go. Another fish in view.	
15	20	1518	350	423682	5087933	Arched layered pillar structure.	Photo
15	20	1518	356	423690	5087942	Pillars in lobate flows observed on route to Roof""	R488-68
15	22	1519	355	423687	5087952	Pillar with hole at top in lobate flow.	R488-69
15	22	1519	353	423687	5087952	Small pillar with a sunken depression on top - hollow inside.	Photo
15	23	1518	359	423690	5087969	Two crabs.	Photo
15	26	1518	358	423683	5088011	Photo of bacterial mat at base of a cavern.	Photo
15	28	1518	357	423683	5088054	Lobate lava.	Photo

15	30	1520	6	424731	5086196	Ugly rattail.	
15	31	1519	357	422818	5083961	Lobate flow with a little bacteria.	Photo
15	32	1519	1	423634	5088073	Highlights of oxide mat/deposits on lobate lavas.	Photo
15	34	1520	1	423691	5088124	Photo of rattail in a small pit.	Photo
15	35	1521	356	423695	5088134	At Mkr-N9 (MiniSnow). No profuse white floc like last year, but just a bit of white mat with mostly orange iron deposits. NO ANIMALS.	
15	38	1522	356	423695	5088134	Probing for temperature at mkr N9. Found an anomaly - up to 3.4 of a degree C.	
15	42	1522	354	423408	5087354	Start to sample bottle #18 of HFS at mkr N9. A scale worm and a few limpets here.	HFS-18_dfl _R488-19
15	48	1522	351	423755	5087941	Close ups of orange stuff - looks like mat? sediment? Looking around while doing the fluid sampling.	
15	51	1522	356	423701	5088129	Stopping sample - pumped 720 ml. Highest temperature was 4 degrees C.	
15	54	1521	318	423714	5088135	Moving north again towards marker N3.	Photo
15	55	1521	348	423689	5088161	Dead bush of tube worms - dead and covered with the orange mat/sediment stuff.	Photo
15	55	1522	342	423689	5088161	Dead tube worm bush covered in orange sediment and surrounded by white mat observed on route to N3	R488-72
15	57	1522	338	424602	5088298	Lots of orange and white mats in between lobates.	
15	59	1522	338	425156	5087802	Bright red sediment/mat, much darker red then the typical orange mat we've been seeing.	Photo Photo
16	0	1522	345	425156	5087802	Red material found on bottom on route to N3	R488-73
16	2	1523	328	425156	5087802	Collapsed pit.	Photo
16	4	1525	336	423672	5088214	Folded sheet flow lava.	
16	5	1526	341	423672	5088214	Jumbled lava, we are probably down in the collapsed area.	
16	8	1526	336	423672	5088214	Just came up past talus over a wall, out of the collapsed pit.	Photo
16	15	1528	334	423632	5088288	Palm worm and scale worm in vent near N3	R488-74
16	9	1526	335	423672	5088214	Lobate lava flows with lots of bacterial mat in cracks. Lots of snails, a palm worm. Going in to probe for temperature. Good fix for this location: 3635,8290. T max at 16 degrees C. Near Mkr-N3. Starting to suck piston #20 of HFS at 16:16.	2 Photos HFS-20_dfl _R488-20
16	22	1528	333	423633	5088284	Stopped pumping #20 - aprox. 650 ml.	
16	26	1528	339	423632	5088286	Starting to pump filter #2 of HFS for XRF.	HFS-2_dfl _R488-21
16	31	1528	334	423632	5088285	The poor bear. he earned this trip down. he sleeps with the worms and stuff.	R488-75
16	33	1528	331	423626	5088302	Stopped pumping into #2. Max temp was 17.3 degrees C and 80 ml was pumped.	
16	38	1528	336	423626	5088292	starting new sample. gas piston.	HFS-5_dfl _R488-22
16	40	1528	337	423626	5088292	photo at sampling site. pulling sampler out of vent. near marker-N3	photo
16	43	1526	28	423627	5088293	We're on the MOVE! North to Milky vent!	
16	46	1528	30	423652	5088318	More dark red sediment/mat interspersed with regular orange mat.	

16	50	1526	31	423676	5088347	Lineated sheet flow. Not striated. Why? because it's lineated (Bill Chadwick quote).	Photo
16	56	1528	3	423700	5088402	We were in ropy to jumbled sheet flow, but now in a lineated patch. So probably in a collapse.	Photo
17	16	1529	313	423672	5088425	Found the Osmosampler at Milky vent!	
17	19	1532	57	423664	5088421	At the OSMO - Mkr N2 is at Milky Vent. There is also a bacteria trap here.	
17	21	1532	71	423666	5088428	Osmo sampler at N2-Milky	R488-76
17	22	1532	54	423671	5088429	Osmo sampler at Milky	R488-77
17	23	1532	57	423671	5088429	Osmo sampler intake at Milky w/Bacteria trap next to it.	R488-79
17	25	1532	58	423664	5088427	Flushing the HFS and taking temperature measurements	
17	35	1532	61	423665	5088437	Starting to sample bag #19 of HFS at 17:36.	HFS-19_dfl _R488-23
17	43	1532	64	422984	5088429	Stopped sampling #19, got 70 ml, max. temp. 3.4 degrees C.	
17	44	1532	64	422984	5088429	Main gauge shows the low hydraulic pressure for the ROPOS system	R488-80
17	46	1532	64	423665	5088428	Heading to Easy Vent. About 20 m north of Milky.	
17	52	1532	62	422976	5088456	Before we leave for Easy we are trying to pick up the osmosampler from Milky.	
17	53	1527	27	423666	5088426	We are leaving Milky (Mkr N2) with the osmosampler in the port arm. Trying to get a better grip on the osmo.	
17	59	1529	337	424763	5088447	Have the osmo. Heading to Easy.	
18	1	1531	0	423670	5088428	Crab near Milky	R488-81
18	1	1531	359	423670	5088428	Crab in view. Very strange lava morphology.	
18	5	1531	293	423671	5088450	Area near Easy Vent.	Photo
18	6	1532	306	423661	5088451	Little oxide mounds.	Photo
18	7	1527	201	425416	5087550	Tubular lobate lavas.	
18	9	1528	222	423676	5088455	Good ROPOS fix. Should be a couple meters to the NW.	
18	10	1529	225	423033	5088302	Going to go north laterally along the Milky-Magnesia line. Couldn't find Easy, so we're going to check out if there is other venting along the line.	
18	12	1527	3	423033	5088302	Out of the collapsed area into lobate flows.	
18	16	1526	343	423678	5088468		Photo
18	16	1526	349	423678	5088468	Only a little white-ish mat along the line of venting from last year. It seems like the venting has subsided significantly in the last year.	2 Photos
18	20	1527	8	423668	5088495	Nearing Ouzo Vent. Some residual bacterial mat in a deep crack.	Photo
18	29	1533	350	423689	5088525	Going in with HFS probe to sample temp at Ouzo? vent - max temp is 3.6 degrees C. Difficulty getting the probe all the way into the crack. Fix on this location is x=3668, y=8518.	
18	33	1533	356	423689	5088525	Taking temp between lavas in crack. Highest T is not in the deepest part of hole. Temps in mid 3 degrees, higher up in hole. Fluid sample 16 at 18:37, bag without filter	HFS-16_dfl _R488-24
18	40	1534	353	423676	5088519	End fluid sampling, highest T 3.8, but 3.5 when sampling	
18	42	1530	184	423668	5088515	Going back to cage for tether management.	
18	48	1529	48	423656	5088504	Pillar connected to roof or arch near the stern of ship/cage/Ouzo vent.	R488-83
18	48	1529	48	423656	5088504	Down by cage, collapse area with nice pillars supporting collapsed roof. Photo of roof	Photo

18	50	1530	85	423645	5088519	Traversing back to Ouzo Vent after tether management.	
18	51	1528	92	423701	5088502	Tree pillars in sequence near Ouzo vent.	R488-84
18	52	1528	112	423701	5088502	pillars	photo
19	6	1521	242	423641	5088484	Good fix.	
19	14	1528	90	423686	5088500	Photo taken in error	photo
19	15	1528	266	423696	5088494	hmm crappy timing	R488-85
19	15	1528	241	423696	5088494	Good fix.	
19	20	1529	95	423683	5088508	pillar	R488-86
19	24	1532	321	423671	5088516	paw print	R488-87
19	23	1530	311	423680	5088510	Arrived at Ouzo, finally. Will try to sample water.	
19	35	1527	295	423658	5088515	Repeating . Looking for place that sampling started at 18:40 was interrupted by need for tether management.	
19	41	1528	58	423655	5088543	At a previously undiscovered small vent about 10 m south of Magnesia Vent. Named Whiteout Vent	
19	45	1530	60	423656	5088554	whiteout vent	R488-88
19	46	1530	62	423658	5088545	more blind temp probing	R488-89
19	46	1530	53	423658	5088546	T max = 4.6 C	R488-90
19	47	1530	53	423658	5088546	HFS sampler piston #23 getting ready. X = 3365.9 Y = 8526 with offset.	
19	52	1531	344	423658	5088547	Start sampling piston #23.	HFS-23_dfl _R488-25
19	57	1531	343	424852	5085576	Sampling #23 piston completed. 60 ml. Max. T 5.6 C.	
20	0	1531	344	425382	5088120	Start DNA filter set #12 at same place as #23 at Whiteout Vent at 20:02.	
20	5	1531	353	423651	5088552	Highlights tape on. Panning around Whiteout Vent while sampling.	HFS-12_dfl _R488-26
20	11	1531	354	423555	5088719	Stopped sampling at 20:1. 1020 ml. T max. 5.1 C. Next sample is bag #9 with filter.	
20	12	1531	356	423656	5088550	Start sample #9. Bag has a POC (particulate organic mater) filter	HFS-9_dfl _R488-27
20	18	1532	356	423449	5088873	Stopped sampling at 20.18 681 ml. Max. T 4.3 C. Start HFS sampler filter #1 for FISH (fluorescent in situ hybridization). Photo	HFS-1_dfl _R488-28
20	22	1531	355	423654	5088548	shelf with hotter fluid on other side (video confused)	R488-91
20	24	1531	358	423594	5088576	another shot of the shelf or plateau	R488-92
20	25	1531	359	423553	5088710	lava bridge covered in snow (top previously referred to as "shelf")	R488-93
20	27	1531	1	423656	5088558	polynoid close-up	R488-94
20	28	1531	358	423678	5088562	oozing polynoid (maybe it doesn't like the company)	R488-95
20	28	1531	358	423678	5088562	Stopped sampling. 105 ml. Max. T 5.1 C.Highlights on.	
20	30	1531	357	423678	5088562	Start HFS sample #10 with filter for lipids.	HFS-10_dfl _R488-29
20	35	1531	2	429242	5083886	Stopped HFS sampler.	
20	41	1531	358	423649	5088552	Start HFS filter #21 at 20:40	HFS-21_dfl _R488-30
20	41	1531	358	424152	5088238	I now have light that doesn't interfere with anyone and I can finally see the keyboard. (Steve)	
20	53	1531	358	424600	5087761	smile button in a more reflective mood	R488-96

20	53	1531	358	423648	5088554	snow blowing	R488-97
20	53	1531	357	423648	5088554	snow blowing II	R488-98
20	54	1531	357	423651	5088558	Stopped sampling. 1542 ml. T max 5.0 C Next will be HFS piston #4	
20	56	1531	356	424673	5088570	Started HFS piston sample at 20:56. Still at same place at Whiteout Vent.	HFS-4_dfl _R488-31
20	56	1531	358	423673	5088557	lava bridge again (higher flow on other side?)	R488-99
21	2	1531	359	423651	5088553	Stopped sampler. 650 ml. T max 4.2 C Next (last) is HFS filter set #13.	
21	7	1531	1	423659	5088555	Started sampling DNA filter set #13 at 21:04.	HFS-13_dfl _R488-32
21	11	1531	0	423622	5088584	white out	R488-100
21	12	1531	1	423588	5088578	plume at white out	R488-101
21	14	1531	360	423653	5088558	plume at white out	R488-102
21	17	1531	359	423653	5088558	plume at white out	R488-103
21	17	1531	359	423653	5088558	Getting suction sample jar J2 ready at Whiteout Vent.	
21	20	1531	358	423650	5088554	Stopped DNA filter sample. End of HFS sampling - all containers are full.	
21	26	1532	14	423650	5088554	Start suction sample into jar J2. Intake is dangling (5 function is holding a recovered osmosampler) over the snowblower at Whiteout Vent at same place where all HFS samples were taken.	SS-j2_dfl _R488-3
						Will be a slow process. Considered opinion is that the floc is mucus - bound sulfur produced by bacteria.	
21	39	1532	10	423654	5088555	you WORM!	R488-104
22	0	1532	15	423710	5088526	End suction sample in jar J2 at Whiteout Vent.	
22	5	1531	84	423648	5088552	Leaving Whiteout vent	R488-105
22	5	1531	82	423648	5088552	Highlights on. Whiteout Vent.	
22	7	1531	72	423648	5088552	Whiteout vent	R488-106
22	7	1531	73	423648	5088552	Photo of Whiteout Vent. Counter says #174 or 177. Monitor says #198. Take your pick, or none of these.	
22	11	1522	59	423652	5088540	Highlight video stopped.	
22	16	1478	274	420625	5088006	All video recording stopped. Getting ready for (yawn) Imagenex single line back to elevator.	
22	28	4397	268	423568	5088479	Oil reservoir has only 4% left on sub display.	
22	47	1510	322	423418	5088499	Starting Imagenex line W4 running from due west of Whiteout Vent proceeding south along west edge of '98 lava to elevator as a fill-in line for '98 NeMO survey. Auto altimeter not working.	
22	57	1508	178	423568	5088168		
23	2	1509	105	423365	5088471	These are good navigation numbers. Apparently we are behind the cage.	
23	53	1499	178	423429	5087592	Approximately 450 m to go.	
0	19	1496	182	423430	5087202	10 meters away from the corner	
0	32	1497	128	423417	5087126	Turning the corner of the line and heading to the elevator. Lost oil pressure on the hydraulics.	

0	39	1397	192	423412	5087128	Lost hydraulic pressure right where we were leaving imagenex line w4 to go over to the elevator. ropos back in cage and heading back to the surface	
0	47	1197	215	423412	5087128	On our way up.	
						Dive Summary following page:	

						<p>Dive R488 Dive Summary: We started at Mkr-33 and took filter samples, fluid samples, slurp samples, and one Ti gas-tight sampler. We then moved to Snail and Marcus took a slurp sample.</p>	
						<p>We also took temperature measurements at Snail with the HFS and got a Tmax = 13. We then moved to Cloud, Mkr-N4 and Mkr-N6 where Ti gas-tight, gas piston, regular piston, bag samples and filtered slurp samples were taken.</p>	
						<p>Bag samples were then taken at Nascent and MiniSnow Vents. At Mkr-N3 bag, filter, piston and gas piston samples were taken. Bag samples were then taken at Milky and Ouzo Vents.</p>	
						<p>We then came upon Whiteout Vent, a previously unnoticed area and took a gas piston, filters for DNA, POC, sulfur and lipids, piston and bag samples. The remainder of the dive was an Imagenex survey, until oil pressure was lost and the dive aborted.</p>	
						<p>Notice: Due to the nav offset, as not all transponders were working, it was later determined that "Whiteout Vent" is actually Magnesia Vent discovered in '98. Much more active in '99.</p>	

							Dive R489	
							Dive Plan: Suction sampling - Cloud for Moyer, Mkr-33 for Levesque, Mkr-N41 for Scott/Juniper, Nascent for Levesque/Marcus/Tunncliffe, Whiteout for Moyer/Juniper, Oxide samples for Scott/Juniper (in flushing bottle).	
							BioBox collections - Mkr-N41, Nascent, Old Flow, OldWorms, and for traps if previous collections are successful. Imagenex survey of western part of lava flow. Recovery/deployments of MTR/Vemcos, osmos and traps. Collect basalt samples, recover elevator.	
							ROPOS Configuration: Suction sampler, Biobox, Gastights, Imagenex, cameras, MTR's carried down in Biobox, BioOsmosampler carried down in 7-function for deployment	
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples	
3	20	1	310	423413	5087134	ROPOS in water		
3	20	1	310	423413	5087134	ROPOS back on deck because have to remove some weight. Only got down to 80 meters, so will continue this dive as R489		
7	25	41	316	423412	5087128	Sub in water. Yahoo!		
7	36	96	214	423412	5087128	Sub coming back up, didn't get to bottom. Dive aborted. Lost pressure in main reservoir.		
7	50	0	43	423412	5087128	on deck		
7	56	1	112	423412	5087128	Sub on deck.		

UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
						Dive R490	
						Dive Plan: Continuation of previously aborted attempts. Primary objective is to complete basic biological collection at Mkr-33/Cloud Vents and to the north (Nascent and old vents)and Whiteout Vent.	
						Osmos and traps to be recovered and put in the elevator. Recover elevator (weather permitting) during the dive.	
						ROPOS Configuration: Suction sampler, Biobox, Gastights, Imagenex, cameras, MTR's carried down in Biobox, BioOsmosampler carried down in 7-function for deployment	
						Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
19	42	1	97	423412	5087128	19:45 ROPOS in water! Everything normal. This COULD be the one!	
19	51	56	78	423412	5087128	ROPOS came out of the cage at 50 m.	
20	7	259	242	423412	5087128	ROPOS back in the cage	
20	16	411	13	423906	5086990	ROPOS coming back on deck because electrical compensation gauge has gone to zero. This is a component that had been disassembled during stipdown for hydraulic system repair.	
20	19	394	21	424024	5087248	20:32 ROPOS back on deck.	
						Dive Summary: El Guapo was still plugged in after calibration, therefore transponders were not responding. Dive aborted.	

							Dive R491	
							Dive Plan: Elevator will be used to gather experiments from Mkr-33, weather permitting. Suction sampling will be done there and at other active vents to the north. Biology and rocks will also be sampled Imagenex survey along western edge of '98 lava flow.	
							ROPOS Configuration: Biobox, Slurp Sampler, Gas Tights, Imagenex, and the other cameras.	
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
UTC	Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
2	0	368	162	424016	5087158	ROPOS in water at approximately 01:45 UTC. ROPOS now at 389 meters		
2	5	466	155	423896	5086982	ROPOS descending in cage, systems look ok.		
2	20	756	287	423966	5087087	Having problems and making adjustments with video cables. Color back on main console monitor.		
2	26	878	207	423960	5087078	Oil reservoir started at 10%, now at 83% and steady while descending in cage.		
2	47	1268	35	423903	5087058	Synchronizing computer clocks to UTC		
2	53	1371	29	423949	5086993	Oil reservoir at 79%		
3	3	1468	154	423981	5086921	Parking sub about 50 m off bottom to wait for P-Code GPS to come back on.		
3	47	1492	281	423842	5087094	Pcode came back, ship has been maneuvering back into position. Ropos out of cage and going down. ON bottom. sheet flows with flocky coating. no fix now		
3	53	1524	26	423868	5087084	x=3869, y=7084 good fix. Found elevator		
3	55	1523	268	424393	5086607	heading to 75 degree spot. Looking for it.		
3	59	1524	225	424409	5087488	At Mkr-33 site. Fissure in sheets has much shimmering water. Putting out OSMO samplers. Discussing where first.		
4	1	1523	228	424230	5087962	Putting Osmo sampler in vent site Mkr-33.	R491-1	
4	2	1523	224	423841	5087087	note that frame grabs appear to have subtle red stripes across them but they are not on the video		
4	4	1523	228	424108	5087609	Positioning OSMO	R491-2	
4	20	1522	236	423854	5087066	BioOsmo sampler deployed in hottest known part of Mkr-33 vent		
4	22	1524	215	424495	5087976	Osomos and Micro traps	R491-3	
4	23	1524	236	423610	5086988	Osmo and micro traps	R491-4	
4	29	1524	244	423839	5087050	Repositioning the green copper OSMO sampler at the 80 degree vent next to the other sampler just positioned		
4	30	1522	235	423851	5087073	Moving Osmo sampler (green copper one) to 80 C spot in crack	R491-5	
4	31	1523	240	423853	5087101	repositioning green osmo next to the BioOsmo	R491-6	
4	33	1523	258	423842	5087050	Osmo samplers at fissure Mkr-33	R491-7	
4	33	1523	258	423842	5087050	3 Osomosamplers at Mkr-33	R491-8	
4	33	1522	226	423856	5087066	another picture of osmo set up	R491-9	
4	34	1521	227	423875	5087038		R491-11	

4	34	1522	220	423856	5087066	3 Osmosamplers at Mkr-33-	R491-10
4	34	1521	238	423875	5087038		R491-12
4	35	1521	209	423851	5087097	Mkr-33 view	R491-13
4	35	1521	209	423851	5087097	More Osmosamplers at Mkr-33-	R491-14
4	37	1524	214	423848	5087102	Osmo analyzer	R491-16
4	37	1524	212	423848	5087102	Iron osmo sampler being picked up.	R491-15
4	38	1524	213	423849	5087104	Iron baby! Osmo analyzer	R491-17
4	38	1523	206	423852	5087092	Picking up Fe osmo sampler to bring back up to surface.	
4	39	1524	192	423840	5087051	Traps and osmoanalyzer	R491-18
4	40	1524	201	423838	5087048	Osmoanalyzer	R491-19
4	43	1523	211	424308	5087903	Picked up Fe OsmoAnalyzer #1 for return to elevator (which is only 2 m away)	FeOsmoAn_ R491-1
4	46	1520	211	424481	5087352	Osmo sampler into elevator.	R491-20
4	48	1521	210	423863	5087061	Fe osmo sampler placed in elevator.	
4	54	1524	249	424043	5087941	Picked up bacteria trap #40 and took to elevator.	Bactrp-40_ R491-2
4	55	1524	251	423851	5087099	Stopped on way to elevator to pick up bacteria trap #43 and took both to elevator.	Bactrp-43_ R491-3
4	57	1522	265	423853	5087092	Bacterial traps 40 and 43 put in elevator.	
5	13	1521	340	423860	5087097	Removing OSMO sampler from elevator.	
5	16	1521	173	423864	5087074	Last entry was wrong. Just repositioning OSMO to make more room. Now getting other OSMO to put in elevator	
5	19	1521	166	424412	5087480	Recovery of iron osmotic analyzer 2, putting in elevator	FeOsmoAn_ R491-4
5	29	1525	61	423840	5087041	repositioned bacterial traps 42	R491-21
5	31	1523	38	423840	5087046	repositioned #42 bacterial traps	
5	37	1522	42	424674	5087294	Recovered bacterial traps #41.	
5	39	1524	214	423840	5087045	Repositioned two bacterial traps 41 and 42 in crack where the temp. is hot and where the OSMO samplers were deployed.	
5	42	1524	223	423993	5087682		R491-22
5	42	1524	226	424362	5087686	bac traps 42 and 41 in place	R491-23
5	46	1524	202	423992	5087679	osmos and bac traps in bed together	R491-24
5	50	1524	229	423849	5087098	Position of bacterial traps	R491-25
5	50	1523	223	423849	5087098	OK NOW IT'S THE FINAL POSITION OF BACTERIAL TRAPS NEXT TO OSMOS	R491-26
5	50	1522	221	423849	5087098	The big view of Mkr-33	R491-27
5	52	1522	180	423852	5087102	Another great grab of Mkr-33 site	R491-28
5	53	1524	188	423857	5087092	Going to suck snails. We will take sample 5.	Photo
5	56	1524	183	423855	5087090	Limpets and snails close-up.	R491-29
6	2	1524	192	423859	5087097	suction sample J1 starting	R491-30
6	2	1524	188	423744	5087252	Sampling limpets and snails in J1	SS-j1_bio _R491-55
6	7	1524	188	423839	5087040	3852 7103 good fix at Sample site.	

6	19	1524	189	423841	5087042	finished suction of snails.	
6	21	1525	183	423853	5087105	Heading to N6 at Cloud, 50 m away.	
6	30	1514	62	423861	5087050	moving the ship.	
6	31	1521	64	424380	5087671	Traversing to NE to next site over lineated sheet flows, some jumbled sheets.	
6	35	1524	137	423898	5087114	Over the plume, lots of cloudy water. 3901 7112 good fix. over the vent with worms on edges, many scale worms on rock faces. Continuing to move around. Much collapse, some pillars.	
6	42	1522	305	423910	5087105	Found Mkr-N6 site	
6	42	1523	285	423903	5087112		R491-31
6	42	1522	334	423933	5087605	View of Cloud Vent, multiple orifices, Mkr N6	R491-32
6	42	1522	295	423903	5087112	3903 7112 good fix at site N6, vigorous venting in hole, many scale worms. some nice tubeworms.	
6	43	1526	352	423773	5087274	Edge of N6, tube worms, venting vigorous	R491-33
6	45	1526	345	423887	5087122	Going to deploy Marker 21 near N6. Marker will have MTR temp recorder on it. Big fish, much bacterial coating on basalts. x=3901 y=7109 good fix.	
6	51	1526	357	423903	5087110	MTR probe at MKR N6	R491-34
6	54	1526	355	424287	5087490	MTR deployed at Mkr N6 Cloud. Mkr-21 being deployed	R491-35
6	52	1526	0	423901	5087108	3903 710 good fix where Marker 21 is being positioned down the hole. Gas tight taken in whole. very vigorous flow.	gtb-6_dfl_R491-6
7	1	1527	0	423902	5087110	Trying to se exactly how big this hole is by scanning it with the red laser things - approximately 5 cm in width.	
7	4	1527	356	424139	5086948	The 5 cm was at the north side of the hole.	Photo-1
7	4	1527	358	424139	5086948	Photo of Cloud Marker N6/21.	
7	4	1527	0	423754	5087341	The pit at Cloud vent - marker N6 and 21	R491-36
7	6	1527	358	423890	5087118	Watching the particles go by to estimate a flow rate out of the pit at Cloud Marker N6/21.	
7	8	1527	360	423902	5087109	Looking at the face of the rock right above the rim to get this flux measurement.	
7	14	1527	312	423892	5087118	We are suctioning at N6 for bacterial mat.	SS-1_mat_ R491-7
7	14	1527	310	423901	5087108	Photo of the hole and bacterial mat and worms.	Photo-2
7	19	1527	8	423903	5087110	x=3903 y=7110 good ROPOS fix	
7	20	1527	6	423905	5087111	Suction sample of microbial mat at Cloud vent (N6)	R491-37
7	21	1527	7	423902	5087096	We're actually sucking mat near Mkr N6 and the Pit, but not actually in it. The good fix is for where we're sampling from now.	
7	29	1526	19	423901	5087107	Still suctioning into Bottle 1.	
7	32	1527	22	423900	5087107	good suction sample at Cloud vent of bacterial mat.	R491-39
7	34	1527	22	423903	5087109	Flushing. Finished sampling into Bottle 1.	
7	34	1527	19	423903	5087109	We're moving to the other side of Cloud now.	
7	37	1522	9	423898	5087106	Retrieving bacterial traps from Marker N4.	
7	38	1524	9	423894	5087110	3894 710 good fix at Marker N4	
7	38	1525	6	423894	5087110	Bacteria trap at N4	R491-41

7	40	1525	234	423898	5087112	Trying to pick up bacterial trap from N4.	
7	42	1525	233	423897	5087111	Retrieval of bacteria traps at N4	R491-42
7	42	1525	230	423897	5087111	Getting bacterial trap #36	bactrp-36_ R491-8
7	44	1525	229	423897	5087111	Putting bacterial trap #36 in starboard side of BioBox.	
7	46	1525	236	423898	5087111	Now we're retrieving bacterial trap #37 from Mkr N4.	
7	48	1525	221	423897	5087111	Putting bacterial trap #37 in starboard side of BioBox	bactrp-37_ R491-9
7	51	1525	244	423896	5087111	Putting bacterial trap #39 into starboard BioBox.	bactrp-39_ R491-10
7	54	1526	237	423900	5087115	Retrieving and placing bacterial trap #38 into starboard BioBox.	bactrp-38_ R491-11
7	57	1526	240	423897	5087111	Going to the elevator!	
7	58	1526	238	423896	5087110	3897 7110 good fix	
7	58	1526	238	423896	5087110	3897 7110 good fix	
7	58	1526	240	423896	5087110	Going to the cage for tether management first.	
8	7	1520	226	423866	5087085	We found the cage.	
8	8	1522	239	423858	5087076	x=3863 y=7099 good fix on elevator	
8	10	1518	179	424092	5087574	We're now at the elevator to put the bacterial traps into the BioBox in the elevator and take the other bioboxes out of the elevator.	
8	15	1521	47	423860	5087081	Bacterial trap missed the box in the elevator. Still trying.	
8	28	1522	153	423862	5087095	3862 7095 good fix at elevator as we put the trap in the right box in the elevator this time.	
8	29	1521	181	423859	5087081	Transferring bacteria trap to elevator	R491-43
8	29	1521	181	423859	5087081	The second bacterial trap is now entering the elevator.	
8	32	1521	171	423860	5087079	The third bacterial trap is now going in the elevator.	
8	33	1521	176	423858	5087095	3858 7095 good fix at elevator.	
8	35	1521	183	423863	5087099	Placing the fourth and final bacterial trap into the elevator.	
8	35	1521	160	423860	5087077	We're having trouble shutting the lid on the box in the elevator with the bacterial traps in it.	
8	45	1522	3	423857	5087073	We have closed the lid on the box in the elevator.	
8	45	1519	101	423858	5087074	Now we will try to remove the portable bioboxes from the elevator. Two will go on seafloor, two will be held in each of the arms.	
8	58	1518	140	423856	5087098	3856 7098 good fix	
9	3	1525	37	423854	5087081	Picking up two of the portable bioboxes - one in each arm - and carrying them to Nascent Vent.	
9	9	1526	64	423848	5086872	The two boxes left behind are close to the anchor of the elevator.	
9	10	1526	59	423852	5087073	Now we're going back to the cage to check the tether and such.	
9	17	1494	174	423935	5087512	We've found the cage, everything's okay, so we're returning to the bottom to head to Nascent.	
9	18	1522	0	423641	5087320	Moving the ship to get ready to move to Nascent.	
9	20	1522	6	423641	5087320	Going north to Nascent vent.	

9	26	1519	3	423873	5087139	On transit to Nascent, seeing lots of diffuse venting with bacterial mat. No sign of animal life.	
9	27	1518	6	423873	5087146	Now we see some tube worms.	
9	27	1520	4	423873	5087153	Very pretty diffuse flow. A little pit with mat and worms and snails.	
9	28	1521	1	423871	5087156	3871 7156 good fix We're still heading north. Saw the new worm, extensive venting.	
9	29	1520	4	423869	5087164	Now we're seeing pillow lavas with that rusty colored sediment/bacterial stuff on it.	
9	30	1521	2	423858	5087179	More rusty colored stuff on the pillow lavas. Some bacterial mat.	
9	31	1520	5	423863	5087180	3864 7180. good fix en route to Nascent.	
9	32	1520	356	423864	5087191	Funny pitted looking lavas - poxey area. They look like grazing spots except that they're single little circles with no animals or fecal trails.	
9	34	1521	4	423870	5087217	Trying to figure out what these little patches are - fecal patches?	
9	37	1518	356	423867	5087262	3867 7263 good fix en route to Nascent - 140 m away from Nascent.	
9	41	1520	10	423886	5087318	Pillow lavas with orangey stuff- no venting or animals visible.	
9	42	1520	7	423886	5087337	3886 3737 About 60 m from Nascent Vent.	
9	44	1520	73	423882	5087386	More poxey sort of areas on the pillow lavas	
9	44	1521	82	423909	5087757	Rattail.	
9	44	1521	78	423909	5087757	Rattail on the way to Nascent.	R491-45
9	45	1520	99	424259	5087166	We are very close, or almost at, Nascent Vent. Looking for the MTR.	
9	46	1520	97	424264	5087173	Bag creatures, snow-looking stuff.	
9	48	1518	164	423908	5087390	3908 7391	
9	49	1520	173	423913	5087390	We have located the MTR.	
9	49	1520	171	423910	5087380	3910 7380 good fix at MTR at Nascent Vent.	
9	50	1521	119	423909	5087376	The bag creatures are super thick! We see snails, limpets, tube worms, etc.	
9	51	1521	127	423911	5087380	Nascent Vent with old MTR in it.	R491-46
9	52	1521	122	423911	5087380	Putting down the two portable bioboxes to free up ROPOS's arms.	
9	53	1521	132	423914	5087375	The BioBox has slipped and fallen into the vent hole!	
9	56	1521	113	423904	5087389	Moving the BioBox out of the hole with the MTR.	
9	57	1521	135	423904	5087389	Dropping the other BioBox in the 7 function arm.	
10	2	1521	126	423908	5087368	Opening one of the bioboxes to get it ready for sampling- this BioBox has the rubber stopper popped out and floating about the box.	
10	3	1521	126	423908	5087368	Portable BioBox before it was filled with worms and such.	R491-47
10	4	1521	126	423910	5087371	Cancelling opening the box because we seem to be kicking things up to much. Now attempting to get a port side gas tight bottle from Nascent Vent.	
10	4	1521	127	423910	5087371	3910 7381 good fix at Nascent. Positioning for this gas tight bottle.	gtb-7_dfl_R491-
10	8	1521	120	424284	5086718	Triggering the port side gas tight right near the MTR at Nascent Vent.	
10	10	1521	122	423909	5087369	Preparing to suction into Jar J3 over the tube worm bush. Flushing the jar- lots of bag creatures in the flush jar.	
10	12	1521	124	423886	5087346	Beginning to suction right over the tube worms in the same vent as the MTR.	SS-j3_bio_ R491-13
10	13	1521	121	423886	5087346	We are suctioning slowly in order to only get little stuff - not the actual worms.	
10	15	1521	125	423900	5087349	Photo	

10	18	1521	128	424287	5086715	Photo	
10	19	1521	123	423911	5087372	3912 7372	
10	26	1521	123	423914	5087379	3914 7380 good fix where we're suctioning.	
10	27	1521	124	423910	5087370	Suction over tube worm bush at Nascent vent.	R491-48
10	31	1521	120	423908	5087370	BETA tape was 60 minutes, but it went to 84 minutes, so 24 minutes of the BETA tape are gone. Oops.	
10	35	1521	126	423908	5087376	Another view of the tube worm bush at Nascent vent.	R491-49
10	46	1521	121	423965	5087790	Stopping suction sample after 3 1min 25 sec.	
10	48	1521	128	423907	5087370	37907 7370 good fix	
10	48	1521	128	423911	5087381	Begin sampling sJ4_bio_491-14	SS-j4_bio_ R491-14
10	53	1521	126	423911	5087381	Suction of gastropods near MTR at Nascent vent.	R491-51
10	54	1521	126	423910	5087378	Still suctioning worms and gastropods at the MTR site at Nascent vent.	
10	58	1521	125	423910	5087379	Testing the Betacam to make sure error code was ok. Betacam still works.	
11	0	1521	125	423677	5087278	Stopping sample 491-14	
11	4	1521	121	423913	5087384	Grabbing external BioBox-box and moving it away from vent somewhat.	
11	6	1521	121	424287	5086716	Attempting to open the portable BioBox-box. Pulling on bungi cord. Pulling top open.	
11	9	1521	123	423956	5087788	Lid is open.	
11	10	1520	122	423770	5087694	Removing MTR4180 from vent and transferring to BioBox-box.	MTR-4180_R491-
11	11	1520	122	423901	5087384	Transfer complete.	
11	12	1521	126	423912	5087382	Attempting to grab tube worms.	
11	18	1520	127	423910	5087379	Portable BioBox box tipped over and was repositioned. MTR is still inside.	
11	20	1520	124	423910	5087379	Attempting to reopen the BioBox-box lid which closed on repositioning.	
11	22	1520	123	423912	5087381	Grabbing the BioBox-box with the 5 function arm. Attempting to open the lid once more.	
11	24	1520	122	423897	5087362	Still trying to open portable BioBox-box. Holding top open with 7 function and grabbing handle with 5 function. Box is open but pointed the wrong direction.	
11	26	1520	124	424912	5087076	Attempting to grab tube worm sample w/ 7 function.	
11	29	1520	116	423897	5087362	Worms grabbed.	Bio_R491-16
11	29	1520	121	423897	5087362	Worms being transferred to portable BioBox-box. Held by 5 function arm. Transfer complete.	
11	32	1521	119	423897	5087362	Worm Grab-Nascent	R491-52
11	32	1520	115	423897	5087362	Attempting to collect second clump of worms at same site.	
11	32	1520	121	424322	5088029	Nav is currently bad.	
11	36	1520	119	423897	5087362	Still attempting to collect second clump of worms.	
11	37	1520	119	423897	5087362	Restarting Kims VCR tape which was stopped for an unknown amount of time.	
11	43	1520	118	423893	5087358		R491-53
11	43	1520	115	423907	5087370	Second clump has been picked up by the arm and transferred to the portable BioBox-box.	
11	44	1520	121	424642	5086950	VCR tapes have been changed.	

11	52	1520	208	424467	5087140	Collecting a third clump at a nearby site after repositioning. This is a larger clump.	
11	54	1520	206	423911	5087381	Highlights on.	
11	54	1520	208	423911	5087381	Worm Grab-Nascent	R491-54
11	54	1520	209	423911	5087381	still photo of worms.	Photo
11	55	1520	205	423916	5087389	Collecting 4th grab of tube worms.	
11	56	1520	205	423911	5087372	Transferring a large clump to portable BioBox-box. Transfer is complete.	
11	59	1520	204	423911	5087372	Transfer complete.	
12	0	1520	209	424032	5087183	Attempting to grab handle with 7 function.	
12	4	1520	205	423909	5087365	Portable BioBox-box transferred between 5 and 7 function arms. Now attempting to close the lid with the 5 function arm.	
12	7	1520	208	424029	5087194	Closing the lid on the BioBox-box.	
12	7	1520	205	424940	5086954	Tube worm samples and MTR in the portable BioBox-box.	R491-55
12	8	1520	208	423910	5087392	Transferring the BioBox-box from the 7 function back to the 5 function arm. Attempting to reattach the bungie w/ the 7 function arm. Bio-box is tipped 90 degrees.	
12	12	1519	207	423910	5087370	Grabbing the handle with the 7 function arm and returning the box to an upright position. The 5 function has let go of the handle. Setting the box down on the bottom.	
12	15	1519	210	424018	5087016	Positioning BioBox-box on the bottom.	
12	17	1520	220	423657	5086835	Nav is still bad.	
12	17	1520	229	425112	5087232	Holding the bio-box lid closed with the 5 function arm while using the 7 function to attempt to close the bungie latch. Latching complete but needs a small nudge to position the bungie completely on the latch. Bungie is now completely secure.	
12	23	1519	231	423910	5087385	Picking up the BioBox-box with the 5 function arm. Repositioning BioBox-box.	
12	25	1520	231	423910	5087383	Checking gauges.	
12	25	1520	232	423912	5087372	Opening the port side BioBox-box. Picking up MTR w/o black tape (# 3175m). Positioning for deployment.	
12	31	1519	90	423821	5087742	Deploying MTR.	
12	32	1519	59	423892	5087353	Positioning to pick up 2nd portable BioBox-box with 7 function arm. Box has been grabbed. Lifting and rotating box.	
12	35	1519	58	423898	5087375	Heading north to Mkr-N41.	
12	35	1519	49	423902	5087384	Leaving Nascent transiting to Mkr-N41.	
12	37	1518	6	423869	5087310	Nav is bad.	
12	41	1520	355	423905	5087427	Nav is showing us NW about 15 meters.	
12	42	1518	70	423911	5087422	good nav fix.	
12	42	1518	198	423910	5087420	Arriving at Mkr-N41.	
12	46	1520	103	424335	5086890	Bio-box on bottom.	
12	46	1520	101	423912	5087405	Pick up BioBox-box in 7 function arm and reposition nearer the marker.	
12	47	1520	107	423905	5087397	Bio-box slide down a pillow lava into a small depression. Attempting to open and reposition. No good nav. Positioning box. Lid is open.	
12	50	1520	104	423904	5087406	good fix.	

12	50	1520	103	423906	5087407	Grabbing MTR 4126. Into box.	MTR-4126_dfl _R491-17
12	52	1520	101	423903	5087402	Beginning to collect worm sample at Mkr-N41.	
12	53	1520	92	423903	5087403	Large clump of worms collected and put into box.	Bio_R491-18
12	54	1520	95	423904	5087408	Attempting to grab second clump of worms. Worms grabbed and put into the portable BioBox-box.	
12	55	1520	90	423904	5087409	good fix.	
12	55	1520	91	423904	5087409	2nd worm clump is in the box.	
12	56	1520	89	423906	5087411	good fix. Attempting to collect 3rd clump of worms at the same area.	
13	1	1520	90	423820	5087757	Third clump collected and transferred to the portable BioBox-box.	
13	2	1520	90	423904	5087409	good fix.	
13	3	1520	83	423899	5087409	Finished collecting sample. Will deploy the MTR-3041 in the same hole as the other one.	
13	4	1519	77	424085	5086794	MTR deployed and now attempting to close the lid on the portable BioBox-box.	
13	10	1520	173	424289	5086722	Still attempting to close the BioBox-box.	
13	15	1519	217	423907	5087407	good Fix. Still trying to close the lid.	
13	18	1520	23	423760	5087605	Picking up the box and repossessing with the 7 function arm.	
13	20	1520	23	423742	5087073	Repositioning box, still trying to close lid.	
13	22	1520	22	423906	5087405	Positioning 1st BioBox-box on top of the second to secure the lid. Using the 7 function to close the lid.	
13	25	1519	23	423904	5087402	Lid closed on second BioBox-box.	
13	25	1519	22	423904	5087402	Checking MTR position.	
13	25	1519	16	423991	5086488	MTR at N-41	R491-56
13	28	1519	15	423907	5087407	Still photo. good fix.	Photo
13	31	1518	347	423906	5087405	Leaving Mkr-N41 transiting to oxide site 15m to the N.	
13	34	1519	10	423904	5087419	good fix.	
13	34	1519	14	423904	5087419	Positioning suction sampler to take oxide sample.	
13	37	1519	353	423899	5087420	Setting down BioBox-box in 5 function arm in order to grab the suction sampler handle. Grab complete.	
13	39	1519	1	423898	5087416	Flushing into J4 getting ready to sample FeO into J2.	
13	40	1519	359	423898	5087416	Steve's tape is running.	
13	42	1519	321	423899	5087414	good fix.	
13	43	1519	317	423900	5087413	Begin sampling FeO	SS-j2_FeO _R491-19a
13	43	1519	321	423176	5087152	Still sampling FeO, s .	
13	44	1519	328	423898	5087412	Photo of FeO	Photo
13	47	1519	285	423903	5087420	Repositioning to find more oxides.	
13	48	1519	294	423999	5087715	VCR tapes have been changed.	
13	49	1519	312	423903	5087418	good fix.	
13	49	1519	314	423904	5087415	Start sampling more oxides into J2. Mat appears to be very deep at the sampling spot.	

13	51	1519	320	424365	5088172	Possible precursor to red cherts. Need Silicon as well.	
13	52	1519	290	423904	5087418	Photo of white mat.	Photo
13	53	1519	289	424878	5087155	Sampled some of the white mat as well.	
13	58	1519	288	424115	5087632	Still attempting to try to clear the clogged suction sampler.	
13	59	1519	292	424519	5087104	Switch to jar 4 and continuing to pump.	SS-j4_FeO_R491-19b
14	0	1519	298	423901	5087397	Finished sampling FeO sample.	
14	1	1519	295	423531	5087297	Reposition to pick up the BioBox-box.	
14	2	1518	305	423531	5087297	photo	Photo
14	2	1518	309	423531	5087297		Photo
14	3	1519	296	423902	5087419	Releasing s hose with the 5 function arm. Picking up the BioBox-box.	
14	4	1519	294	423884	5087775	Picking up BioBox-box.	
14	4	1519	291	423899	5087415	Returning to cage. Will then reposition ship.	
14	5	1519	302	423899	5087415	photo of FeO area.	Photo
14	6	1518	179	423901	5087420	photo	Photo
14	6	1517	188	423901	5087420		Photo
14	6	1517	201	423901	5087420		Photo
14	6	1516	223	423901	5087420		Photo
14	8	1492	24	423901	5087420	Heading back to the bottom.	
14	11	1519	359	423889	5087344	ROPOS is ready at the cage. Ship will move N about 81 m.	
14	12	1518	357	423889	5087344	Ship is starting to move.	
14	13	1518	356	423897	5087354	Transit from N41 North to old flow site. Approximately 81 m.	
14	15	1518	356	424614	5086896	Photos of mysterious black circles on lobate lavas - they look like grazing circles, but there are no animals about.	2 photos
14	17	1518	357	423884	5087384	More photos of the 'pox' marks.	Photo
14	19	1518	1	423891	5087397	'Pox' marks	photo
14	22	1519	5	423890	5087419	photo of oxide	Photo
14	24	1518	42	423894	5087444	good fix	
14	25	1517	27	423869	5087382	Contact with old lava.	
14	26	1518	41	423868	5087380	Crabs and clams.	
14	27	1518	30	423868	5087380	crabs and worms.	Photo
14	30	1519	35	423835	5087342	No good fixes photo of BioBox-box	Photo
14	32	1520	35	423834	5087362	old worms	R491-57
14	34	1520	32	423847	5087359	photo of old worm site to be sampled	Photo
14	36	1519	34	423868	5087463	sample of old tube worms.	Bio_R491-20
14	38	1520	36	423840	5087337	Still collecting old tube worms sample. Sample placed in port BioBox-box on sub.	
14	42	1519	38	423907	5087448	Putting second clump of old worms into port BioBox-box on sub.	

14	44	1519	35	423855	5087404	Still sampling for old tube worms.	
14	53	1519	99	423835	5087390	Finishing stuffing the 'Old Flow' grab into the port BioBox - doing a little BioBox management.	
15	0	1519	101	423778	5087225	Worms in the BioBox! On to take a rock	
15	5	1519	33	423839	5087406	Going in to sample a rock for the rock guys.	
15	13	1519	83	423949	5087536	Putting the honking rock into the port BioBox.	R491-58
15	16	1519	83	424134	5087869	good view of the spider crab.	
15	19	1519	85	423877	5087474	Hollow pillow(or lobate)where rock sample taken near old flow vent in association with the tube worm grab	R491-59
15	20	1519	87	424110	5087884	Close-up view of hollow pillow (or lobate) near tube worm grab	R491-60
15	21	1519	87	423700	5087141	Another shot of the LOBATE! flow that was sampled above. Cool crab and Nascent sample (in box) in view.	R491-61
15	23	1519	86	423814	5087346	Crust of the lobate flows is about 10 cm.	
15	25	1517	104	423834	5087378	Completed sampling at 'Old Flow'. Now preparing to transit back to the elevator to drop of bioboxes.	
15	45	1518	222	423954	5087486	Looking for a basalt sample of new flow southwest of Nascent vent about 10 m.	
15	48	1516	142	423955	5087254	Lobate flows and some collapsed features. Bacterial mats in cracks between lobes. Beautiful features.	
15	52	1515	185	423906	5087295	Lava buttress.	
15	54	1508	170	423881	5087282	Still waiting for the ship to stop in order to take a rock sample.	
15	56	1518	184	423930	5087301	Lava pillar and collapsed lobates.	
15	57	1518	188	423886	5087184	Jumbled sheets on top of collapsed structure. Field of Pillars staring Mike Perfit and Kevin Costner.	
16	1	1517	356	424451	5086748	Lava pillar and arch.	
16	1	1518	360	424451	5086748	Lava pillar connected to arch Unknown fix/near Mkr-33	R491-64
16	7	1518	322	424152	5087643	collection of new lava flow near Mkr-33(10m)	R491-65
16	10	1518	317	424647	5087044	Rock sample near Mkr-33 (10m)	R491-67
16	7	1518	330	424027	5087484	Going in for a rock sample of new flow on a roof structure. Putting rock in starboard side of BioBox	Rck_R491-22
16	10	1518	317	423903	5087223	x=42391, y=508728 - lat/long estimation for the rock sample (R491-22).	
16	12	1518	316	423898	5087246	Better lat/long for the rock sample (R491-22): 3902, 7224.	
16	14	1518	320	423936	5087307	Ship heading back to elevator, rock sampling finished.	
16	32	1492	266	423864	5087170	Ship moved. Moving back to the elevator to drop of the two portable bioboxes.	
16	46	1523	62	423866	5087100	At the elevator. Beginning to position the two portable bioboxes into the elevator.	
16	50	1519	43	423858	5087087	Tubeworm grab from N41 in portable BioBox is being transferred to the elevator.	
16	53	1519	131	423828	5087145	N41 tube worm sample going into elevator.	R491-68
16	59	1520	286	423846	5087055	Nascent BioBox deposited in elevator.	R491-69
17	0	1519	24	423844	5087054	TW sample of Nascent (R491-16) in left side of elevator.	
17	2	1519	91	423858	5087092	Closing the lid on the BioBox compartment of the elevator.	

17	6	1521	332	424401	5087492	Going to pick up another portable BioBox (on the seafloor at the base of the elevator) to take north to Milky area for sample of 'Old Worms'. First we are heading to Cloud for video/still camera mosaicing work. Still at the elevator doing rope management.	
17	10	1516	246	423863	5087092	Save for ROPOS guys. Tangled launch line with the anchor. Top of the bridle.	R491-70
17	10	1523	148	423551	5087340	The elevator launch line tangled around the ropes and under the anchor. Working on untangling it.	
17	19	1521	114	424414	5086752	Removed the launch line from under the anchor. Heading to Cloud vent (N4).	
17	30	1524	317	423845	5087046	Just finished repositioning tubeworms in port side of BioBox. On our way to Cloud.	
17	43	1522	92	423885	5087118	Waiting for the ship to reposition so we can transit to Cloud.	
17	45	1519	91	423889	5087115	Collapsed area just before we reach Cloud - a ridge with a bit of venting, some gastropods and a dense aggregation of the unknown polynoid.	Photo
17	47	1522	93	423886	5087066	We are at Mk-N6 (Cloud). Stirred up a lot of floc while landing ROPOS. Waiting for the floc to clear before we start taking pictures and survey the area. Kim wants video and still photo images to mosaic Cloud vent area. good fix for N6 at 3900, 7115.	
17	51	1523	268	423901	5087113	Trying to go to Mkr-N4 to begin photo imagery work - to the west.	
17	52	1523	306	423896	5087114	At Mkr-N4, good fix.	
17	55	1522	71	423897	5087118	Stopped to try and get a bunch of good fixes to locate precisely where we are.	
18	1	1522	68	423879	5087069	Starting at N4 we are going to survey all of Cloud with video, 35 mm still camera (mounted vertically) and imagenex from a depth of 1521m. We are going to take overlapping photos and since there is a 5 sec. lag between each photo, the pace will be slow.	
18	6	1522	78	423893	5087117	Lift off! Camera survey starting. Heading east.	3 photos
18	8	1523	93	423898	5087117	Aborting survey because we stirred up too much debris in the water column. Starting again.	
18	11	1522	86	423906	5087135	Back at Mkr N4, positioning to start survey again.	
18	20	1522	105	423775	5086584	Attempt #2 - starting survey from Mkr-N4 at a heading of 105 degrees for approximately 6.5 m to Mkr-N6.	
18	22	1522	104	423880	5087070	Photo survey. Imagenex head is about 2.5-3 m of the bottom.	5 photos
18	24	1522	112	423882	5087064	Still transiting to mkr N6 taking pictures. Imagenex now at 4 m.	3 photos
18	25	1521	101	423859	5087018	Imagenex up to 5 m - need to come back down.	
18	26	1521	120	423859	5087018	Imagenex still at 5 meters. Now down to 2.5 m on right and 5 m on left. Turning ROPOS around, heading back towards N4, heading 285.	
18	27	1522	277	423900	5087097	Transect from N6 back to N4. Heading staying roughly between 285-295. Photos seem to be about every 10 seconds.	12 photos
18	30	1520	294	423952	5087220	Still heading west.	2 photos
18	30	1520	280	423860	5086972	Worm Pillar. Near N4 & N6	R491-71

18	31	1518	323	423889	5087105	Moving 2 meters to the north, turning around to run a reciprocal course.	
18	32	1518	126	423890	5087110	See N4, set down briefly. Heading 105 and making a transect back towards N6.	5 photos
18	34	1520	102	423905	5087118	Got out of the venting area. We are going to fly back to N6, go to the eastern edge of the field and then will hop 2 m north, then transect west again.	
18	38	1520	275	423894	5087117	Trying to find mkr N6.	
18	39	1524	248	423904	5087109	good fix. Found N6. Hopping 2 m north.	
18	41	1523	282	423902	5087111	Heading 285 back towards N4.	9 photos
18	42	1520	294	423896	5087114	Swinging around, back to N6 (mkr 21). Hopped south and are going to do another east-west transect (N6 is just slightly to the northwest of where we are starting this transect).	
18	47	1525	283	423902	5087108	Beginning of the last line of transect. good fix	
18	48	1523	287	423948	5087533	Last transect heading west at 285. Crossing over worm pillar. Survey work is finished for now.	13 photos
19	3	1520	271	423742	5086943	worm moves while scientists wait	R491-72
19	6	1520	272	423511	5086604	worm eats bag lunch	R491-73
19	10	1510	271	424190	5087650	Moving ship to west.	
19	17	1462	188	424422	5087902	At cage. Preparing to go to Old Worm Site. Too rough to recover elevator. Will try later in the day.	
19	56	1502	357	423379	5087115	Start of Imagenex line W5. Starting at middle of line west of Mkr-33, proceeding north.	
22	47	1506	176	422412	5089376	22:16 finish north end of Imagenex line W5. 22:30 start north end of Imagenex line W6 heading south to latitude of the elevator for release	
1	19	1499	186	423306	5087087	No elevator recovery as previously planned. Moving ship towards Mkr-N4.	
4	24	1530	93	423672	5088415	ON bottom again, very collapsed area, with large blocks of lava strewn around chaotically over rubble. A bit less floc material between flows here.	
4	27	1531	74	423662	5088434	further N, there was more continuous ropy sheets. Turning E it is more scrambled with collapse and rubble. Many of the walls seem to have fallen over or collapsed onto the floor.	
4	31	1529	59	423676	5088439	Typical view of chaotic terrain here.	R491-74
4	31	1528	352	423675	5088443	good fix 3671 8442	
4	33	1530	322	423671	5088442	more to north and west hummocky terrain in sheet flows.	
4	35	1531	41	423657	5088465	featureless sheet flow in hummocky terrain, lots of floc along cracks	R491-75
4	38	1527	149	423667	5088456	good fixes around this time. On boundary between sheets and collapse	
4	41	1528	122	423668	5088440	Into areas of collapse, good fixes. Very jumbled flows. spider crab.	
4	43	1528	1	423592	5088310	Folded sheets over a fairly large area. Giving up heading to old worms.	
4	51	1526	91	423711	5088440	On bottom again to E looking for old worms. just near contact. Old lavas are more rubble and covered in sed and sponges	
4	53	1527	134	423725	5088442	Older lavas	R491-76
4	53	1526	132	423733	5088430	good fix, lavas are less coherent here, no floc, more sed and sponges. Some lobates as we go SE.	
4	57	1524	86	423744	5088369	rat tail in old lobates	

4	59	1525	89	423746	5088406	old lobates	R491-77
5	4	1524	89	423758	5088411	Mostly lobates with some large collapse in lobates. Not much relief. some folded sheets.	
5	6	1524	96	423768	5088408	found site with some tube worms, a little floc along lavas. good fixes. More	
5	7	1523	149	423785	5088410	old worm site	R491-78
5	8	1526	130	423784	5088418	stopped to pick up worms and small rock. Little vent fish. Clams at base of wall in sed.	
5	10	1526	137	423788	5088412	putting box down 3787 8414 good fix for bio grab	
5	11	1526	147	423786	5088415	grabbing worms	R491-79
5	13	1526	129	423784	5088419	Going in handheld BioBox. Sample of tubeworm grab.	Bio_R491-23
5	16	1526	130	423786	5088417	OOPS tube worms went into stb. BioBox.	
5	22	1526	142	423786	5088417	Opening handheld BioBox now for sampling.	
5	26	1526	141	423788	5088410	second sample at old worm site.	R491-80
5	26	1526	131	423785	5088421	sample was a tube worm grab at old worm site, put in handheld BioBox.	Bio_R491-24
5	39	1526	90	423785	5088417	sampling the sheetflow substrate from the same locality as the tube worms. Fairly high sed cover here. very thin brittle glass hard to recover with arm.	Rck_R491-25
5	44	1526	71	423784	5088419	sampling rock sheet flow R491-25	R491-81
5	45	1526	75	423784	5088417	two small pieces of the glass top of sheet flow are in with the tube worms.	
6	9	1526	119	423787	5088416	Picked up another large piece of old flow but BioBox fell over.	
6	32	1526	120	424627	5088470	still at same spot, having trouble closing lid on BioBox box. There is a bent hinge keeping it open.	
7	6	1527	101	423788	5088416	finally got the lid closed. Shrimp here too.	
7	2	1527	105	423786	5088418	Latched - finally.	R491-82
7	9	1527	102	423002	5086798	Heading 31 to Whiteout. Whiteout is 160 km north of Old Worms.	
7	17	1527	116	423786	5088422	Picking up the portable BioBox with the 7-function arm. Heading to Whiteout.	
7	22	1528	309	423724	5088450	Ship is repositioning towards Whiteout.	
7	29	1528	312	423695	5088464	good fix.	
7	38	1526	1	423657	5088492	3657 8492 good fix	
7	42	1527	2	423533	5088229	Still looking for Whiteout Vent	
7	57	1528	73	423660	5088542	We're at Whiteout - which Maia says is equal to Magnesia from last year.	
8	2	1532	9	423663	5088542	Okay we are at Whiteout Vent. We can see the lava bridge.	
8	4	1532	18	423663	5088539	Flushing into bottle #4	
8	6	1532	16	423663	5088541	3662 8541 good fix at Whiteout/Magnesia Vent	
8	7	1532	15	423642	5088605	good fix 3661, 8548 at Magnesia/Whiteout sitting right in front of where we sampled	
8	10	1532	18	423051	5089138	Preparing to sample white bacterial mat/sulfur into suction bottle #2.	SS-2_mat_ R491-26
8	14	1531	8	423668	5088554	We are suctioning the white stuff/orange stuff right near the vent.	
8	22	1532	58	423668	5088557	Still trying to suction at Whiteout/Magnesia	

8	25	1532	55	423668	5088558	Suction sample of bacterial mat at Whiteout/Magnesia	R491-83
8	26	1532	57	423668	5088561	Still suctioning Bottle #2.	
8	30	1532	56	423666	5088555	Moving to bottle #3 to fill it with the same sort of mat/orange stuff.	
8	31	1532	58	423663	5088546	Beginning to suction Bottle #3 Sample R491-27	SS-3_mat_R491-
8	35	1532	58	423660	5088542	Still suctioning into Bottle #3.	
8	37	1532	57	423671	5088549	Done suctioning into Bottle #3. Flushing and moving on.	
8	40	1532	56	423667	5088557	We're going to suction oxide at 10 m south of here.	
8	46	1527	185	423655	5088543	Steve is waxing poetic about oxides.	
8	46	1527	201	423642	5088551	We are still heading south to look for Steve's oxides.	
8	47	1527	245	423637	5088550	These are pretty bad fixes.	
8	49	1533	157	423647	5088543	Beautiful curtain drape feature of the lavas.	
8	51	1526	28	423648	5088547	Going to do some tether management.	
8	54	1493	155	423660	5088525	Slight electrical fault - still looking for the tether.	
8	57	1490	245	423659	5088522	We can see the cage now.	
8	57	1490	197	423659	5088522	Heading back down to the bottom to go to Oxide.	
8	59	1527	174	423662	5088519	Collapsed lava lake with pillars.	
9	0	1529	176	423654	5088533	Decent ROPOS fix.	
9	1	1528	178	423660	5088548	Proceeding south to Oxide.	
9	4	1529	177	423662	5088505	Relatively good fixes.	
9	7	1534	178	423686	5088443	We see an ophiuroid amidst the oxide stuff.	
9	7	1534	195	423678	5088470	Oxide site	R491-84
9	8	1534	186	423678	5088470	Sitting on some sheet flow right near the fluffy iron hydroxide orange stuff along fractures of the lava surface. Very thin glassy surface - it would break up very easily according to Steve. More little brittle stars.	
9	9	1534	184	423677	5088470	We are considering ourselves at Oxide.	
9	10	1533	169	423676	5088470	We are now looking for a place with shimmering water in order to do metal analysis on the hydroxy stuff and the water.	
9	17	1533	190	423667	5088460	iron oxide coating basalt mound	
9	17	1532	176	423667	5088460	small mound on covered with FeO	R491-85
9	19	1533	153	423680	5088459	FeO sampling site	R491-86
9	20	1533	158	423680	5088459	sampling iron oxide in jar 4 - contaminated sample since stuff from other flushes in the jar	SS-4_FeO_ R491-28
9	22	1533	173	423679	5088458	Suction of FeO into flushing bottle	R491-87
9	22	1533	170	423679	5088458	3679.1 8458 - OK fix	
9	24	1533	173	423687	5088432	Taking a look at Jar #4 to see what we got.	
9	25	1534	153	423713	5088570	Going to suction more oxides.	
9	26	1531	178	423666	5088465	x=3666 y=8465 good fix.	
9	29	1534	65	423022	5089140	Starting to suction again into Bottle #4.	
9	31	1534	64	423677	5088469	3677 8470 Okay fix	
9	32	1534	89	423671	5088461	3671 8461 good fix where we're trying to sit down and sample from.	
9	38	1534	129	423673	5088460	Still trying to suction the oxide stuff.	

9	48	1535	132	423667	5088444	We're trying to grab the suction hose.	
9	50	1535	134	423063	5089090	Still sampling. Checking out the wind velocity and gusts.	
9	57	1535	131	423055	5089095	Finishing up this suction of the oxide stuff.	
10	6	1490	184	423644	5088509	moving ship to west from Oxide (near Milky) to rejoin Imagenex line W4. We will do the northern end of W4 (going north), then move west and do line W7 (going south).	
10	28	1506	4	423429	5088546	Start of Imagenex line W4 (northern end). Ship heading north.	
11	11	1506	270	423428	5089203	End of Imagenex line W4 (northern end). Moving ship west to northern end of line W7.	
11	27	1506	179	423234	5089205	Start of Imagenex line W7 (northern end). Ship going south.	
14	45	1500	88	423247	5085989	End of line W7 (south end). Ship moving to south end of Imagenex line W6.	
15	5	1500	358	423311	5086038	Start Imagenex line W6 at 15:0 (at south end going north).	
16	22	1501	6	423305	5087098	End line W6 (south). Ship moving 60 m east to line W5 and will drive south.	
16	33	1498	189	423380	5087045	Start Imagenex line W5 (south end) ~16:27. Ship will be moving south along line.	
17	54	1498	191	423364	5086010	End of Imagenex line W5 (south end). End of dive (due to ground fault in gauge).	
18	9	1475	188	423054	5085770	ROV in the cage and coming up.	
						Dive 491 Dive Summary Follows	

						Dive 491 Dive Summary: ROPOS set a new record of 41 hrs 34 min total wet time, 38.5 hrs on bottom. Dive was terminated by choice (science done, ground fault pending).	
						Activities at Mkr-33, Cloud Vent (Mkr N6/21), Nascent Vent, Mkr-N41, Old Worm Site, Whiteout/Magnesia. Video/photo/Imagenex survey in area of Mkr-N4/Mkr-N6.	
						Deployments: BioOsmo at Mkr-33, MTR at Cloud, MTR at Nascent, MTR at Mkr-N41. Recoveries: FeOsmo and bactraps at Mkr-33 taken to elevator, Bactraps at Cloud taken to elevator, MTR's at Nascent and Mkr-N41 taken to elevator.	
						Sampling: Limpets and snails at Mkr-33, gastight at Cloud, Bacterial mat at Cloud, gastight at Nascent, suction sample over tubeworm bush, suction sample of bio at Nascent, tube worm grabs at Nascent and Mkr-N41 and Old Worms. Iron Oxide at Mkr-N44.	
						Basalt sample (pillow crust) at Old Worms, basalt sample (sheet surface) near Mkr-33. Imagenex line north to area of Whiteout/Magnesia. Suction sample at Oxide area, then on with long Imagenex survey on western edge of '98 flow.	

							Dive R492	
							Dive Plan: To map and sample '98 lava flow, SRZ. Sample Dying Vent, if still in existence, and any new vents we might see. Also possible suction sample for Tunncliffe of diatom/sediment on new lavas.	
							ROPOS Configuration :Suction Sampler, 5 and 7 function arms with claws, cameras, and BioBox with a marker in each side and 4 rock samplers in a bag	
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples	
8	55	0	128	422710	5089068	ROPOS launched and in water. Moderate seas. Keith nervous. Snap load on down umbilical.		
8	59	32	148	422710	5089068	ROPOS out of cage.		
10	37	1499	329	425223	5083490	ROPOS is at 150 m.		
10	39	1496	311	422938	5085206	We are going to the bottom.		
10	40	1527	171	424442	5085776	Bottom in sight.		
10	41	1533	198	423629	5085815	We can se ophiuroids on pillow lavas.		
10	45	1533	178	424126	5085844	took photo of bottom, pillows		
10	49	1531	236	424210	5085780	Making traverses trying to find contacts between old and new lava. Initial bottom was old lava.		
10	50	1531	307	424203	5085782	A number of holothorians heading NW back to line. Lobate flow.	photo 3	
10	52	1533	310	424186	5085799	Lots of cucumbers. A drain-out pit.		
10	53	1530	255	423823	5086232	Collapsed lava pit		
10	53	1529	251	423823	5086232	Lobate flow with holes drain out holes.		
10	54	1529	252	424168	5085788	Going SW in more extensive drainout area.	R492-1	
10	55	1530	250	424168	5085788	Speed is only .5 knot. More holothorian.		
10	55	1530	253	425264	5084278	Collapsed lava pit		
10	55	1530	250	425264	5084278	photo of drain area. 2x photo counter advanced but no flash was seen. fish.		
10	56	1530	252	424159	5085780	back to more solid lobate flows.	R492-2	
10	58	1530	250	424165	5085776	Ophiuroids. More solid lobate flow. Some pillows mixed with lobates.	photo 6	
10	59	1531	270	424142	5085771	Lobate lavas. Two flashes. Counter only advanced one		
11	0	1531	273	424136	5085771	Fish and two camera flashes again.		
11	1	1531	270	424135	5085769	Holothorians and fecal trails.	photo 7	
11	1	1531	273	424129	5085775	Holothorian. Start Highlight tape. Lobate flow with ophioids.	photo 8	
11	2	1530	271	424111	5085774	Double flash		
11	3	1530	270	424111	5085774		photo 12	
11	3	1530	271	424104	5085772	Young lava flows	photo 13	
11	3	1530	258	424104	5085772	contact with new flow . Clean looking lava. mats not present. less material	photo 14	
11	4	1530	257	424091	5085768	Pillow lavas with some brittle stars	R492-5	
11	3	1530	259	424098	5085771	younger lavas. Ophioids on with brittle stars. Density down from older flow. Lobate flow, flatter with small pockets of sediments.	photo 15	

11	4	1530	255	424078	5085762	Ophiods.	R492-6
11	5	1529	257	424078	5085762	Drainout pit	photo 16
11	5	1529	257	424078	5085762	Drain out area	
11	5	1529	240	424070	5085759	Skate or ray swimming away	R492-7
11	5	1529	244	424070	5085759	a ray going away.	photo 17
11	5	1529	259	424062	5085755	young flow glassy especially on the fronts. speed .5 knot	R492-8
11	6	1529	257	424044	5085744	young lobate flows. coming at us. flow direction was towards us.	photo 18
11	6	1529	257	424034	5085739	Solid lobates close up	
11	7	1529	256	424030	5085740	close up of lavas.	
11	7	1529	260	424030	5085740	Close up of some lavas	
11	8	1529	258	424013	5085734	thin lava about 1 meter thick.	photo 19
11	9	1529	259	423996	5085728	so far we have come about 20 m along the 1.2 km line still in young lava, pillowy lobate, probably thin	R492-9
11	10	1528	262	423980	5085723	edge of a drain out area	
11	10	1528	255	423980	5085723	Edge of drained out pit	
11	10	1528	255	423980	5085723	drain out	
11	11	1529	260	423540	5085878	shrimp. a little yellow sed at the bottom of lobates	R492-10
11	11	1528	257	423968	5085718	back to more solid flow.	photo 20
11	11	1529	256	423963	5085716	small pockets of sediment but not as much as last year.	
11	13	1529	258	423936	5085703	close up of lavas.	
11	13	1529	256	424490	5086026	Broken up lavas	
11	13	1529	258	424490	5086026	becoming more broken into drain	photo 21
11	14	1528	256	424490	5086026	Skylight of drained out area	R492-12
11	14	1528	256	424490	5086026	skylight couple meter thick	
11	14	1529	256	424262	5085771	in a major collapse area	R492-13
11	15	1530	255	423946	5085716	broken roof material	photo 2
11	15	1528	257	423916	5085690	A fish	
11	15	1528	258	423916	5085690	in drain out, broken material w/ fish	
11	15	1529	256	423933	5085712	broken pohoi hoi	R492-14
11	15	1530	257	424306	5085995	broken curtain folded	photo 23
11	16	1530	258	423891	5085682	drain out area	
11	16	1529	256	423886	5085686	drop of into a pit. shrimp.	photo 24
11	17	1530	257	423870	5085678	drain out area	photo 25
11	17	1530	253	423853	5085670	collapse sheets. More broken, sharp changes in lava morphology . complex flow	
11	18	1530	256	423844	5085667	Jumbled ropy lava	photo 26
11	18	1529	252	423829	5085789	jumbled flow with lots of collapse area	
11	19	1529	257	423826	5085660	fish and complex lavas in	R492-17
11	19	1530	256	423832	5085670	Rat tail fish	
11	19	1530	248	423832	5085670	lava spire w/ glass	photo 27
11	19	1529	265	423832	5085670	broken up area, jumbled flow.	R492-18
11	20	1529	260	423826	5085667	sometimes coherent ropes, other times more broken up. going over ridges.	photo 28
11	20	1530	252	423806	5085663	close up of jumbled flow	

11	21	1529	256	423797	5085662	over a ridge into a deeper area.	
11	21	1530	243	423740	5085939	we are in line with the deepest	photo 29
11	22	1530	257	423777	5085660	complex terrain jumbled broken	
11	23	1532	257	423761	5085658	mostly random chunks of angular lava, piled up	
11	24	1532	259	423753	5085654	hydrothermal sediments	
11	24	1530	257	423753	5085654	Scary looking rat tail	
11	24	1529	260	423750	5085652	yellow sediment, over top of ridge, lineated flows	photo 30
11	25	1531	258	423728	5085644	ridges are several meters high, last down drop was 4-5 m	R492-19
11	25	1532	258	423727	5085642	lobate surface	
11	26	1531	258	423721	5085638	jumbled again, don't see many animals in here	
11	26	1530	257	423710	5085634	blocks of lava on ridge, on the other side drained out lobates with circular ?	
11	27	1529	257	423696	5085629	lobates	
11	27	1529	257	423696	5085629	Collapsed lava pits	photo 31
11	27	1529	256	423696	5085629	back into lobate flows again	photo 32
11	27	1530	257	423682	5085623	very glassy lobate	R492-20
11	28	1529	261	423674	5085618	Window of old lava surrounded by new lava	
11	28	1529	258	423682	5085623	window of older lava indicating thin ?	
11	28	1528	262	423674	5085618	same	R492-21
11	28	1527	264	423674	5085617	lobate	photo 3
11	29	1524	245	423689	5085615	highlights off, lost controls, joystick is not functioning.	photo 34
11	29	1522	253	423711	5085634	stopping the ship	photo 35
11	45					Video off.	
12	25	1496	298	422940	5084868	testing repairs that were made to the joystick	
12	27	1525	260	422940	5084868	back on the bottom. Video back on.	
12	28	1527	260	422407	5084350	back to the lobate flow	
12	28	1528	264	423052	5084936	solid glassy lobate lavas.	
12	29	1529	261	423532	5085556	good sub fix, to SW of ship	
12	30	1529	259	423565	5085596	shallow drained out area, collapse material	
12	31	1529	249	423023	5085025	collapse material	
12	31	1529	261	422830	5084834	small spire, back on the solid lobate surface of the flow.	
12	33	1524	259	423496	5085535	good fix	photo 36
12	33	1529	259	423496	5085533	lobate lavas w/ some sediment , on glassy lobes. fish - lots of big ones	
12	33	1529	259	423496	5085533	Pillow lavas	
12	34	1530	260	423583	5085692	close up of lobate surface	
12	34	1528	252	423481	5085530	somewhat more sediment, but not many organisms, shallow drain out area, back to lobate area	R492-22
12	35	1529	258	423468	5085528	lobate surface	photo 37
12	36	1530	260	423466	5085528	Lobate lavas	
12	36	1530	258	423482	5085547	lot of small pockets of sediment, holothorian, more sediment	photo 38
12	37	1529	261	423444	5085531	another holothorian	R492-23
12	37	1529	261	423444	5085531	another holothorian	
12	37	1530	261	423438	5085531	large pillow lavas	
12	37	1530	256	423429	5085531	lobates w/ some pillow lavas	

12	38	1531	261	423422	5085523	Cool lavas	
12	39	1530	258	423413	5085521	appears to be an older surface underneath, back to solid flow	photo 39
12	39	1531	255	423405	5085520	surface	R492-24
12	41	1532	258	423408	5084952	more sediment, local pocket, lavas glassy, not a lot of biology	
12	41	1533	254	423377	5085517	Lavas with sediment in cracks	photo 40
12	41	1533	264	423344	5085738	surface	
12	42	1532	257	423344	5085738	flatter with more sediment pockets, looking older, holothorian	R492-26
12	42	1532	257	423536	5085638	sediment pocket	photo 41
12	42	1532	260	423365	5085513	quick look at gauges	
12	43	1532	268	423359	5085508	possible hydrothermal area, a call for stopping the ROV while looking at gauges, so as not to miss hydrothermal activity	photo 42
12	44	1533	260	423355	5085508	possible bacterial mat, pockets	
12	44	1533	258	423358	5085498	Little white patches of mat on lavas	
12	44	1533	257	423349	5085504	A vent we've just found!	photo 43
12	44	1532	257	423358	5085498	bacterial mat, swimming worm. stop the ship, warm water.	R492-29
12	45	1534	244	423343	5085503	vent	R492-30
12	45	1534	245	423343	5085503	Vent fish	photo 43
12	45	1534	245	423343	5085503	photo of vent fish	photo 45
12	45	1534	245	423343	5085503	Bacterial mat and flow	R492-31
12	46	1534	245	423341	5085504	fixes good	photo 46
12	46	1534	244	423342	5085503	bacterial mat on the edge of pit, warm water and worms	R492-32
12	47	1534	247	423338	5085501	40m s of Mkr-113	
12	48	1534	247	423340	5085504	good fix, highlights	
12	48	1534	272	423275	5085430	bag creatures	
12	49	1534	10	423337	5085506	highlights off for repair of joystick	
12	50	1534	36	422850	5084915	surface near the venting area	photo
12	51	1534	56	423341	5085504	worm dance	
13	1	1534	54	423346	5085505	still repairing joystick	photo 50
13	9	1534	226	423338	5085502	still fixing joystick,	
13	10	1533	204	423343	5085504	video on, joystick fixed, good nav	
13	10	1534	15	423344	5085505	Joystick Vent	
13	10	1533	49	423344	5085505	vent has been named , 'joystick' vent	
13	11	1535	53	423342	5085504	hole with lots of venting.	R492-34
13	11	1535	50	423342	5085507	tube worms just below ROPOS, bag creature, scale worms, tube worms	
13	13	1535	47	423338	5085502	vent is similar to those at the north end, lots of flock, temps are about 1.5 degrees too cold.	photo 51
13	14	1535	48	423340	5085506	3 degree area, lots of white flock coming out	
13	14	1534	45	423341	5085506	highlights on, going to do a short survey here	
13	15	1535	46	423340	5085509	vent appears to be in new flow	
13	15	1535	48	423341	5085505	looking down into deep pit, looks somewhat like whiteout vent, but not as large particles, lots of water	
13	16	1534	49	423339	5085502	inside vent	
13	17	1532	74	423341	5085508	Joystick Vent	

13	16	1532	90	423337	5085499	trying heading 10 deg east of north to look for	photo 53
13	17	1534	92	423341	5085508	worms and hole	R492-37
13	18	1533	80	423339	5085508	Joystick Vent	
13	17	1533	74	423341	5085508	roof collapsed into pit, ROPOS is facing NE, line of venting, grayish milky water	photo 54
13	18	1533	112	423339	5085508	of bottom	R492-38
13	19	1533	141	423336	5085512	Joystick Vent	
13	19	1533	141	423336	5085512	lots of scale worms swimming in the water, flock from a small hole	photo 5
13	20	1533	135	423337	5085512	Joystick Vent	R492-39
13	20	1533	143	423337	5085512	continuing to follow pit to NE , we are looking to the SE	photo 56
13	21	1534	120	423339	5085518	jumbled flow,	R49240
13	21	1534	120	423339	5085518	Jumbled flow with bacterial mat near Joystick Vent	
13	22	1531	74	424174	5085502	heading back to the main vent and maybe a little south	photo 57
13	23	1530	168	423347	5085523	looks like a little fracture, NE trend, that has collapsed	R492-41
13	25	1534	92	423339	5085508	picture of the hole	
13	25	1534	98	423339	5085508	fixes good	
13	25	1534	95	423340	5085504	edge of pit	photo 58
13	28	1534	136	423327	5085489	Stirred up floc near Joystick Vent	
13	28	1533	167	423327	5085489	still moving SW, lots of flock venting	photo 59
13	29	1535	157	423337	5085495	crab, vent fish, material in water may be stirred up by ROPOS	R492-44
13	30	1535	174	423336	5085492	highlights off	
13	30	1534	172	423336	5085492	driving a little SW along the line	
13	32	1531	72	423337	5085486	at the edge of the depression. looking around for anything else	
13	34	1532	133	423339	5085477	venting appears to have run out, not the best fixes at this point.	
13	35	1532	127	423342	5085467	moving a little south and west, then return to joystick vent	
13	36	1534	196	423339	5085463	pillars in lobate flows, some with bacterial mat	
13	37	1533	195	423324	5085455	Top of a pillar	
13	37	1533	197	423324	5085455	photo of top of large pillar, staining on top, possible tube worms, confirmed tube worms.	
13	38	1533	183	423320	5085462	Some sort of worm/mat stuff on top of a new lava pillar	R492-45
13	39	1533	170	423322	5085455	view of top of pillar, probably to hard to sample on top of the pillar. decided to wait for a better sample	photo 60
13	39	1533	169	423321	5085456	More gunk on top of this pillar	R492-46
13	40	1532	189	423321	5085456	pillars conduits for vent fluids since it had tube worms on it	
13	40	1530	185	423321	5085454	SW 5 m of joystick vent	R492-47
13	42	1535	355	423308	5085463	may have stop soon due to weather, heading back to pit to attempt a sample	
13	44	1534	18	422832	5085037	large spires near the pit	
13	44	1530	54	422673	5084771	no good fixes now	
13	47	1532	62	423327	5085506	back at the vent area	
13	50	1534	40	423341	5085507	highlight on beta	
13	50	1534	44	423341	5085507	Rock with tube worms at Joystick	
13	50	1534	38	423340	5085507	Rock with tube worms at Joystick Vent	
13	53	1534	45	423338	5085504	decided to suction worm first , into J1 64 micron	R492-48

13	55	1535	40	423342	5085507	bag creatures at the joystick vent	R492-49
13	56	1535	38	423339	5085505	suction sampling worms	
13	58	1534	34	423271	5085640	suctioning tube worm	photo 62
13	59	1535	39	423338	5085505	continuing to suction sample	SS-j1_bio _R492-1
14	1	1535	29	423341	5085507	continuing to sample worms and bag creatures	
14	3	1534	15	423337	5085501	ROPOS lifted off, ship is losing heading stop sampling	
14	6	1533	255	423332	5085497	looking for a good place to put the marker	
14	11	1527	92	423332	5085499	still looking around for the vent	
14	14	1531	85	423345	5085515	Located sampling site.	
14	15	1533	326	423342	5085510	sitting on the bottom, deploying the Mkr-42	
14	17	1533	356	423321	5085488	marker 42deployed.	
14	18	1532	360	423344	5085506	good fix at joystick vent , marker 42	
14	19	1532	358	423343	5085506	Mkr-42 at Joystick Vent	
14	20	1532	14	423343	5085505	going back to sample area to continue suction sampling in J1	R492-51
14	23	1534	104	423340	5085508	Sitting at the venting orifice where we got the odd-looking worms (nemerteans?) and getting ready to suction more for fauna.	
14	25	1534	103	423340	5085509	good fix: 3340x 5508y. Suctioning Part Deux. R492-1.	
14	26	1534	97	422935	5085145	More red worms on the rock below where we were suctioning. Trying to get gastropods, but failing, so going in for more of these worms.	
14	37	1534	77	423339	5085503	scanning area, short camera survey	R492-52
14	37	1535	68	422621	5084739	Joystick Vent	
14	38	1535	68	423291	5085462	Joystick Vent	
14	38	1534	59	423291	5085462	getting highlights of joystick vent	R492-55
14	39	1535	83	423337	5085508	moving up on top to look for a rock sampling area	R492-56
14	41	1534	72	423341	5085509	stopping highlights	
14	43	1533	24	423344	5085510	VCR tape change	
14	43	1532	20	423284	5085119	going to attempt a modified rock corer, hand rock corer, ROPOS-core. up on top, near marker	
14	45	1533	25	423344	5085507	picking up yellow core sampler	
14	47	1533	27	423339	5085503	Unused core with wax. Yellow	
14	47	1533	27	423346	5085509	preparing to take core sample, grabbing sampler with 5 function arm, now grabbing with 7 function arm	
14	52	1533	26	423341	5085504	Rock core success! Just went in for a second hit - got even more! Took sample a few meters southwest of marker 42 - heading 030.	R49258
14	53	1533	31	423285	5085643	Core sample after collection. Yellow corer Joy Stick Vent	Rck_core_ R492-2
14	55	1532	17	423346	5085513	x=3342, y=4405 - good fix for rock core R492-2.	
14	57	1532	23	423344	5085507	Putting rock core in sample basket on front of BioBox.	R492-59
14	58	1532	23	422968	5085238	The rock core R492-2 was orange.	
14	58	1532	23	422968	5085238	Going in to suction sample for C. Moyer into jar #6. Note: two of the long, skinny nemertean looking worms got sucked into the flushing jar from the first suction sample (Jar J1, R492-1).	
15	4	1534	51	423278	5085451	Suctioning bag creatures and mat for Moyer into Jar #6.	

15	14	1534	42	423343	5085515	Still suctioning. A few drops of hydraulic fluid in view.	
15	21	1534	35	423233	5085498	Finished suctioning jar #6, moving to jar #8.	SS-6_mat_ R492-3
15	23	1534	40	423266	5085838	Positioning to suction the 'fuzzy rocks' into jar #8 for C. Moyer. Stopping for a moment to watch hydraulic fluid leak out of 5-function arm.	
15	31	1533	330	423345	5085508	Starting to suction into Jar #8.	
15	38	1532	91	423325	5085788	Finished suctioning some white fuzzy stuff of the rock; now looking around for another place to suction.	
15	42	1534	125	423131	5085308	Suctioning more bags, mat and worms into bottle #8.	SS-8_mat_ R492-4
15	47	1534	114	423338	5085511	Suction sample bottle #8 from Joystick vent (Mkr 42)	
15	56	1534	124	423332	5085508	End of suctioning into Jar #8.	
15	59	1533	149	423354	5085530	Heading back to the cage for tether management.	R492-60
16	0	1535	263	423792	5085753	Heading southwest along original transect towards 'Dying Vent'. Lineated sheet flows. Fair amount of sediment in cracks.	
16	2	1535	251	423291	5085408	Jumbled, folded flow now, moving into lineated, ropy sheet flows again.	
16	5	1534	299	423281	5085722	A collapsed area with lobates on the floor. A cool pillar with square windows. A collapsed wall.	
16	7	1533	209	423278	5085481	Wall with Lava Pillar just west of Joystick Vent.	
16	7	1533	210	423278	5085481	Same collapsed area, wall with a lava pillar. Top of the pillar has bacterial mats.	63 photo 64 photo
16	11	1532	259	423275	5085479	Still in collapsed area with pillars and ridges. Floor is littered with collapsed plates and folded sheets. Photo of hole in the top of the pillar.	R492-61
16	16	1532	260	423226	5085458	Short pillars with top.	65 photo 66 photo
16	16	1532	258	423226	5085458	Jumbled flow. Looks like short pillows on top of lobates.	photo 68 photo 69
16	17	1533	262	423214	5085457	Lobate roof supported by a thin pillar - can see hole in top of pillar.	R492-62
16	17	1533	259	423210	5085455	Lobate roof supported by thin pillar. SW(250) of Joystick	photo 70
16	18	1532	258	423199	5085452	Ophuroids and fecal trails. Lobates on top of pillar. Holothurian and fecal trails.	photo 71
16	19	1532	260	423193	5085451	Jumbled flow and lobates next to each other.	R492-63
16	20	1533	259	423178	5085443	Well formed glassy lobates. Looks like a contact. We think we were on old lavas for a while and came onto new lavas. The new flow is probably getting thin in this area. Old lavas with lots of sponges, ophuroids, holothurian.	photo 72 photo 73
16	22	1534	268	423162	5085445	Mixture of old and new lavas. Sea fan (gorgonian). Photo of lobate flow.	
16	25	1533	255	423117	5085401	Lobate flow. Sea star and brittle stars. Old flow underneath and new bulbous, glassy flow on top. Photo of contact.	
16	28	1534	256	423083	5085388	Lots of sponges, brittle stars, holothurians on older lobate flows. Sponge city".	Photo 75
16	29	1534	257	423020	5084913	Older flow. Observe sponges (white blobs) on the lava. S. west of Joystick.	Photo
16	31	1534	258	423036	5085365	A little bit of bacterial mat in-between lobate flows. Tons of tiny sponges.	Photo 77 Photo 78

16	33	1535	258	423039	5085379	Crab and clam site.	R492-64
16	32	1533	257	422850	5084756	Tube worms and clams! Stopping to get a suction sample. x=3000, y=5350 approximate location.	
16	47	1536	294	422625	5084986	Suction sampling into bottle #7 for clams and background fauna.	R492-65
16	50	1536	290	423015	5085362	x=423016, y=5085362 - good fix for this sample location.	Photo 80 Photo 81
16	57	1535	274	422970	5085316	Just suctioned another holothurian into bottle #7.	SS7_bio_R492-5
17	2	1536	256	423013	5085361	Clams, tubeworms and collapsed lobate.	
17	5	1535	270	422923	5085293	Clam sampling site, 'Coquille'. Temperature up by 0.2 degrees.	
17	13	1535	286	423011	5085363	Finished suctioning into bottle #7. Going to take a look around this 'Coquille area'. Tube worm tufts and batches of clams in lobate depressions. On old lavas - holothurians too.	photo 83
17	16	1536	179	422988	5085342	Large drainout area. Clams in cracks with tube worms.	photo 84
17	17	1535	140	422984	5085345	Clams in crack at Coquille vent area.	Photo 85 Photo 86
17	17	1535	214	422598	5084950	Tube worm clump	Photo 87 Photo 88
17	19	1535	42	422979	5085326	Tube worm clumps. Coquilles Site	R492-71
17	18	1535	216	422771	5085104	Coquilles area.	R492-72
17	20	1534	46	422733	5085109	More tube worm tufts.	R492-73
17	20	1535	72	422733	5085109	Tube worm site. Christian's clam area.	Photo 89 Photo 90
17	21	1536	11	422709	5085088	Surveying around Coquilles Vent. Increasing hydrothermal activity at this site - bacteria, shimmering water, clams, snails, tube worm bushes, etc.	Photo 93
17	25	1536	8	423043	5085390	Tons of limpets in with the tubeworms.	R492-74
17	27	1536	7	422994	5085368	Maia's Sample-Coquille- 350 SW of Joystick.	
17	28	1536	9	422992	5085367	x=2291, y=5365 is new location for Coquille vent area. Maia is about to sample a tube worm bush in this old venting area.	
17	30	1536	23	422587	5085074	Sample collection at Coquille.	R492-75
17	30	1536	24	422587	5085074	Sampling tube worm bush.	Bio_R492-6
17	32	1536	303	422746	5085115	Tube worm grab into starboard BioBox.	R492-77
17	45	1536	0	422903	5085268	Suction sample in the middle of a tube worm bush at Coquille. Into bottle J4.	
17	54	1536	3	422746	5085164	Done with suctioning into J4.	Photo 96 Photo 97
17	57	1535	354	422961	5085328	Going around the field to get an idea of the extent of venting - going to the west right now.	SS-j4_bio_R492-7
17	58	1533	120	423026	5085392	Heading southeast towards Dying Vent.	
17	59	1536	140	423026	5085392	Still flying over lobates with TW bushes.	
18	0	1534	137	422978	5085315	Clams, crab, still on old lava.	
18	2	1535	149	422997	5085311	Crab photo	Photo 98 Photo 99
18	4	1535	149	422492	5084940	Contact of old and new lavas.	
18	5	1534	149	423019	5085328	good fix for the contact. Billowy, tubular new flow and older, flatter flow.	Photo 10

18	7	1535	139	423022	5085323	Old and new lava jumbled together.	
18	8	1536	140	423007	5085301	Contact photo.	Photo 101
18	9	1534	116	423049	5085356	New lobate lavas.	Photo 102
18	15	1534	113	423050	5085293	Still on new lavas - lobate flow. Some holothurians and sediment in the cracks.	Photo 103
18	18	1534	130	423070	5085283	New tubular lobes.	Photo 104
18	21	1532	119	423064	5085270	Sulfide staining in cracks. Lots on sponges. In a collapsed structure.	
18	23	1532	116	423084	5085267	Lavas with some staining.	Photo 105
18	24	1532	120	423080	5085320	Jumbled sheets, collapsed area, lava pillars with arches.	
18	30	1534	110	423106	5085304	Sponges found on lava flow. Near dying vent where new and old ?	Photo 106
18	31	1534	95	423299	5085477	New and old flow/Old with sponges. Near Dying Vent.	Photo 107
18	28	1533	79	423091	5085280	Contact again. Old lavas covered with sponges and new lobate flows. Settling down to get a couple rock samples of new and old lava.	R49278
18	32	1534	78	423097	5085292	Trying to sample lava with 7-function claw. Lava seems too friable? to pick up with claw. Got a piece of the new lava flow - put into the starboard BioBox. Fix is 3080, 5277.	R492-79
18	42	1534	57	423094	5085289	Taking a rock core (black corer) of the old flow at the same contact point. The core is contaminated, so the sample should come from the rope side of the corer (no contamination on upper half).	Photo 108 Photo 109
18	44	1534	55	423072	5085267	Black core sampler/Rope side before sampling	Rck_R492-8
18	47	1534	52	422429	5084639	Forget the above contamination comment - ROPOS guys managed to swipe off the contamination (rock flecks from somewhere unknown). good fix, 3076,5272. Going in for the rock core.	Rck_core_ R492-9 Photo 10
18	50	1534	54	423096	5085291	Black corer after cleaning.	R492-80
18	51	1534	76	423078	5085273	Another good fix for contact/rock core location: 3093, 5284.	
18	57	1535	77	423093	5085282	Sample rck_R492-9 is in the purse". Got a good bunch of glass."	R492-81
19	4	1534	111	423075	5085264	Continuing traverse in SE direction at 0.5 kt.	
19	6	1533	121	423088	5085243	Stopped while ship changes its hdg so as not to back over the cage's cable.	
19	11	1532	123	423120	5085265	good fix, says Maia.	
19	17	1533	129	423106	5085258	Ship hdging changed and now continuing along track.	
19	19	1533	133	422824	5085068	Accumulation of yellow sediment in collapsed pit.	Photo 111-112
19	20	1534	115	423105	5085233	Pillar holding up lava roof.	
19	21	1534	104	422388	5085546	Lobate flow with sediment around base.	
19	22	1532	109	423152	5085255	Good fix.	R492-82
19	22	1534	116	423159	5085256	good fix.	Photo 113
19	23	1537	110	423170	5085254	Jumbled sheet flow at bottom of ~4 m drainout depression.	
19	24	1534	109	422930	5085065	bathtub rings on edge of drainout area	
19	24	1534	112	422930	5085065	bathtub rings on side of lava drainout.	Photo 14
19	26	1533	103	423200	5085233	Increasing amount of particulates in water column.	R492-83
19	28	1534	100	423213	5085229	Crab on top of spire at edge of drainout.	Photo 115 Photo 116
19	28	1533	108	422833	5084944	Very deep drainout (4m).	
19	29	1537	107	423874	5085578	Bottom of 4m deep drainout.	Photo 117
19	30	1535	111	423253	5085231	thin spire at bottom of 4m lava lake	

19	30	1535	105	423253	5085231	Tall thin lava spire.	Photo 118
19	31	1534	122	422874	5084938	Edge of drainout.	R492-85
19	32	1534	128	423273	5085229	good fix. Some bacterial mat. Cloudy. Must be near a vent.	Photo 119
19	33	1535	122	423507	5085304	spire with mat on it	Photo 120
19	33	1535	122	423507	5085304	Bacterial mat on side of drainout.	Photo 121
19	34	1535	80	423277	5085216	close-up on white stuff	R492-86
							Photo 122
19	34	1536	76	423274	5085212	Edge of drainout.	Photo 123
19	35	1535	74	422937	5085160	limpets on top of pillar	R492-87
19	37	1534	191	423198	5085121	chunks and tube worms	Photo 124
19	37	1534	194	423198	5085121	weak venting and animals.	R492-88
19	38	1534	162	423274	5085205	good fix: 3274, 5205. Looking around this new vent. Some reddish floc.	R492-89
19	41	1533	211	423284	5085214	big clump of tube worms at Bag City	Photo 126
19	41	1533	209	423284	5085214	Good fix: 3284, 5214.	Photo 128
19	46	1535	220	423267	5085201	Deployed Mkr 36 at Bag City Vent	R492-90
						Tube worm grab at Bag City vent into port BioBox. Difficulty getting them all in!	
19	48	1535	206	423265	5085200		
19	54	1535	206	423281	5085209	good fix. Still stuffing worms.	
						Beta highlights video changed at 19:52. Vereena's video changed at 19:55. Still stuffing worms.	Bio_R492-10
19	59	1535	213	423279	5085208		
20	7	1535	216	423279	5085208	At last, the worms are stuffed. Removing some that are sticking out so as not to obscure the color video.	
20	12	1535	211	423281	5085208	Taking gas tight bottle sample at Bag City Vent where tube worms were just sampled.	gtb_dfl_R492-11
20	20	1535	221	423438	5085215	suction sample about the same spot as gtb 2	
						Suction sample of vent fluid in jar J3 in same clump of tube worms that were sampled here at Bag City. Maximum temperature (yes, we now have this capability) is 2C. Stopped sampling when intake and outlet were same temperature.	SS-j3_dfl_R492-12
20	16	1535	214	423281	5085208		
20	25	1535	222	423401	5085180	sort of a focused flow	R492-91
						Nice view of tube worm bunch from where we just sampled. Finished with the fluid sample in J3, now we are going to look around for some iron oxides to sample.	
20	23	1535	222	423470	5085250		
20	29	1536	179	423654	5085452	Trying to suction sample red oxides into bottle #4 (flushing jar); can't really reach it, just got a little bit - going to try another spot.	R492-92
						Looking around 'Bag City' - there don't seem to be any more red oxide patches around. Time out to do some tether management - going back to the cage.	SS-j4_FeO_R492-13
20	37	1530	327	423404	5085215		
						Going back to the bottom to continue our track heading southeast across new lavas.	
20	41	1520	107	423002	5085030		
20	42	1535	114	423010	5085066	Back to bottom to continue SE along traverse.	
20	46	1534	127	423367	5085182	Contact between two lobate flows. Both appear to be old.	
20	47	1536	118	423369	5085194	Lobate flow.	
20	48	1536	116	423065	5084862	Pillows.	

20	49	1536	112	423316	5085163	Pillow.	Photo 131
20	56	1534	117	423464	5085170	No fixes but ship has moved ~20 m SE of Bag City.	
20	57	1536	120	423258	5084999	New (1998) lava.	R492-93
20	57	1536	122	423394	5084736	Pillowed 1998 lava. No fixes.	
20	59	1535	134	423478	5085123	On 1998 lava but can still see windows of old lava as we proceed SE.	R492-94
21	1	1537	118	423470	5085226	Definitely on older lava. (Bill says intermediate age)	Photo 132
21	8	1539	111	424592	5085054	Sampled lava rubble. (intermediate age) x=423281 y=5085209	
21	9	1539	102	424592	5085054	Rubble basalt. Old flow?	
21	15	1539	328	423693	5085125	Lost sample out of the 7-function claw. Couldn't put into BioBox for fear of losing of worms out of the left compartment and confusion with sample already in the right compartment. Doing a wax stab instead. Purple sampler, put in Perfit's purse.	Rck_core _R492-14 Photo 13
21	37	1514	154	422978	5084462	ROPOS returning to cage for recovery.	
21	38	1490	171	422978	5084462	ROPOS's cage.	
21	45	1373	131	423087	5084932	Winching cage to surface with ROPOS outside to give Craig some driving experience.	R492-95
22	24	405	289	423645	5085308	2324 GMT ROPOS on deck	R492-100
22	24	405	289	423645	5085308	Dive Summary next page:	

							Dive Summary R492: Dive R492 was a geology reconnaissance dive of the '98 lava flow on the SRZ, south of the area surveyed in '98. The eastern and western limits of the '98 flow were surveyed, and several targets were added to aid in improving the lava flow	
22	24	405	289	423645	5085308		outline. Biological and suction samples were taken, as well as many rock samples. A large ventfield was discovered on the east side of the '98 flow in older lava. The vent was named Coquille. Dying Vent was not seen, but Bag City Vent was discovered.	

UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
Dive R493							
Dive Plan: Dive R493 is an extension of Dive R492, which was halted to recover the elevator. Again the objective is to map the 1998 lave flow from the caldera down to 45deg 52min North.							
The earthquake swarms extended south to that location but the only seafloor information is from Dive R465 ('98), which mapped a lava flow at the site of the SeaBeam anomaly at 45deg 52min North.							
Vents discovered along the way will be sampled. On Dive R492 new vents were discovered at the western edge of the contact between old and new lavas.							
ROPOS Configuration : Suction Sampler, 5 and 7 function arms with claws, cameras, and BioBox							
Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.							
3	30					ROPOS in water	
6	4	1052	320	422617	5083763	ROPOS is continuing to go down. Started down around 03:30 UTC	
6	35	1541	188	422747	5084862	Just above bottom. Lobate flows below.	
6	38	1543	242	421952	5084933	lobate new flow, but some larger lobes appear to be older. This may be a function of their rougher texture that collects sed. more readily. Hard to tell. Probably all older flow. Larger lobes are transitional to pillows with good striations on surface.	
6	41	1544	247	422736	5084866	good fix here in Older lavas. These all have brittle stars all over them, moderate sed between lobes and pillows.	
6	40	1545	250	421952	5084933	Older Lava West of contact, close-up of surface showing typical sessile biota including echinoids	R493-1
6	44	1543	83	422745	5084867	Mix of pillows and tubular flows that appear much glassier but are also old. Rat tail fish. Photo 1 old pillows	Photo 1
6	45	1544	90	422777	5084887		Photo 2
6	45	1544	82	422777	5084887	Pillow in older lava	R493-2
6	46	1544	81	422777	5084887	Older pillows. west of contact	Pic 3
6	47	1543	78	422793	5084897	good fix. Still in old lavas	
6	48	1543	78	422339	5085300	Brittle stars on pillows	photo 4
6	53	1541	86	422789	5084891	continuing in mixed older pillows and tubular flows, lots of biology on surface, small amount of sed inter pillow.	Photo 5
6	59	1540	80	422834	5084901	going east, a few bigger pillows, big fish. still in older lavas with brittle stars and sponges. Switched from local to UTC time on SIT overlay	
7	2	1540	124	422851	5084883	Contact new lava flow	R493-3
7	4	1540	150	422890	5084899	New Lava	R493-4
7	3	1539	154	422890	5084899	Contact between new and old. Young flow is fairly sed free very tubular and glassy, a few brittle stars, slight sed in cracks. Stopping for a sample	
7	9	1538	139	422894	5084894	Surface of young flow near the contact. Station here to get sample.	R493-5

7	12	1541	139	422527	5084408	Right at contact, more massive old flows.	Picture 8
7	21	1541	90	422890	5084909	Gorgonian on older flow	R493-6
7	23	1541	67	422883	5084910	sample of old flow	R493-7
7	34	1541	74	422882	5084905	x=42282 y=5084905 good fix. Can't sample glassy old lavas so we will take a core. Using orange core.	
7	37	1541	46	422880	5084907	grabbing at contact W5	R493-8
7	37	1541	44	422880	5084907	stbd rock core (orange)-getting ready	R493-9
7	39	1541	18	422879	5084904	Taking wax core	R493-10
7	38	1541	45	422880	5084907	Taking a rock core with orange corer at ContactW5. got a few pieces of old lava x=422880, y=5084908	Rck_core_R493-1
7	48	1540	40	422880	5084907	Heading east after sampling	
7	49	1540	80	422886	5084910		photo
7	50	1540	79	422886	5084910	New lava	R493-11
7	50	1540	78	422896	5084916	New lava - Beautiful lava drip feature	R493-12
7	50	1540	81	422896	5084916	Drip	R493-13
7	51	1540	357	422782	5084764	contact of new and old. sampling of same as drip sample	Photo 15
7	52	1540	353	424147	5085837	picking up piece of rock	R493-14
7	53	1540	352	422904	5084921	good fix while sampling	
7	56	1540	17	422891	5084910		R493-15
7	57	1540	11	422891	5084911	small piece of new flow put in stb. bio box x=422899 y=5084917	Rck_R493-2
7	58	1540	1	422891	5084911		R493-16
7	59	1538	96	422891	5084911	starting to head east again in young flows.	Photo 16
8	0	1538	96	422928	5084938	some lobates with collapse, meter or so thick here	
8	1	1538	93	422912	5084897	back into smaller glassy tubes and lobes.	
8	5	1537	102	422912	5084872	Going back to the bottom - sheet flows, glassy, drained out area.	
8	5	1540	101	422905	5084877	Big crab and a big starfish	
8	5	1540	101	422905	5084877	Crab and sea star	R493-17
8	7	1540	98	422907	5084824	Picture of young lavas, beginning to see some sediments under the lobes	Photo-18
8	8	1539	102	422910	5084813	Something's up with our headings? We're stopping.	
8	10	1539	94	422935	5084879	Sediment in the bottom of the pits	Photo-19
8	11	1538	89	422976	5084898	Pillow lavas and big fish	Photo-20
8	11	1535	101	421318	5086936	Extensive drained out area	
8	12	1536	99	421318	5086936	Exploded pillow	
8	12	1537	94	425539	5084820	Picture of this exploded pillow	Photo-21
8	14	1536	97	422856	5084742	Lobate flows. Having some trouble with navigation. Looks like there is more sediment. Collapsed area - debris on top and in hole.	
8	15	1538	94	422856	5084742	Lots of broken up lavas. Very glassy. Looks like young lava - a lot of fragmented pieces of rock.	Photo-2
8	16	1538	99	422988	5084874	Young lobate flows, a bit of sediment.	
8	18	1537	95	423176	5085015	Heading across young lavas to the east	
8	18	1538	92	423015	5084896	x=3015 y=4896. Crab on top of collapsed area.	Photo-2
8	19	1538	106	423025	5084898	Lots more sediment on bottom of pits. Ropy lavas.	Photo-24
8	20	1537	107	423019	5084867	More shallow collapse.	

8	20	1539	106	423042	5084882	Chaotic jumbled folded area. Crab. Some thin plates that stand up vertical. Glassy.	Photo-25
8	21	1539	104	423056	5084871	x=3056 y=4871 good fix on this line. Glassy flows.	
8	22	1538	105	423068	5084862	Large drained out area - flat. Down in a collapse area. Lineated lava flow.	Photo-26
8	22	1540	109	423059	5084828	Looks like flow is to the south. Lines heading south. Big broad plain.	
8	23	1540	104	423100	5084854	Flat plain - sheet flow	R493-18
8	23	1540	106	423090	5084854	Large flat area. First large lineated area we've seen like this.	Photo-27
8	24	1540	107	423099	5084853	Extensive area of sheet flows.	Photo-28
8	25	1539	109	423107	5084854	x=3114y=4855 good fix. Collapsed area. Glassy.	Photo-29
8	26	1538	111	423135	5084821	Up on a more solid surface. Young lobate flows.	
8	26	1538	110	423136	5084867	young lobate flows	R493-19
8	26	1538	108	423136	5084867	x=3136 y=4867 good fix. Photo of crab. Extensive pockets of sediments. Back on the roof of a pit.	Photo-30
8	27	1538	111	423147	5084867	3147 4867 good fix. Photo of skylight.	Photo-31
8	28	1537	115	422990	5084680	More jumbled chaotic area.	
8	29	1540	107	423156	5084856	Glassy jumbled flow.	Photo-32
8	29	1541	107	423174	5084865	x=3174 y=4865 good fix.	Photo-3
8	30	1541	110	423188	5084860	Mounds of jumbled sheets. Glassy. Some sponges - very small.	Photo-34
8	31	1541	121	423194	5084854	More mounds of jumbled lavas. Slightly deeper.	Photo-35
8	32	1542	107	423272	5084885	Still in young jumbled lavas	Photo-36
8	33	1541	105	423218	5084860	x=3217.5 y=4859.7 good fix. Giant pillar, wall structure, about 4 m tall. Photos 37 - 40	Photos
8	34	1538	114	423209	5084854	Lots of collapsed areas, young lobate flows at bottom. More spires up ahead.	
8	34	1538	103	423209	5084854	Picture of lava spire.	Photo-41
8	34	1538	103	423209	5084854	Spires	R49321
8	35	1537	110	423209	5084854	We're in an area where the eruption may have occurred. Deepest drainout area.	Photo-42 Photo-43
8	35	1540	111	423218	5084859	Intact structures. More pits.	Photo-44
8	36	1537	106	423165	5084764	No sign of any venting so far.	
8	36	1538	115	423165	5084764	Jumbled sheet flow at bottom of pit area.	
8	37	1539	112	423088	5084636	More jumbled lavas.	Photo-45
8	38	1539	107	423284	5084848	Folded back piece of lava - very shiny.	
8	38	1539	106	423291	5084844	Jumbled up crust is very thin.	
8	39	1540	112	423293	5084841	Into flat area again - lineated lavas.	
8	39	1540	106	423059	5084494	Jumbled lava. Spires.	Photo-46
8	40	1538	110	423313	5084843	Series of intact areas with spires holding them up. Lobate flow on top.	
8	41	1538	109	423291	5084792	Lobate lavas. Apparently out of collapsed drained out area.	Photo-47
8	41	1538	108	423335	5084838	3335 4838 good fix.	
0	0	0		0		Lobate flows, very glassy, very little life on them.	
8	42	1538	111	423300	5084785	Photo of young lobate flows. Big rattail fish.	Photo-48
8	43	1538	111	423356	5084839	Shallow collapsed pits. Jumbled flow.	
8	44	1538	110	423365	5084840	A holothurian	

8	44	1538	109	423373	5084839	Lobate flows. Surfaces have small pockets of sediment, some brittle stars	Photo-49
8	45	1538	109	423383	5084838	Tops of the lobes look glassy.	
8	46	1538	108	425253	5084725	Fragments of the glass in the pockets with sediment.	Photo-50 - 51
8	46	1538	110	423392	5084830	Glass in pockets of lobate flow	R493-22
8	47	1539	109	423360	5084774	Lobate flows, pockets of sediment with glass. A brittle star.	Photo-52
8	48	1539	108	423363	5084774	Problem with the consoles.	
8	49	1539	108	423221	5084598	We've lost console link-no telemetry	
8	52	1539	108	423386	5084812	Looks like we've had some serious snap-loading on the umbilical causing a fiber to break.	
8	54	1539	108	423536	5084972	Turned everything off to try restarting the whole thing.	
9	1	1411	22	423536	5084972	Power is up again	
9	5	1375	329	423436	5084849	They think it's a surface computer glitch that caused the problem.	
9	6	1372	325	423438	5084850	The sub motor isn't starting at depth.	
9	14	1320	295	423591	5084706	Going to bring the sub up to a shallower depth (50-70 m) to see if we can turn the motor on.	
						Dive Summary: R493 was an extension of Dive R492. Collected a couple rock samples, but didn't go to any vents. ROPOS on bottom 0635 - 0848. At 0848 the sub lost telemetry due to snap-loading on the umbilical. Dive was aborted.	

							Dive R494
							Dive Plan: Dive R494 will start about 1 km south of the SeaBeam anomaly site surveyed on R465 in 9198 and move north to map the limits of the 1998 lava flow and sample the young and adjacent older lavas.
							Note: NO ACOUSTIC NAV THIS DIVE. NAV FIXES ON DIVE PLOT ARE SHIP AT STERN. X/Y ARE SHIP GPS.
UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
3	12	738	258	423645	5085308	ROPOS in water at 0230 GMT. Marginal sea conditions. Biobox, 4 rock cores, Suction sampler and standard cameras on.	
4	16	1717	228	422037	5078794	on bottom, old-looking sheet flow with a good amount of sediment. Flow may be as old as Bob.	
4	19	1719	217	422037	5078794	some older looking lobates too. Skate in video on bottom. We are about 1km south of dive 465. Heading north	
4	21	1722	3	422037	5078794	skate	R494-1
4	21	1722	3	422037	5078794	Deep-Sea Skate	R494-2
4	21	1719	6	422037	5078794	Yellow hydrothermal sed. around. Also a 0.5 m high mound of hydrothermal, yellowish color.	
4	22	1721	6	422037	5078794	Sediment looks to have a hydrothermal component, mixed sheets and lobes. lots of hydrothermal deposits concentrated in mounds and edges of pillows.	
4	28	1722	180	422037	5078794	Older folded sheet flows near where we landed. Lots of brittle stars, sponges. Taking first rock sample from here	Photo 1
4	30	1722	183	422037	5078794	location of first rock sample	R494-5
4	36	1723	165	422037	5078794	Nice sponge with rock core sampling	R494-7
4	35	1722	168	422037	5078794	sheets are too brittle to sample with arm so they are taking a rock core	
4	37	1722	174	422037	5078794	sponge at site one.	R494-9
4	39	1723	179	422037	5078794	Rock core sample 1	R494-11
4	38	1723	172	422037	5078794	Core manipulation. Taking core. Far left core, purple core. (Photo2)	Rck_core_494-1
4	45	1723	200	422037	5078794	going to suction the surface of the flow for sediment.	
4	49	1722	199	422037	5078794		SS-j2_rck_R494-2
4	50	1722	198	422037	5078794	sediment taken here is on top of lobate, relatively thin pelagic looking. sucked a brittle star to. Sucked into J2.	
4	54	1722	200	422037	5078794	Background sample	R494-12
4	57	1723	181	422037	5078794	Sea pen	R494-13
4	56	1722	189	422037	5078794	Solitary soft coral, Gorgonia also an Anemone in the same area.	
5	1	1723	177	422037	5078794	Moving a bit forward to continue sucking another sample from top of the lobate near the coral.	
5	9	1723	170	422037	5078794	Finished sampling suction sampler, last suck was in hollow between lobates. some may have been hydrothermal yellowish material. Photo3 - Gorgonia sponge on lobates	Photo 3
5	11	1723	128	422037	5078794	Background bottle	R494-17

5	12	1723	61	422037	5078794	Looked like J3 was contaminated by sed. from J2.	
5	15	1720	360	422037	5078794	Heading N, lobate lavas, crinoid and hydrothermal sed. Older area than anything in Caldera. Turning into jumbled and folded flows. Photo 5 - Hydro sed on older lavas and crinoid	Photo 5
5	17	1720	339	422037	5078794	Big sponges on lobates, ropy lavas between lobates. Strange looking very flat ridge, could be a pressure ridge up to east.	Photo 7
5	18	1720	352	422037	5078794	Lineated flows, rat tail. small fissures in lineated sheet flow.	
5	19	1722	0	422037	5078794	Lobates with hydrothermal sed. between lobes. Dark crinoid. Sponges	
5	21	1722	358	422042	5078807	Jumbled sheets with crinoid and sponges. Photo 8 - white sponge	Photo-8
5	24	1721	3	422042	5078807	large flat blocks of tilted lava, lobes on other side of sheets toward the north.	
5	26	1719	5	422042	5078807	More broken and tilted blocks of sheets, fairly thick, up to about 20cm thick	
5	28	1721	359	422038	5078879	lobate over the sheet flow. Lobates are to the east. Photo - flat sheet	Photo-8
5	30	1720	5	422040	5078901	Pillows and tubes, with sediment accumulated in lows. Pillows and lobes may be related. Both on top of sheets. pillows stick up higher than the lobates.	
5	34	1722	2	422046	5078983	Stalked crinoid	R494-18
5	34	1722	9	422046	5078937	old lobate field, sediment infilling, crinoids, rattail. gorgonia. Photo - pile of lobes	photo 10
5	38	1720	360	422047	5079038	in lobates but back into lineated sheets, massive with fractures, then back into lobates around the edge. Photo 12 - anemone. Photo 13 - gorgonia	photo 12 photo 13
5	39	1719	6	422047	5079038	Looks like lobates were younger than the fissure. Photo - fissure	Photo
5	40	1719	7	422047	5079038	Photo - in the fissure	photo 15
5	41	1720	357	425922	5079394	Fissures in flat sheet flow	R494-21
5	41	1719	2	425922	5079394	fissures run east of north maybe 20 degrees. huge sheetflow, lineated sheets. flat broad area. over high point and again the lobates lap up on it again. Photo - lapping lobates	Photo 16
5	43	1721	4	422044	5079096	older lobates. typical pic.	R494-22
5	43	1720	356	422044	5079096	moving laterally east in lobates.	
5	44	1719	1	422043	5079103	Fissure in lobates, quite continuous with white staining on edges.	Photo 17
5	45	1719	29	422043	5079103	back into sheets, thick flows that have fissures running NE. Most lineations run east-west. Photo - lobates to sheets with fissures	Photo 18
5	46	1718	33	422043	5079103	fissure	R494-24
5	47	1721	34	422043	5079103	Deep Crack	R494-25
5	47	1719	28	422043	5079103	following fissure and stopping to get piece of thick massive sheet. Photos - fissure	Photo 19 Photo 20
5	48	1722	1	422043	5079103	Sample of thick sheet flow along fissure	R494-26
5	51	1721	353	422043	5079103	Slabby piece of thick sheet flow from fissure, aprox. 10 cm wide, put in STB BioBox.	Rck_R494-3
5	53	1721	30	422048	5079201	Heading 020 along fissure, with both sheets and lobes are fissure.	Photo 21
5	54	1720	20	422048	5079201	fissure narrows through lobates	R494-27
5	55	1721	16	422048	5079214	fissure widens in lobates	
5	56	1722	19	422048	5079214	Jumbled sheets with many animals	photo 22
5	56	1722	17	422048	5079214	Jumbled sheets with stalked critters.	
5	57	1722	19	422048	5079214	Lineated sheets, crinoid. Ropy sheets, back into rift	

5	58	1722	20	422048	5079214	Flow in the crack	R494-28
5	58	1722	23	422048	5079214	Eruptive fissure with new flow	R494-29
5	59	1722	24	422048	5079214	New flow in fissure. Photos of new flow	Photos 25?-27
5	59	1722	24	422048	5079214	New flow in fissure	R494-31
6	0	1722	23	422048	5079214	Photo - fissure	Photo 28
6	1	1722	22	422048	5079214	New lava 1.5 meters down, between thick sheet.	R494-32
6	3	1720	203	422058	5079245	fissure looking south narrower fissure down a meter	R494-34
6	3	1721	216	422058	5079245	Fresh lava in crack	R494-35
6	3	1721	216	422058	5079245		Photo 31 - 33
6	4	1722	208	422058	5079245	Continuing down fissure	R494-37
6	3	1722	222	422058	5079245	New lava up at level of older lobates. following the fissure to the south	Photo 34 - 37
6	5	1721	197	422058	5079245	End of flow, fissure starts and then there appears to be a bit more in fissure	Photo 39
6	6	1721	204	422058	5079245	Continuing down fissure with fresh lava	R494-38
6	6	1722	200	422058	5079245	New flow continues to south in fissure. Photo - down in fissure, new but sed coated flow	Photo 40
6	7	1723	203	422058	5079245	Fissure seems to get very narrow and flow dies out. End of tether, have to go back N.	
6	12	1719	48	422058	5079245	Heading north again, back on fissure.	
6	14	1724	36	422058	5079245	New flow in axis of fissure. Sampling	R494-39
6	14	1724	43	422058	5079245	Taking a rock sample in the fissure. End of a tube. Very glassy. Putting it in STB. BioBox with the slabby, sheet. Lava, toe.	Rck_R494-4
6	20	1723	44	422058	5079245	Fissured older pillow above the young flow.	R494-40
6	21	1723	46	422058	5079245	sampling new flow.	R494-41
6	23	1723	42	422058	5079245	Another sample from the same site Sample B is larger (sample B was changed to R494-5	Rck_494-5
6	24	1723	41	422058	5079245	Broken pillow	R494-42
6	26	1723	30	422058	5079245	Last sample now be changed to Rck-494-5, BUT it is the same flow.	
6	28	1724	10	422060	5079240	sample locale for older sample just outside of eruptive fissure.	R494-43
6	29	1724	14	422060	5079240	Graben rocks	R494-44
6	29	1724	10	422060	5079240	Sampling older lava just outside of eruptive fissure, slabby small plate. Appears to be difficult to sample, but they got a small piece and put it in the purse	Rck-494-6
6	37	1723	20	421982	5079345	Heading N along the fissure again, lava almost to the top.	Photo 42
6	38	1721	28	422060	5079242	Narrow fissure with lava in bottom. Fissure narrows to cm width	Photo 45
6	38	1721	34	422060	5079242	Moving to west to see if there is another fissure. Lots of small cracks and fractures in Massive sheet but no eruptive fissure.	
6	41	1723	80	422060	5079242	Complex terrain, with fissure cutting through it. Waiting for ship to move. Want to move at 030 heading.	
6	44	1719	26	422060	5079242	extensive lineated sheet with fractures running 060.	
6	47	1723	37	422060	5079242	Back along fissure, very narrow here, can't see any lava in it.	
6	51	1723	22	422060	5079242	Back at the lava filled crack	R494-47
6	51	1723	22	422060	5079242	Pillows in bottom of narrow fissure	Photo 48
6	52	1722	37	422060	5079242	Following the fissure, blocks on top of lava in fissure. Pillows coming out of fissure, ERUPTION!	Photo 49 - 52

6	53	1722	23	422060	5079242	young flow over older near fissure	R494-49
6	54	1722	353	422060	5079242	Contact where lava has come out of crack	R494-50
6	54	1722	345	422060	5079242	Near eruptive fissures, young flow on old. where lava erupted out of fissure. Young and old lavas have similar morphologies here.	Photo 54 - 57
6	55	1721	25	422060	5079242	contact	R494-51
6	55	1721	26	422060	5079242	Contact again	R494-52
6	55	1722	31	422060	5079242	fissure eruption	R494-53
6	56	1721	33	422060	5079242	Photo of east edge of fissure with lava just coming out.	Photos 60's?
6	57	1720	21	422060	5079242	several fissure with lava in bottom. Very close.	
6	58	1719	22	422060	5079242		R494-55
6	58	1720	24	422060	5079242	edge of fissure with lava	R494-56
6	59	1723	28	422060	5079242	Photo of whole fissure	photo 69
7	0	1723	32	423135	5079100	Narrow eruptive fissure , some bigger pillows.	photo 70
7	1	1722	21	423135	5079100	contact of flows	Photo 73
7	2	1724	30	421786	5079005	more of contact of young and old	Photo 74
7	2	1723	61	421786	5079005	contact	R494-57
7	3	1723	60	421786	5079005	Larger pile of pillows, harder to see the eruptive fissure. Fissure if only a few meters across.	photo 75, 76
7	4	1724	58	421786	5079005	Primordial process of seafloor spreading - "R. Embley 1999"	Photo 78
7	6	1724	60	425906	5079838	skate	R494-59
7	6	1724	60	425906	5079838	see a skate	R494-58
7	6	1724	56	425906	5079838	Fissure seems wider and larger pillows	
7	7	1724	58	425906	5079838	Can still see the edges of the flow. Photos - skate	photos
7	8	1726	28	423231	5078522	Pillow in new flow. about a meter wide	R49461
7	8	1726	28	423231	5078522	Large pillow of lava - over a meter	R49462
7	9	1725	35	423231	5078522	Meter across pillows in new flow.	
7	9	1724	30	423231	5078522	West contact	Photo 86
7	10	1724	28	423231	5078522	new flow about 10m wide, covering the fissure.	
7	11	1723	27	423231	5078522	edge of fissure	R49463
7	12	1723	25	423231	5078522	Thicker flow	R49464
7	12	1724	20	423231	5078522	widening out here.	photo 89
7	14	1723	18	423231	5078522	contact showing that the flow is only one pillow thick, but spread out now.	photo 90
7	15	1723	10	423231	5078522	East contact , could be 60 m wide here	Photo 91
7	17	1723	3	423231	5078522	Stopping ship and going 010.	
7	22	1716	267	423231	5078522	Now we're going to go due north.	
7	25	1724	7	425904	5080697	Contact	Photo-92
7	26	1724	3	425904	5080697	Moving over young lobate lava pillows	
7	27	1723	9	425904	5080697	Beginning to see some hydrothermal staining	
7	28	1724	14	425904	5080697	Young lobate lavas. Waiting for the ship to move.	Photo-93
7	32	1727	7	426597	5081096	Picture of eastern side of the contact	Photo-94
7	32	1726	13	426597	5081096	Contact	R494-65
7	32	1726	14	426597	5081096	Another picture of the contact.	Photo-95

7	33	1724	5	421811	5080068	Going northwest a bit to get to the top of the pile of the lava pillows. Pillows are a few meters thick.	
7	34	1722	9	421811	5080068	We've come up about 5 m- degrees with SeaBeam data	
7	35	1720	4	423246	5079378	Lobate flows - some hydrothermal staining. Can see some holes where flow was coming through.	
7	36	1720	2	423246	5079378	Top of this pile of lavas - approximately 8 m.	Photos 97 - 100
7	37	1720	13	423246	5079378	Some brittle stars apparent here.	
7	37	1720	14	423246	5079378	Entering a flatter area here. Rattail.	Photo-101
7	38	1720	13	423246	5079378	Flatter top area, even depth.	Photo-102
7	39	1720	4	423246	5079378	Lots of holes where hydrothermal fluid was coming out.	
7	41	1722	9	423349	5079440	Moving into larger pillow lavas on the edge of this.	Photo-103
7	42	1722	10	423349	5079440	Crab on young pillow lavas	Photo-104
7	45	1721	6	423326	5079486	Young lavas	Photo-105
7	46	1720	12	423326	5079486	Smaller glassy lobe-like pillows. Morphology varies from large pillows at edge to flat lobate flow in the middle.	
7	47	1719	12	422217	5079965	Curtain-draped sheet flow	R494-66
7	47	1720	15	422207	5079951	Looks like we're in this east-west running channel, curtain draped lava flows.	Photo-106
7	50	1720	10	422206	5079975	Brittle stars- looks like it's flattening out again.	
7	52	1720	10	422211	5080020	Flatter lobes, more hydrothermal staining, more even surface.	Photo-107
7	52	1719	8	422208	5080055	White colored scale-looking worms	
7	53	1720	14	422212	5080056	These little wormy things are moving very fast- what are they? They're doing the scale worm dance. They're really pale because they're malnourished.	
7	54	1720	10	422213	5080075	On the edge of something- a big deep hole- porthole to the subsurface. A big collapse about 5 m deep. Photos 108 and 109	Photos
7	54	1720	13	422009	5080464	Edge of a big collapse - about 5 meters deep	R494-67
7	55	1719	11	422208	5080097	Looks sort of post-eruptive.	
7	56	1719	18	422208	5080097	This is a pretty chaotic collapse - looking north to find the edge of it. Looks tectonic-structural trend.	
7	57	1720	12	422208	5080097	Floor is covered with jumbled pahoehoe lavas.	
7	57	1718	10	422196	5080116	We can see the other side of this feature - approximately 40 m wide. It's not a sheet flow.	Photo-10
7	59	1720	33	422196	5080116	Picture of a gossamer-parachute like creature.	Photo-1
7	59	1719	10	422196	5080116	Maybe this is the channel we saw last year? Continuing to lateral around here, to the right.	Photo-12
8	1	1718	7	422196	5080116	Roof collapse	R494-69
8	1	1718	11	422196	5080116	Rat tail. Edge of collapsed area again.	Photo-14
8	1	1718	18	422196	5080116	Doesn't really look like a drainout, looks more like a bang." Overhung a lot on the edges. Continuing to the north."	
8	3	1720	11	422196	5080116	Contact northern edge	R494-70
8	2	1718	10	422196	5080116	Looks like the lava might be thinning out here? Maybe not. Holothurian. Contact.	Photo-15
8	3	1721	14	422196	5080116	Sudden change to this contact- sudden depth change.	
8	4	1721	12	422196	5080116	Going to go west to see if we can find a fissure going north from here.	Photo-16

8	5	1720	14	422196	5080116	Picture of contact. Photos 17 and 18	Photos
8	6	1720	220	422196	5080116	Contact. Moving the ship 10 m to the west so we can go along this contact.	Photo-19
8	8	1720	180	422196	5080116	Siting over older folded sheets.	
8	10	1721	174	422196	5080116	Lots of brittle stars on the old lavas.	
8	16	1720	191	421169	5080255	Back on the contact	
8	17	1718	267	421169	5080255	Looking west along the contact: tubular-like protrusions finger-like extensions caressing the sheets.	Photo-120
8	17	1719	266	421169	5080255	Young lobate lava interacting with older sheet flow	R494-73
8	19	1720	256	421169	5080255	Edge of contact	R494-74
8	19	1720	266	421169	5080255	Contrast of textures at the contact.	Photo-121
8	20	1719	268	421169	5080255	A little extension of the flow to the north, northwest, maybe north.	
8	21	1719	265	422122	5080370	Photo of young flow flowing around little remnant mound	Photo-122
8	21	1719	265	422291	5080342	Picture of crab on new flow	Photo-123
8	24	1720	266	422291	5080340	Still moving west following the contact - weaving in and out - no fissure.	Photo-123
8	26	1720	266	422291	5080340	The older flows are changing now into more lobate-like pillow forms.	
8	31	1719	270	422291	5080340	Moving the ship 20 m southwest.	
8	38	1717	248	422291	5080340	Moving ship 20 m to bearing 25 - around northern end of SeaBeam anomaly lava flow. Still unclear if an eruptive fissure extends to the north from here. Trying to find out by going west first, then will go northeast.	
8	45	1719	216	422291	5080340	Still looking at the contact-great contrast between old and new.	
8	47	1721	171	422291	5080340	Having the ship move 10 m to the south, then continue 25.	
8	49	1711	162	422291	5080340	Accidental photo - slippery popcorn hands photo.	Photo-125
8	53	1713	184	422291	5080340	Another c*h shot ??	Photo-126
8	55	1720	180	422291	5080340	Glass on the old lava	R494-75
8	55	1720	184	422291	5080340	Glass pieces on the old lava. Anemone as well. Pretty close to the contact.	
8	56	1721	159	422291	5080340	Pieces of young lava, exploded pillows, lying on the surface of older lavas. Highlights on.	Photo-127
8	58	1720	172	422291	5080340	Quite a bit of this fragment material. Going south.	
8	58	1721	191	422291	5080340	Maybe these chunks are from when a pit collapsed. Crinoid.	Photo-127
8	59	1722	171	422291	5080340	Contact with young lava, with pieces of glass on the old lava. could be due to a collapse.	R494-76
9	0	1724	190	422291	5080340	Picture of contact, close up.	Photo-142
9	0	1723	190	422291	5080340	Proceeding to the west. Highlights off.	
9	1	1721	273	422291	5080340	Following the contact.	
9	2	1721	276	422291	5080340	The fragments don't appear to be on the new lava, only the old flows.	
9	3	1720	274	422291	5080340	Picture of contact.	Photo-133
9	5	1720	275	422291	5080340	We haven't found any evidence of a northward fissure along this east-west contact. Looks like the contact is trending southerly.	
9	8	1720	274	422291	5080340	Going back to the cage for tether management.	
9	10	1696	94	422291	5080340	Back in the cage, now we're heading back to the bottom.	
9	11	1717	37	422291	5080340	Now we're just going to follow the contact, but right now we're in the new lava. Heading north to look for the contact.	
9	12	1720	2	422291	5080340	We're at the contact again. Starfish on the old lava. Heading west.	
9	14	1720	276	422291	5080340	Continuing to follow the contact to the west.	

9	14	1719	275	422291	5080340	We don't see any more of those glass fragments.	
9	16	1720	277	422291	5080340	Approximately 60 m west of the ship's position.	
9	21	1716	276	422291	5080340	Moving the ship 40 m to 340.	
9	27	1716	344	422291	5080340	Crab. Heading north/northwest around 340.	
9	28	1716	348	422291	5080340	A big sponge on the old lava.	
9	29	1717	348	422291	5080340	Picture of old lava near contact	Photo-134
9	29	1716	343	422291	5080340	Approximately 50 m ahead of the cage- the ROV is probably directly under the stern of the ship.	
9	30	1714	345	422291	5080340	A the edge of a collapsed pit of the older lavas. Some sheet flows. Quite a bit of sediment here.	
9	33	1715	345	422291	5080340	Lots of sediment here- lobate lavas under there. Kind of heading off axis so things are getting older and older.	
9	34	1714	350	422291	5080340	We've found a fissure. Taking a look in the fissure. Looks deep - looks pretty old. Clean straight sides.	Photo-135
9	35	1714	47	422291	5080340	Deep fissure	R494-80
9	35	1716	44	422291	5080340	This is a very deep fissure.	
9	36	1714	2	422291	5080340	A crinoid at the edge of the fissure, a crab, a starfish.	
9	37	1713	30	422291	5080340	Still looking at the fissure.	
9	38	1714	349	422291	5080340	Older lobate lobes, lots of sediment between the lobes. Some sponges and anemones on the lavas.	
9	41	1712	346	422291	5080340	ROPOS is still right under the stern of the ship.	
9	42	1713	343	422291	5080340	Older lavas turning more to pillows - still about the same age, though.	
9	45	1713	356	422291	5080340	Looks like we see some of the glass fragments again on the old lavas. Hmmm. curious.	
9	47	1712	356	422291	5080340	Still seeing those little pieces of glass on the old pillows and in the sediment pockets. Must be something new nearby.	
9	49	1710	355	422291	5080340	Looks like there are even more little pieces of glass on the old flow now.	
9	51	1709	0	422291	5080340	Fine particulate glass pieces on top of older lavas. Heavily sediment. Fresh glass shows up dark.	Photo-136
9	51	1709	356	422291	5080340	Glass on older lava, heavily sediment.	R494-82
9	53	1708	359	422291	5080340	Inside collapsed pit	R494-83
9	53	1709	352	422291	5080340	Collapsed area with some pillars.	Photo-137
9	54	1708	354	422291	5080340	Still seeing the fine particulate dusting of fresh glass on old lavas.	
9	59	1707	1	422291	5080340	Flow is turning into a jumbled mess with collapses.	
10	1	1707	1	422291	5080340	End of the 40m. Now we're going to go 50 m on a 045 course.	
10	2	1708	48	422291	5080340	The cage depth has changed to 1675 m.	
10	8	1707	44	422291	5080340	Looking for new lava.	
10	10	1708	48	422291	5080340	We're in a jumbled zone. Hard to see if the glass deposits are still present.	
10	14	1709	48	422291	5080340	Coming up on some pillars with intact roof.	
10	16	1708	44	422032	5080676	Back into collapse, pillars, some crinoids. Photo of crinoid on top of a pillar.	Photo-138
10	17	1707	47	422032	5080676	Echinoid on top of pillar	R49485
10	18	1708	47	422032	5080676	pit with glass in it	R494-86
10	19	1708	44	422032	5080676	Jumbled lava. Very irregular microtopography.	

10	22	1708	44	422032	5080676	seem to be on a slope that's going to the south.	
10	22	1708	52	422032	5080676	A neat white thing- a sponge?	
10	22	1708	55	422032	5080676	A sponge of a different shape	R494-87
10	23	1708	49	422032	5080676	Really rough topography here.	
10	24	1708	46	422032	5080676	Spinous lava. Lots of sponges and such.	
10	28	1707	54	422032	5080676	A pretty crinoid. A valve or two in a little pit- a large beautiful pink crinoid.	
10	28	1708	46	422032	5080676	A valve in the small pit with an echinoid on the upper edge.	R494-88
10	28	1707	42	422032	5080676	Out of the jumble into the lobate now.	
10	32	1706	49	422032	5080676	We've found another narrow fissure. Looks deep.	
10	32	1706	44	422032	5080676	Narrow fissure	R494-90
10	32	1706	46	422032	5080676	The fissure is only about 20 cm wide. Fairly fresh breaking, but the lava is old.	
10	33	1705	45	425427	5080885	ROV is lagging just a bit behind the stern of the ship.	
10	34	1706	45	425427	5080885	Away from the fissure. In the older pillows and lobates.	
10	36	1703	45	425427	5080885	We're going down slope.	
10	37	1705	49	425427	5080885	A more collapsed area.	
10	41	1705	46	422243	5080933	Going to keep on this course for 50 m (045).	
10	43	1705	45	422268	5080947	Heavily sediment here.	
10	47	1702	45	422253	5080978	Very few tectonic features here	
10	47	1702	44	422253	5080978	no nav just ship positions	
10	48	1703	51	422253	5080978	heavily sediment pahoehoe lava	
10	49	1704	51	422326	5080989	jumbled flow, broken pieces of pahoehoe lava	
10	51	1703	49	422646	5080494	Crab in defensive posture	R494-91
10	51	1703	49	422646	5080494	crab large and fierce	
10	52	1704	35	422360	5080912	ROPOS is attempting to grab the crab	
10	55	1704	49	423344	5080451	crab leg collected into stbrd bio box	Bio_R494-7
10	56	1704	49	425626	5081474	fish and crab heading north $x=2455$ $y=0891$ was position of crab leg sample above	
10	59	1703	54	422389	5081094	pillow lava	
11	2	1704	52	422423	5081094	New flow/old flow contact	R494-95
11	2	1705	51	422423	5081094	contact with new lava $x=2515$ $y=0950$ all pillows	
11	2	1704	53	422434	5081095	western contact, new flow	R494-96
11	3	1703	92	422438	5081123	ROPOS is heading east to cross the flow of new lava	
11	4	1703	86	422442	5081166	new lava	photo 139
11	4	1703	93	422489	5080964	pit	photo 140
11	4	1702	98	422492	5081128	more collapse	photo 141
11	5	1702	95	422497	5081117	deep drain out pits in new lava	
11	5	1703	99	422511	5081134	maybe older lava just below ? not sure	photo 142
11	6	1702	90	422511	5081137	lots of big holes and drain pits	
11	6	1702	98	422545	5081099	pits	photo 143
11	7	1702	92	422545	5081099	large drain out	photo 14
11	8	1703	87	422540	5081158	the flow is wide, probably continuous with the flow to the south	
11	9	1704	90	422560	5081163	appear to be out of the drained out area, back to sheet flow	

11	10	1703	88	422582	5081138	big hole	
11	11	1704	83	422633	5080641	x=2603 y=0992 ship pos	
11	11	1704	87	422666	5080685	ROPOS is a little south of the ship pos just given, flow of big collapse area	
11	12	1707	87	422584	5081157	bottom of pit	photo 145
11	12	1708	88	422584	5081157	up on the wall	photo 146
11	13	1704	96	422598	5081013	east wall	photo 147
11	14	1703	93	422422	5081492	flat plates, buckled up area	photo 148
11	14	1704	92	422625	5081161		photo 149
11	16	1705	90	422734	5081035	pillows	photo 150
11	17	1704	93	422672	5081114	contact on eastern edge	photo 151
11	17	1704	91	422403	5082167	contact	photo 152
11	17	1704	90	422403	5082167	Corresponding Eastern contact, after traverse across flow	R494-97
11	18	1704	93	422670	5081166	turning North to follow the contact for a while	
11	18	1704	10	422670	5081174	Eastern contact of new flow	R494-98
11	18	1704	16	422670	5081174	contact	photo 153
11	19	1704	16	422672	5081194	contact	photo 154
11	25	1705	177	422740	5080848	trying to grab a rock for a rock sample	
11	26	1705	176	422649	5081265	collecting piece of new lava at the eastern contact	R494-99
11	27	1705	179	422734	5080842	rock is shaped like a lamb chop	
11	28	1705	180	422736	5080849	rock broke off, only a small piece remains	
11	29	1705	174	422672	5081148	might have lost one of the corers, putting the piece of rock into the bag	Rck_R494-8
11	32	1705	172	422667	5081146	rock has been placed into the bag	
11	35	1704	3	422658	5081274	starting north along the contact	
11	37	1703	358	422707	5081032	x=2727 y=0994 ship position	
11	36	1703	2	422658	5081274	"Island" of old flow surrounded by new flow. Photo - near east contact	R494-100
11	42	1704	6	422813	5080746	large collapse area to the port	
11	43	1704	6	423657	5080807	still on the eastern edge of a very large collapse area. there are problems with the highlights tape	
11	46	1703	1	422666	5081244	still parts of a big collapse area	
11	47	1703	4	422949	5081647	still have a large collapse area to the west of ROPOS	
11	49	1703	5	422677	5081256	x=2730 y=1180 ship's position may be out of the large collapse area	
11	50	1705	355	422647	5081299	large crab	
11	51	1703	358	422766	5080822	collapse area has ended	
11	52	1703	5	422641	5081368	contact x=2729 y=1228 ship's position	
11	54	1703	1	422760	5081306	chrinoid in the old flow , small sponge and stalk chrinoid	
11	57	1702	1	422732	5081343	shallow collapse area, asking ship to turn to 045 to NE	
11	58	1702	44	422756	5081345	ship's position 2732 1322	
11	59	1701	50	422657	5081515	two stalk chrinoids, sea star, moderately heavy sediment	
12	1	1701	42	422702	5081408	contact with the contact down in x=2741 y=1331 a topographic low	
12	2	1704	49	422712	5081373	new flow into old fissure area	R494-101
12	3	1702	47	422981	5080997	Hightlights on	
12	4	1703	47	424598	5083037	asking to stop the ship	

12	5	1702	44	422759	5080929	backed up to look again at the NE	
12	5	1704	50	422594	5081820	contact and	photo 15
12	6	1703	47	422695	5081482		photo 156
12	6	1703	46	422695	5081482	new VCR tapes	
12	7	1702	47	422819	5080978	ROPOS turning to the south	
12	7	1703	193	422694	5081496	following a fresh flow	
12	8	1703	218	422694	5081496	highlights off	
12	8	1703	184	421802	5080664	contact	
12	10	1703	204	422682	5081502	asking the ship to move 20m bearing 045	
12	13	1692	48	422645	5081522	in older lavas heading NE	
12	14	1672	60	422710	5081561	back to cage	
12	16	1693	33	422875	5080683	back on bottom on old flows heading to NE	
12	18	1692	44	422062	5080713	collapse area on the stabrd (collapse pit or fracture)	
12	19	1694	46	422062	5080713	debris falling downslope, debris apron in front of wall, crab	
12	20	1700	45	422944	5081163	ship's position x=2842y= 1428	
12	21	1700	45	422951	5081037	back up the other side of the wall, lots of mass wasting into the pit	
12	22	1690	47	422859	5081365	less like a collapse looks more like a tectonic feature, rift zone	
12	23	1688	45	422182	5080814	lots of brittle stars, bottom terrain is rugged, old lava	
12	25	1688	45	422836	5081526	crevice cutting throughout the jumbled flow, faults appear to have a NE trend	
12	26	1688	45	422835	5081612	area of old broken pillows and jumbled	
12	27	1688	47	424419	5083009	anemone, crab lots of brittle stars in old jumbled lava	
12	29	1688	45	422592	5082403	heading NE out of jumbled into lobate, back into jumbled	
12	29	1689	47	422872	5081607	2934 1522 ship's position	
12	30	1687	38	422866	5081648	cucumber, collapse pit full of sediment	
12	31	1688	3	422852	5081743	lobate flows as we go upslope	
12	33	1688	357	422872	5081681	shallow collapse area	
12	34	1687	355	422813	5081688	deep drop of to the port	
12	35	1688	359	422865	5081440	10 meters deep	
12	36	1686	359	422810	5081684	deep depression full of jumbled blocks	
12	36	1683	4	422686	5082140	pillows moderate sediment	
12	38	1681	352	421233	5080454	nice large pillow structures	
12	40	1672	6	422962	5081714	still in large pillows	
12	43	1660	358	422864	5081802	nice lava tube	
12	44	1657	356	422835	5081918	striations on pillows	
12	45	1655	356	422929	5081831	2942 1762 ship's position, cage is at 1630m	
12	47	1650	2	422868	5081817	continuing N across the old lava flows	
12	49	1651	1	423799	5081461	rattail fish, still old lava	
12	50	1650	4	424406	5083387	large chrinoid on the old lobate flows	
12	51	1650	355	423048	5081343	deep fissure 7 or 8 meters deep to port	
12	52	1649	357	423793	5081958	moving to port to find the other side	
12	52	1651	265	422844	5081934	western wall, not w/ typical collapse pit. orientation is E-W ROPOS will head North, 2937 1909 ship's position	

12	55	1649	6	422928	5081953	still over large hole	
12	56	1652	3	422857	5081954	deep area is channels	
12	57	1649	360	422856	5081982	contact new lava dripping over	
12	57	1651	1	422856	5081982	dripping lava	photo 157
12	57	1650	6	422856	5081982	lava dripping over cliff	R494-102
12	57	1650	3	423097	5081393	lava	photo 158
12	58	1651	26	423097	5081393	dripping lava	photo 159
12	58	1652	35	423097	5081393	new lava dripping over fissure in older lava	R494-103
12	58	1652	38	423097	5081393	2940 1980 ships position, dripping lava	photo 160
12	59	1652	42	422583	5082054	new lava drip into fissure	R494-104
12	59	1652	27	422720	5081525	lava falls, lava stalactite	
13	0	1652	22	422855	5081982	new lava drip into fissure	R494-105
13	0	1652	40	422855	5081982	new lava drip	R494-106
13	0	1652	24	423098	5081413	lots of little stalactites	
13	1	1652	8	422857	5081983	new lava above drip	R494-107
13	1	1652	6	422857	5081983	asking to head east to follow the flow	
13	2	1649	323	422826	5081988	looks like flow just made it to the cliff, we are at the western edge of the flow	
13	4	1648	267	422846	5082131	contact area now heading NE	
13	4	1651	24	422887	5081979	highlights of lava stalactites	
13	5	1650	76	422887	5081979	heading east, appears to be the edge of the flow contact is roughly east-west here	
13	6	1650	88	422977	5082009	heading east to find the source of the flow, now at the edge on the east side	
13	7	1648	94	422977	5082009	heading north along the eastern contact, ship pos 2945 1984	
13	8	1649	90	422886	5082144	heading east in a thick part of the flow, contact is just to stbd, found a crack highlights on	
13	10	1649	121	422886	5082144	fissure on southern edge of the flow	photo 161
13	14	1650	198	423162	5081458	contact may be moving south at this point, contact irregular, general trend is hard to determine	
13	15	1651	184	423162	5081458	highlights of, looking at a small group of pillows of the new lava flow on top of the old lava.	
13	16	1650	225	423162	5081458	heading WSW, will follow the eastern contact to the N	
13	19	1650	8	423162	5081458		photo ?
13	19	1650	106	423162	5081458		photo
13	19	1650	48	423162	5081458	lava contact	R494-108
13	19	1649	130	423021	5082040	the source?	photo 165
13	20	1650	20	423021	5082040		photo 16
13	20	1650	8	423021	5082040	flowing into fissure	R494-109
13	21	1650	68	423080	5081712	very deep hole, lava dripping of the cliff	
13	22	1651	24	423080	5081712	dripping	photo 167
13	22	1650	28	423080	5081712	flow just made it to cliff, dripped over in a few spots	
13	24	1648	355	423080	5081712	moving to west side of the flow	
13	24	1648	282	423080	5081712	lava is very thin here, the western edge ends in large hole, really flat sheet flow on top	

13	27	1649	282	422983	5082087	collapse structure in young lava	
13	27	1648	275	422983	5082087	still moving west, lava looks young on top	
13	28	1651	287	422869	5082054	moving ship over this position, highlights off	
13	29	1650	275	422869	5082054	jumbled debris in the bottom of the collapse area.	
13	31	1647	270	422869	5082054	changing heading to south along this fissure, waiting for the ship	
13	33	1647	272	423064	5081534	fissure trend is NE-SW, asking ship to move 50m west	
13	37	1647	279	422860	5082086	heading west to look at other side of the fissure	
13	40	1648	269	423818	5081604	moving south, collapse area w/ large pillars.	
13	41	1647	267	423057	5081531	large eruptive area, now the trend is N-S	
13	42	1648	267	423057	5081531	2890 1988 ship's position	
13	43	1647	213	423057	5081531	edge of the collapse area, asking to change heading to S over the new lava	
13	45	1649	176	423632	5081521	changing direction to the west	
13	46	1649	268	422990	5081694	over pillows, new lava	
13	48	1650	270	422990	5081694	contact flow of new lava right up to old lava	photo 168
13	48	1652	272	422990	5081694	no new lava up on top	photo 170
13	49	1652	269	423557	5081497	lava ran up to the wall and was contained, new lava came into an old collapse area	
13	50	1650	266	423557	5081497	looking at the top of the wall, all old lava up on top	
13	51	1650	357	423557	5081497	turning North, contact with a wall	
13	51	1650	1	422971	5081689	drip of new lava of the cliff	photo 171
13	52	1649	4	422810	5082072	moving to North over new flow	
13	54	1648	8	422810	5082072	highlights off, changing direction to NE	
13	55	1647	50	422810	5082072	flow is getting flatter, small drain out collapse areas.	
13	56	1648	48	422810	5082072	asking to move the ship 015, ROPOS is over the irregular collapse area we visited earlier	
13	58	1648	48	422909	5082130	moving North heading 015	
13	58	1647	16	422909	5082130	deep drain out area	photo 172
13	59	1646	18	422909	5082130	very deep drain out area, 10m deep drain out, deepest we have seen	
14	0	1646	23	422817	5082190	large rattach, broken flow, moving right looking for collapse area	
14	1	1646	19	422817	5082190	lots of little windows of small collapse before the big collapse area	
14	2	1648	16	422931	5082172	2911 2059 ship's position, over lobate new lava flow	
14	3	1648	19	422867	5082138	changing direction to east to try to trace the collapse area	
14	4	1648	22	422846	5082221	contact on east side	
14	5	1648	18	422894	5082134	changing direction back to the NW	
14	6	1646	6	423127	5081517	very jumbled area of the flow near the center	
14	7	1646	2	422868	5082150	changing direction to the NE zigzag	
14	7	1646	16	422862	5082153	over jumbled area	
14	8	1646	27	422870	5082157	hydrothermal staining in the jumbled a like flow, scale worm	
14	9	1646	22	423799	5083138	over pressure ridges, jumbled flows	
14	9	1645	25	423572	5082976	2941 2170 ship's position	
14	10	1646	27	423940	5083252	new VCR tapes	
14	10	1645	26	423590	5082995	small pockets of white alteration	
14	11	1648	295	424132	5083410	just alteration (white) not mat material in the jumbled flow	

14	13	1639	355	422951	5082198	back into lobate, asking the ship to stop	
14	16	1642	339	422912	5082165	2964 2238 ship's position, this is where the last core sample will be taken on the jumbled flow	
14	19	1642	312	423500	5081650	two black strips on the core, 7 function arm removed the core, 5 function arm grabbing corer, 7 function re-grabbing corer	
14	22	1642	273	422956	5082303	Core sample	R494-111
14	22	1642	274	422956	5082303	looking at clean wax on the core before deploy	
14	23	1642	247	422909	5082183	rock core sample in the jumbled new lava flow	Rck_R494-9
14	26	1643	291	422957	5082297	2962 3337 ship's position for core sample	
14	33	1642	281	423475	5081665	Core sample-black stripes-mashed on BioBox-new flow	R494-112
14	34	1642	283	422956	5082296	core sample- position x=2965 y=2338 sample #494-9	
14	38	1642	283	422960	5082240	asking the ship to move 015 about 30m	
14	42	1637	3	422976	5082309	moving over jumbled flow from the new lava	
14	44	1635	28	423032	5083037	possible iron staining on the jumbled flow	
14	46	1635	22	422898	5082637	extensive iron staining in the jumbled flow	
14	48	1634	15	422931	5082345	still over jumbled flow with light sediment	
14	49	1632	11	422938	5082368	possible older lava?	
14	51	1632	22	422947	5082375	2977 2301 ship's position, still over very confused terrain, jumbled flow	
14	53	1632	17	422976	5082395	heading NE another collapsed area w/ columns jumbled lava, hole is about 10m deep.	
14	54	1631	25	422975	5082397	Interior still plastic within lava lobe.	R494-113
14	58	1631	14	423036	5082491	Very rugged terrain, some ophiroids.	
14	59	1631	15	423041	5082502	A lot of topographic changes - jumbled flow now. Broken up flow with some intact pillows. Lots of exploded pillows. Very complex terrain.	
15	1	1632	17	423053	5082511	Swimming brittle star.	
15	1	1632	17	423053	5082511	Very thin crust on the surface of this flow - never had a chance to solidify into a thick pillow crust.	
15	1	1632	17	423053	5082511	Collapsed pit with nice layering in the walls. Sheet flow over the top of the cliff.	
15	6	1631	18	422995	5082491	Mysterious white swimming polychaetes again. Sheet to jumbled to pillow to sheet flow again - quick transitions.	
15	8	1630	13	423049	5082548	Nice, glassy lobate flow with a few ophiroids.	
15	9	1628	16	422995	5082520	Thin pillow lava shells with some exploded out.	
15	9	1628	16	422995	5082520	Unknown seabug - crustacean (basalt flea)	R494-114
15	9	1628	16	422995	5082520	Stopping the ship, about to change course. Weird white crustacean.	
15	17	1629	7	423045	5082732	Unknown worm (disco worm)	R494-115
15	17	1629	360	423338	5081918	It's a bug life. worm and crustacean	R494-116
15	18	1629	358	423046	5082727	Great close up of unknown white 'disco' worm and it's crustacean buddy. Ship moved, now heading due north. Just waiting for some navigation.	
15	22	1626	351	423173	5082760	Pillow flow, moving into lineated flow.	
15	24	1627	343	423071	5082611	3034, 2510 - ships position at stern. Still waiting for nav and ship to move before heading north.	
15	26	1627	349	423014	5082573	On the move again. Proceeding north. Glassy lobate flow.	

15	30	1619	4	423185	5082791	Glassy lobate flow. We have commentary again. Swimming ophuroid. Lavas with yellowish sediment on them at the bases - is a product of hot rock/see a water interruption of new lavas.	Photo 17
15	33	1616	4	423881	5083417	Contact of new pillows over old.	R494-117
15	32	1617	360	424603	5083122	Pillows are becoming bigger and a bit broken up. CONTACT running north between old and young pillows. Very stark contrast between glassy, black young pillows and grayer older pillows. 3037, 5283 - ship's position at N-S contact.	Photo 178
15	36	1611	3	423403	5083047	Heading back into the new lava. Stopping the ship to head 350 - want to get back to the contact again.	
15	38	1611	351	423335	5082995	Getting into shelly, drained out lobes. Another CONTACT - we are lateralling west facing north. Mixture of old and new flow - the new lava flow is getting thinner. Lots of broken pillows. Heading about 35.	Photo 179
15	40	1608	342	423046	5082728	see a anemone on older pillow/lobe surrounded by new flow.	R494-118
15	40	1608	346	423046	5082728	Beautiful huge pink anemone with smaller ones below.	
15	41	1608	342	422969	5082673	Still a mixture of old and new lavas. Moving the ship again to heading 290 to keep up with the new flow. Nice view of a contact point again.	
15	45	1606	352	423039	5082750	New flow contact (L) over older flow (R). Note the thin nature of the newer material (upper left)	R494-119
15	49	1606	319	423039	5082750	Shallow, collapsed pit. Into drained out lavas. Still waiting for the ship to move.	
15	51	1606	308	423039	5082750	Moving west at a heading of around 290. Drained out lobes with debris all over - exploded lobes, broken up. Getting into flatter, sheet flow rocks - approaching the source of the flow.	
15	54	1605	301	423039	5082750	Hardly any intact lava, most of it is broken up due to drain out. Moving into glassy lobates again, but drain out area seems to be increasing. Photo of large drained out lobe.	Photo 181
15	57	1602	296	423039	5082750	Going back to the cage to make sure everything is hunky dory. Then stopping the ship and going to head in a more northerly direction.	
16	1	1609	341	423039	5082750	Point of contact. New flow surrounding older lobes.	R494-121
16	1	1601	348	423039	5082750	Going to head 350 at half a knot. Back at the floor, on a contact - a bum shot, old lavas surrounded by a donut of new lava.	
16	4	1605	349	422981	5082671	Contact again - 2998, 2686.	Photo 182
16	7	1605	298	422651	5081720	Stopping the ship to head 30. Back on the new lavas consistently.	
16	10	1604	301	423167	5081883	Still waiting for the ship to move.	
16	13	1602	294	423211	5081875	We're moving. Heading 30. Nice collapsed pit.	
16	16	1599	313	422975	5082624	CONTACT again. Nice large pillow. Looks like a major scarp.	
16	18	1599	318	423000	5082804	Pink ophuroid. CONTACT again. Following the contact at a heading of around 30-310.	
16	21	1599	310	422984	5082712	see a anemone on older pillow	R494-122
16	21	1599	308	422984	5082712	Beautiful pink anemone on the side of a pillow. Stopping the ship for it to move 10m to the west but continuing on the same course.	
16	24	1597	313	423453	5081438	Still waiting for the ship to move. Hanging out on the contact.	
16	30	1598	305	423440	5081429	Ophuroids, a crinoid on ropy sheet flow.	

16	32	1595	307	422915	5082724	Into more complex terrain now - jumbled, broken flow and a big drained out structure. Still no fixes from the southern net - using the stern of the ship for positions. Back into a stream of sheet flow, photo.	Photo 183
16	35	1599	308	422668	5082716	Ropy sheet flow with sediment in groves, probably mostly pelagic in origin. Ship starting to move again at a heading of 30.	Photo 184
16	37	1599	323	423732	5083623	sediment in the groves of the sheet flow.	Photo 185
16	39	1597	310	423725	5083628	Moving from the sheet flow into more rugged terrain. Very sparse biology. A big push up structure with a large collapsed drained out area behind.	
16	40	1595	317	423725	5083628	Climbing up a cliff with rubble talus at the bottom. Some yellowish sediment that may be hydrothermal in origin. Moved into very rough terrain - jumbled flow.	
16	43	1593	313	423744	5083688	Traversing over very broken up lava, jumbled flow in a collapsed area.	
16	47	0	0	0	0	Photos of the very broken up lava. Photo 188 of a big block with lots of sediment at the bottom. Rough terrain with many jagged blocks. (photos 186 - 189)	Photos
16	47	0	0	0	0	Strange swimming white polychaete again. Big rattail. Still very jumbled, rough flow.	
16	53	1592	316	422727	5082816	2704, 2831 - ships position at stern. Still traversing jumbled, broken up flow. Swimming polychaete again.	
16	55	1592	316	422727	5082816	Lots of pushed up ridge structures. We are moving perpendicular to them.	
16	56	1591	309	422727	5082816	Photo of rattail and jumbled lava.	Photo 190
16	56	1592	308	422689	5082881	Rattail for scale - probably around 50-60 cm long. Lasers for scale.	
16	58	1592	322	423227	5082929	Note: red laser points are 10 cm apart.	
17	0	1593	307	423325	5082423	see a star (plump) on old lava flow	R494123
17	0	1592	312	423325	5082423	Lobate flow for a few meters. Back into jumbled, broken ropy flow. A photo of a plump asteroid. Now ropy sheet flow again. Back up along a pressure ridge, into lobate flow.	Photo 19 Photo 192
17	2	1592	316	422585	5082884	Broken, jumbled flow again.	
17	4	1591	316	422585	5082884	Very broken up flow into lobates again. Probably nearing a contact point again because of lobates, slower flow.	
17	6	1592	316	422569	5082920	large pit, sediment	photo 193
17	7	1591	316	423190	5082442	more of the big hole	photo 194
17	7	1591	306	423177	5082448	Overhanging rim. Still in lobate flows, with intermittent collapsed structures about 3 m deep.	Photo 195
17	9	1591	319	422625	5082852	Into a ropy sheet flows.	
17	11	1592	314	422625	5082852	Jumbled flow, breccia at the bottom of a push up feature. Photo of blocky, hackly lava.	Photo 196
17	13	1593	312	422625	5082852	Had to reset the Imagenex.	
17	15	1595	311	422625	5082852	A couple swimming polychaetes again. Still in jumbled, blocky flow. Very broken up.	
17	17	1594	322	422388	5083018	On top of a hill/ridge structure. Big broken blocks.	
17	19	1596	312	422388	5083018	Back into lobate flows.	
17	21	1600	321	422388	5083018	Lobates mixed with broken up flow now. More continuous lobate flows again.	
17	24	1600	317	422297	5083071	Into jumbled, broken, blocky flow again. Some old lava peeking through - new lava crust quite thin here.	Photo 197

17	27	1601	277	422976	5082500	Heading west to try and find the contact. Pillow lavas.	
17	30	1604	304	422391	5083043	Drain out structure with a small column supporting the roof. Still lobate surface with drained out areas. CONTACT point: 2184, 3139.	
17	31	1604	324	422391	5083043	Stopping the ship. ROPOS is 60 m NE of the stern of the ship - where the above fix was from. Moving ship 50 m to the east, then starting on a heading of 045.	
17	35	1598	56	422074	5085359	Bob thinks new flow is about 90 m wide. Waiting for the ship to move.	
17	41	1598	45	422074	5085359	We're moving again - heading northeast. On old lavas now.	
17	44	1598	48	422206	5083150	2206, 3159 - fix of stern of ship.	
17	44	1597	44	422206	5083150	Crinoid and asteroid on old lava.	
17	49	1593	43	422206	5083150	Still on the old lavas heading 045 - lots of holothurians. Edge of a collapsed pit, into the new lava again? 2282, 3286 fix.	
17	52	1589	46	422276	5083225	Still in old pillow lavas - that jumbled bit of flow may have been a channel of new lava passing through the old flow.	
17	53	1587	50	422316	5083267	Old lavas. Beautiful slender asteroid, crinoid, ophiroids.	Photo 199
17	56	1584	45	422316	5083267	Sunken area with a wall of large pillows - coming up a slope. x=2404, y=3362 fix.	
17	58	1578	48	422343	5083334	Still climbing up the wall. Highlights on. Nice big pillows with lots of biology. Come up about 9 meters now (18:01).	
18	1	1568	45	422872	5082784	2527, 3478 fix. Tons of sponges on the old lava, some holothurians, an asteroid (18:02).	
18	4	1567	36	422131	5084096	Stalkless crinoid on old lava flow	R494-124
18	4	1567	38	422131	5084096	Photo of a stalkless crinoid. Still tons of sponges. Huge plump starfish (18:05).	Photo 20
18	7	1563	46	423145	5082693	Highlights are off. Fix: 2642, 3602.	
18	10	1559	35	422700	5083642	seem to have reached the top of the ridge/hill structure. There were tons of sponges and other biology on the slope, Fix: 2736, 3684.	
18	18	1518	227	422825	5083759	We have been having some problems with the tether for the past 10 minutes or so. The ship is stopping so we can get back to the bottom.	
18	23	1525	23	422709	5083710	Back at the cage.	
18	27	1528	20	422709	5083710	Lost video on the sub. Is power down? The tether went again. Coming back up.	
18	36	1528	20	422709	5083710	Dive Summary following pages:	

18	36	1528	20	422709	5083710	<p>Dive Summary R494: ROPOS Dive R494 was a continuation of the two previous dives, which were ended early.</p>	
						<p>The objective was to determine if the 1998 eruption was continuous between the northern, well-mapped area and the southern SeaBeam anomaly (visited last year on R465), and to map out the extent of the 1998 lavas.</p>	
						<p>This dive started about 800 meters south of the southern SeaBeam anomaly (1200 m south of the R465 dive track) on Axial's South Rift Zone, near 45 51.5'N and generally headed north along the rift zone.</p>	
						<p>The pre-1998 lavas were much older here, in general, than further north (near Bag City Vent), allowing the 1998 lavas to be easily distinguished. About 500 meters south of the southern SeaBeam anomaly ROPOS encountered a fissure with '98 lavas in the</p>	
						<p>bottom. As ROPOS approached the anomaly, the lavas overflowed the fissure and spread outward. This was clearly the surface expression of the dike that fed the eruption. North of the southern SeaBeam anomaly, we traversed NW and lost the '98 lava, but</p>	
						<p>encountered it again after we traversed back to the NE, about 700 meters NE of the north edge of the anomaly. The '98 lava here was ~200 m wide, but as we followed it north, it narrowed and eventually pinched out completely about 400 m further north.</p>	
						<p>This '98 lava is probably connected to the southern SeaBeam anomaly. The '98 eruptive fissure along this part of the SRZ was further to the east than we had expected, based on bathymetry. For example, it is 350 meters east of the large cratered mound</p>	
						<p>at 45 52.85'. ROPOS crossed the trend of the '98 eruptive fissure again, 600 meters further north and again young '98 lava. There was a big drained out lava lake in this area. '98 lava was followed another 200 - 300 meters along axis, and then ROPOS</p>	

						crossed another 200 - 300 meters of older lava, before reaching the eastern contact of more new lava. The sub then traversed to the NW and was in '98 lava for ~ 800 meters. Once at the western contact, ROPOS turned to traverse NE, but did not cross '98	
						lava again. The traverse to the NE was never completed because ROPOS telemetry was lost and the dive ended prematurely. At the end of the dive, ROPOS was about 1000 meters NNE of the last crossing of '98 lava (and west of where it would be expected),	
						and about 1150 meters south of the traverse on Dive R493 (and about 100 meters west of the '98 lava contact from Dive R493 if extended southward). In summary, the '98 eruption appears to be nearly continuous from its northern end, south to almost 1 km	
						south of the southern SeaBeam anomaly. In this area between the two, the eruptive fissure changes orientation from north-south in the north to a NNE orientation in the south. ROPOS back on deck 1930.	

UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
Dive R495							
Dive Plan: 1) Fluid sampling of southern caldera/upper South Rift Zone vents - Mkr-108, Mkr-113, Castle, Joystick, Coquilles, Bag City.							
2) Suction sampling: Mkr-113 Marcus/Moyer, Bag City Moyer/Juniper, Diatom mat on new lava - Tunncliffe.							
3) Recover and deploy MTR's at Mkr-113 and Bag City. 4) Sulfide sampling at Castle. 5) Finish Imagenex survey, geology traverse south.							
ROPOS Configuration: Hot Fluid Sampler, Suction sampler (j1 - j4 and 1 - 4), Niskin, Imagenex, cameras and rock purse							
Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.							
3	39	99	290	422709	5083710	ROPOS in water at 3:30, Julian Day 186.	
4	52	1478	328	423814	5087055	Nearing bottom, water is murky.	
4	56	1519	18	424638	5087317	On the bottom, lineated sheets and ropy sheets. old flows	
5	0	1521	97	423812	5087127	Mkr-33 in view.	
5	2	1522	241	423845	5087103	AT vent site. Lots of growth on the Osmo samplers already.	
5	6	1523	191	423841	5087040	Mkr-33 site with gear	R495-3
5	7	1523	202	423841	5087040	Mkr-33 vent site, deploying OsmoSampler	Photo-1
5	13	1523	187	423824	5087152	osmoanalyzer Fe-analyzer Deployed at Mkr-33	R495-4
5	18	1523	193	423836	5087124	placement of osmo	R495-5
5	21	1523	198	423821	5087152	Placement continued - osmo	R495-6
5	21	1523	198	423821	5087152	Finishing positioning Osmo sampler just to right of bacteria traps under the lip of the sheet flow, in the concentrated fluid flow.	
5	26	1523	187	423845	5087108	Placement continued	R495-7
5	31	1523	185	423847	5087107	final osmo placement	R495-8
5	27	1523	187	424648	5087324	Going to take a temp measurement with the fluid sampler tip. Temps. Max 15 C. Photo 2 of position of deployed Osmo. in vent at Mkr-33.	Photo-2
5	32	1523	185	423870	5087044	Making a lateral video survey of area around Mkr-33. Highlights being taken to.	
5	33	1523	179	423845	5087109		R495-9
5	33	1523	178	423845	5087109		R49510
5	34	1523	180	423845	5087109	Picture of fracture at Mkr-33 with the many interesting pieces of scientific equipment.	Photo-3, 4
5	36	1523	184	424645	5087322		R495-12
5	37	1523	202	423846	5087103		R495-13
5	36	1523	178	424645	5087322	Photos of vent facing S.	photo-6,7, 8
5	37	1522	220	423856	5087086		R495-14
5	37	1523	220	423856	5087086	turning to face the fracture, taking more photos	Photo 9
5	38	1523	234	423855	5087078		R495-15
5	38	1523	236	423855	5087078		R495-16
5	38	1523	234	423855	5087078	one more photo of site and deployment.	photo-10

5	39	1523	232	423936	5086880		R495-17
5	42	1522	228	423747	5087351	Need to reposition traps	R495-18
5	48	1523	103	423833	5087055	Backside of Mkr-33	R495-19
5	49	1523	88	423851	5087102		R495-20
5	51	1524	36	424647	5087321	Tube worms galore	R495-21
5	50	1524	40	423853	5087085	Moving to the S side of the sheet flow, where the slab has collapsed and there is new? venting. Tubeworms, snails, limpets, bacteria, bag creatures present. Possible that the slab of sheet dropped within the last year so this venting is a new expression.	
5	52	1524	36	423846	5087110	Concentrated diffuse venting has worms and snails. Trying to get a temperature. Max temp around 14 C.	
6	1	1523	184	423838	5087058	View of area around Mkr-33	photo-12
6	2	1523	197	423843	5087098	transect	R495-22
6	2	1523	221	423713	5087595		R495-23
6	3	1522	216	423713	5087595		R495-24
6	3	1522	222	423713	5087595		R495-25
6	3	1522	217	423967	5086873		R495-26
6	7	1523	214	423718	5087595	Repositioning Bacterial traps 41 so that they are closer to venting.	
6	9	1523	213	423848	5087109	Trap reposition of 41, 42 looks good!	R495-27
6	9	1523	190	423847	5087113	Moving ship to Mkr-108.	
6	16	1518	181	423968	5086640	lava spires	R495-28
6	16	1519	179	423968	5086640	more lava pillars	R495-29
6	18	1516	186	424779	5087025	A moving experience. over old collapse area, pillars galore.	
6	19	1518	182	423964	5086598	White bacterial? stains on tops of pillars/ lobate crusts of roofs of drained out areas.	
6	23	1517	175	423868	5086975	Continue in collapse area with many pillars. some seem to be aligned. May be 3-4 m deep? Altimeter is not on. Depth of collapse seems to be shallowing to the SW. More arches and remnant roofs.	
6	27	1519	239	423788	5086921	Pillars and collapse area. Photo 15 is of a fallen pillar.	Photo 14,15
6	29	1519	218	423766	5086905	roof over pillar	R495-30
6	30	1518	216	423761	5086896	Roof over collapse	R495-31
6	30	1517	213	423766	5086891	Still heading SW. Started Imagenex. Collapse region, with more uncollapsed roof. Not more than a meter or two deep here.	
6	33	1517	212	423747	5086858	Turning on suction bottle to get a background temp.	
6	36	1519	217	423732	5086821	Large coherent sheet flow on floor of collapse. Taking temp up in water column. Folded and jumbled sheets.	
6	43	1519	274	423702	5086775	rumble-o-meter	R495-32
6	40	1520	219	423719	5086780	Broken up sheets, chaotic area. Rumbleometer in sight. Sitting in folded sheets.	
6	44	1520	132	423716	5086770	Fairly flat area of mostly folded sheet flows and jumbled sheets. Light sediment in-between folds.	
6	48	1521	201	423784	5086704	Ropy sheets then into folded sheets and then jumbled sheets.	
6	49	1522	204	423781	5086656	Some relief here. Pillars again with bacterial staining. Lots of white staining. May be venting. more activity.	Photo 16
6	51	1515	183	423778	5086616	water definite cloudy here.	

6	52	1518	186	423780	5086604	Pillars have staining on them but relatively little on the collapsed floor.	
6	54	1520	230	423780	5086589	Mkr-108?	R495-33
6	54	1520	230	423780	5086589	Top of pillar with some bacterial stains.	R495-34
6	54	1518	223	423775	5086591	good fixes.	
6	56	1509	350	423766	5086601	Tether management. We'll take a short break and then Andy will take over.	
7	6	1499	124	423738	5086632	looking for Mkr-108, bearing 105, around 25m away	
7	8	1523	100	423752	5086614	ropy sheet flow, possible venting to the left	photo 17
7	8	1523	106	423758	5086612	staining of ropy sheets, with fracturing, mkr should be around south end of pillar	photo 18
7	10	1519	39	423778	5086591	staining on pillar	photo 19
7	10	1522	20	423752	5086608	tube worms visible, venting is apparent but no marker in sight, good fix	
7	11	1523	38	423777	5086605	no marker visible, but according to fix should be around 20 meters away	
7	13	1520	177	423407	5087266	staining visible on surrounding pillars	
7	14	1519	182	423782	5086601	smaller pillars with visible venting	
7	15	1519	250	423757	5086591	date is wrong on the overlay - it is one day behind	
7	16	1519	296	423757	5086593	coming around to get on south side of pillar, lots of white staining but no apparent venting	
7	16	1520	11	423772	5086587	no venting on south side of pillar	
7	17	1519	47	423772	5086585	possible marker in distance, moving around to check it out	
7	18	1520	6	423778	5086589	good fixes, lots of floc but no marker yet	
7	20	1520	100	423786	5086592	good fixes	
7	24	1518	251	423776	5086589	heading back to first place we saw venting, worms are visible on top of pillar	
7	25	1520	230	423778	5086580	stopped on top of pillar, appears that there is a little bit of venting, very slow trickle of non shimmery water.	
7	27	1519	318	423301	5087530	heading NW, 318.2 to the place we started looking for Mkr-108	
7	29	1521	338	423764	5086599	low lying pillar with cracks leading up to it, but no shimmering water, continuing	
7	32	1521	323	423756	5086603	good fix, has us right under cage	
7	33	1520	6	423746	5086625	fix now has us north west of cage, with no pillars in sight	
7	36	1520	270	423305	5087533	jagged, crumbly flow	
7	37	1521	271	423738	5086591	good fix, due west of target by about 40 meters but no pillars in sight	
7	38	1520	89	423726	5086587	heading straight east over jumbled ropy sheet flow	
7	39	1521	86	423749	5086583	good fix	
7	40	1520	86	423743	5086575	possible vent out of big hole, but we cant get to near it to check it out	
7	44	1521	81	423771	5086586	good fix, and some vent coming out of the base of a pillar, we are going to continue the transect to the east and then come back if there is nothing better	
7	47	1522	352	423773	5086605	venting coming out of hole with worms surrounding it. Dave has decided to sample here	
7	49	1523	29	423312	5087530	we are 20 meters at 329 from the target but have decided to sample from what appears to be two holes	
7	51	1523	73	423772	5086607	placing the temp probe inside one of the holes,	

7	56	1524	136	423781	5086593	good fix, but the temp probe bumped into the side of the vent and now it has collapsed into a swirling mass of floc and shimmering water, the temperature did reach 9 C though.	
8	7	1524	132	423771	5086608	temp is around 13.6 C for max	
8	7	1524	128	423772	5086609	starting first sample, max 13.6 C	HFS-17_dfl _R495-1
8	9	1524	132	423789	5086580	the last was a false start, now we are really sampling!	
8	11	1524	130	423771	5086608	Taking hfs at base of pillar near Mkr-108	R495-35
8	14	1524	131	423772	5086608	stopping sampling, 50ml sampled	
8	16	1524	130	423751	5086609	starting to sample with gas piston 5	HFS-5_dfl _R495-2
8	17	1524	129	423751	5086609	stopping sampling at 125ml	
8	18	1524	128	423324	5087585	picture of sample site	photo 20
8	18	1524	132	423981	5086592	starting sampling	HFS-10_dfl _R495-3
8	24	1524	130	423771	5086607	stopping sample with 60ml of fluid, this is the last fluid sample here, we are now heading south to slurp	
8	27	1524	128	423774	5086605	Where we fluid sampled near Mkr-108	R495-36
8	28	1524	126	423774	5086607	leaving sampling site	
8	29	1522	197	423752	5086602	saw 2 Alvin dive weights 1 m at 238 heading	
8	32	1523	204	423769	5086563	heading over ropy sheet flow to get a suction sample	
8	33	1525	220	423756	5086558	found a good pocket of sediment to sample, now attempting to pick up the suction sampler, good fix of x=3755 y=6560	
8	36	1525	219	423757	5086560	good fix	
8	47	1525	265	423293	5087520	people are now changing their minds whether they want samples here, we are moving into a better area to get suction samples	
8	50	1526	211	423759	5086554	beginning suction sampling, new fix is x=3759 y=6555	SS-j1_sed _R495-4
8	51	1526	211	423759	5086556	Taking sediment sample near Mkr-108	R495-37
8	55	1526	212	423760	5086555	stopping sample	
8	58	1526	212	423759	5086555	suction is on	SS-j4_sed _R495-5
9	2	1526	211	423760	5086558	outlet temp probe on suction sampler is working but the inlet temp probe is broken off, we think it broke off sometime before now	
9	5	1526	213	423758	5086558	done sampling here, going to move ship and then head over to Castle, which is 40 m SE	
9	9	1500	15	423542	5087430	we are now up at 150m and there is definitely a plume, lot o' particles, Dave deduces that there must be more venting going on near Mkr-108 (which we never found) than we discovered	
9	12	1519	141	423542	5087430	we are down right under the cage, and found the venting that we first discovered when we got here	
9	13	1520	131	423790	5086551	ship moving 350m at heading 141	
9	24	1522	131	423794	5086585	transit to castle	photo 21
9	25	1519	137	423808	5086578	going over some very thick orange sediment, good fixes	
9	28	1522	153	423845	5086531	going over ropy sheet flow	

9	29	1518	156	423848	5086513	going over a long network of collapsed lobate roof	
9	30	1518	154	423858	5086498	good fixes	
9	31	1519	156	423860	5086495	no more sign of collapsed lobates, all are intact	
9	33	1520	161	423878	5086470	lot of collapsed lobate surfaces, held up by pillars	
9	35	1519	159	423894	5086437	we are 185 m away from castle	
9	36	1520	162	423898	5086427	beautiful skylight	photo 2
9	36	1520	160	423898	5086427	Skylight with a basalt pillar supporting it	R495-38
9	36	1520	158	423904	5086422	coming to the edge of a drain away area, lots of iron oxide sediment	
9	45	1521	154	425173	5086358	a beautiful example of a lobate crust, it looks solid but it isn't. surprise!	
						lots of white staining on rock, there is a vent in site. we are officially at castle	
9	46	1518	98	424003	5086307	lots of white staining on rock, there is a vent in site. we are officially at castle	
9	47	1511	64	424011	5086310	Castle	R495-40
9	47	1512	66	424011	5086310	4011 6310 this is a good fix	
9	48	1512	49	424012	5086310	photo of castle	photo 23
9	48	1512	55	425181	5086333	top of castle	photo 24
9	48	1512	52	425181	5086333	Edge of Castle	R495-41
9	49	1510	70	424013	5086310	top of castle	photo 25
9	49	1512	117	424012	5086309	top of castle	photo 26
9	49	1512	120	424012	5086309	SE view of Castle	R495-43
9	49	1512	144	424012	5086314	top of castle	photo 27
9	50	1514	151	424012	5086314	Another view of Castle	R495-44
9	50	1513	158	424014	5086315	top of castle	photo 28
9	50	1514	191	424013	5086315	top of castle	photo 29
9	51	1514	219	424015	5086319	top of castle	photo 30
9	51	1515	234	424003	5086317	A lower portion of Castle	R495-46
9	51	1514	246	424003	5086317	side of castle	photo 31
9	52	1512	281	424015	5086301	Castle again	R495-47
9	52	1512	280	424015	5086301	bacteria side of castle	photo 32
9	52	1513	220	424032	5086328	side of castle	photo 3 and 34
9	54	1513	13	424013	5086305	Castle yet again	R495-48
9	54	1514	12	424013	5086305	mat side of castle	photo 35
9	54	1519	16	424013	5086305	Venting area on Castle	R495-49
9	54	1520	20	424016	5086302	Another view of venting at Castle	R495-50
9	55	1520	358	423982	5086306	parked in front of small anhydrite structure	
9	55	1520	3	424023	5086305	Top of spire with venting at Castle	R495-51
9	56	1519	16	424016	5086310	Protozoan mat at Castle - the blue goo	R495-52
9	57	1519	12	424001	5086310	lots o' limpets and blue protozoan mat above anhydrite structure	
9	58	1520	346	424002	5086310	three of Craig's traps are there but are completely covered in limpets!	
9	58	1520	345	424002	5086310	Bacteria traps at Castle deployed in '98	R495-53
9	59	1521	348	425181	5086324	anhydrite structure	photo 36
9	59	1520	344	425299	5086355	attempting to break of anhydrite structure for Steve	
10	0	1520	348	425181	5086324	structure fell and we may try to pick it up after we fluid sample	

10	1	1520	345	425182	5086332	Bacteria trap at Castle	R49-554
10	2	1520	348	423999	5086310	fluid is really rushing out of the hole we made by knocking over the anhydrite structure, placing temp probe into hole	
10	6	1521	350	425167	5086316	Temperature probe at Castle	R495-55
10	7	1520	346	423576	5086341	max temp so far of 151 C, lost coms but now it is back	
10	10	1520	348	424015	5086303	temp has now peaked at 175 C	
10	12	1521	351	423978	5086313	temp increasing up to 255 C	
10	15	1521	349	424526	5086299	new high is 270	
10	16	1520	346	424016	5086309	starting fluid sampling at castle, t1 274 C, t2 17 5C, good fix at 4016 y= 6309	x= HFS-4_hfl _R495-6
10	19	1521	348	424020	5086309	pump turned itself of and Dave is attempting to turn it on, which he succeeded at	
10	20	1521	351	424019	5086310	stopped sampling, 460 ml	
10	22	1521	352	424022	5086227	starting filtering for xrf	HFS-2_hfl _R495-7
10	27	1521	345	424016	5086309	Worms at Castle	R495-56
10	27	1521	347	424016	5086309	sampling done at 507 ml	
10	27	1521	347	424019	5086310	probe nozzle appears to have crud on it, so Dave is trying to blow the flow out in reverse to clean the tip off, it appears successful	
10	31	1521	347	425189	5086335	starting sampling on bag 18 with filter	HFS-18_hfl _R495-8
10	34	1521	350	423998	5086310	sampling stopped, 3mins of sampling, around 375 ml	
10	39	1521	349	424016	5086310	gas tight fired at 10:40, starboard gas tight	gtb_hfl_R495-9
10	46	1521	350	424021	5086310	getting 5 function positioned to take a Niskin	
10	52	1518	12	424202	5086836	Nisken collected 2m	Niskin_R495-10
10	55	1515	311	424020	5086309	Steve and Bob highlight on	
10	58	1513	162	424018	5086313	FeOxide chimney	photo 37
10	58	1513	158	424018	5086313	Castle again	R495-57
10	59	1513	163	424016	5086314	Grabbed a large sulfide sample	R495-58
10	59	1513	164	425183	5086324	chimney spire broken of, taken to the bottom to subsample	
11	2	1517	243	423999	5086320	ROPOS on the bottom near castle vent, trying to open the bag on the front of the fluid sampler with the probe. Bag is open, chimney is positioned above the bag. Pieces of the chimney are breaking off after hitting the fluid sampler and falling	SF_R495-11
11	15	1518	261	424024	5086318	Moving to Flattop SE 5-10 m away.	
11	17	1515	162	425505	5086968	Arrived at Flattop, Mkr-N5. Look	
11	17	1512	158	425184	5086323	Mkr-N5, Flattop	Photo 38
11	24	1512	97	424035	5086306	Attempting to collect a piece of FeO from the top of Flattop. Positioning sample over bag, opening the bag with the probe, putting FeO sample into bag.	FeO_R495-12
11	31	1512	80	424036	5086306	Attempting to close the bag completely with the 5 function arm. Bag closed.	
11	33	1512	91	424034	5086306	Just next to Flattop there was another small FeO spire. Just about 2m away, heading west.	
11	36	1512	31	424042	5086291	ROPOS is moving back to the cage.	
11	39	1519	232	425193	5086345	ROPOS is on the bottom, starting to move toward Mkr-113.	

11	40	1520	231	424006	5086276	Moving over the old flow. Nav is reasonably good.	
11	47	1520	232	423996	5086280	good fix	
11	49	1521	232	425197	5086271	Partial collapse lobate area. May be young lava flow.	
11	53	1523	236	423912	5086200	Iron staining, a few meters back we went through the contact.	
11	59	1528	252	423550	5086856	Glassy flow, probably '98.	
12	0	1527	249	423829	5086153	Close up of jumbled lava flow, now with hydrothermal staining. Some ropy flows that are now broken up. Also lots of Fe oxyhydroxide	
12	1	1526	253	423800	5086133	Oxides	Photo 40
12	1	1525	243	423794	5086128	The bottom	Photo 41
12	2	1524	243	423783	5086121	Seeing some white mat. More white mat. Very broken up, drained out area.	
12	3	1525	247	423772	5086111	Lava looks like '98 flow, infiltrated with FeOxides, some more white sulfide mat.	
12	4	1524	243	423756	5086097	Patch of small tube worms	
12	4	1524	243	423756	5086097	Jumbles lava, with tube worms, and mat.	Photo 42
12	5	1526	248	423756	5086097	Large ropy sheet flows, lots of FeOxide sediments, some white mat.	
12	6	1525	246	423756	5086097	Mat along the cracks	
12	6	1526	248	423721	5086083	cracks, mat and (before) we saw small tube worms.	photo 4
12	8	1527	246	423702	5086077	large ropes, FeOxide sediment low temp hydrothermal deposits.	photo 45
12	9	1526	244	423684	5086062	Fe deposit	photo 46
12	9	1526	245	423677	5086057	Heavy FeOxide sediment	photo 47
12	10	1526	241	423671	5086052	heavy FeOxide sediment on the ropy flow.	photo 48
12	10	1525	247	423671	5086052	iron oxide sediment on sheet flows	R49560
12	10	1524	244	423665	5086047	Mound of sheet flow, lots of FeOxide sediment, some light in color suggesting recent activity.	photo 49
12	11	1524	243	423654	5086038	Over main sheet flow.	
12	12	1526	241	423650	5086035	Sheet flow with FeOxide.	photo 50
12	12	1525	242	423645	5086030	push up area	photo 51
12	13	1524	245	423624	5086014	Small collapse area. Now into a more solid lobate flow w/ drain outs.	
12	15	1523	243	422920	5085314	Spires in	photo 52
12	15	1522	244	423595	5086006	More spires in a collapsed area.	photo 53
12	16	1524	245	423586	5085997	more spires , roof collapse, in young lava.	photo 53
12	17	1523	246	423567	5085980	Debris of collapsed roof material.	photo 5
12	17	1522	244	423564	5085977	Floor of collapse area.	
12	18	1523	240	423557	5085970	Area of extensive drain out. Very broken up.	
12	19	1524	244	423545	5085966	Spires.	photo 56
12	20	1523	246	423534	5085961	Drain out area, 4-5 meter high spires.	
12	20	1524	243	423529	5085956	natural bridge	photo 57
12	21	1523	247	423517	5085947	lobate	photo 58
12	22	1523	248	423511	5085943	Floating creature	R49561
12	22	1522	243	423511	5085943	floating gelatinous creature.	photo 59
12	25	1524	268	423463	5085921		photo 60
12	25	1524	268	423456	5085919	lobates	photo 61
12	26	1523	269	422789	5085259	Ropy bottom	

12	26	1524	266	423450	5085934	white mat	
12	26	1525	270	423450	5085934	good fix.	
12	27	1524	267	422467	5084937	FeOxide sediment on pahoehoe	photo 62
12	28	1524	272	423419	5085909	Tube worms.	
12	29	1524	274	423409	5085908	pillar with a lot of white staining	photo 62
12	30	1524	272	423405	5085901		photo 64
12	31	1523	267	423398	5085903	on top with tube worms.	photo 65
12	32	1523	271	423392	5085906	top surface with tube worms, bacterial mat , young lava, glassy.	photo 6
12	33	1524	281	423392	5085906	Dead Tube worms near Mkr 13	R495-62
12	33	1522	273	423386	5085900	Spire covered with mat underneath.	
12	34	1524	270	423394	5085879	Dead tube worms near Mkr-113	R495-63
12	34	1524	275	423386	5085895	Lots of stressed or dead worms, spread out in a crack.	
12	36	1523	268	423596	5085540	Highlights on.	
12	36	1524	270	423388	5085889	Area of warm water.	
12	36	1524	265	423388	5085889	Tube worms. some alive near Mkr-113	R49565
12	37	1523	267	422765	5085284	Looking for Mkr-113	
12	39	1524	2	423357	5085901	spire structure, looks like a house.	photo 676
12	39	1524	360	423364	5085906	Window in lava wall	R49566
12	39	1525	356	423365	5085908	same another view	photo 68
12	40	1525	358	423364	5085910	interior of column	photo 69
12	40	1524	360	423368	5085912	tube worms	photo 70
12	40	1523	358	423370	5085914	same as above, worms	photo 71
12	41	1523	2	423372	5085919	warm water w/ new worms.	
12	41	1523	5	423372	5085926	arrive Mkr-13	
12	41	1523	4	423372	5085926	same	photo 72
12	41	1525	3	423372	5085926	same marker 113	photos73 and 74
12	42	1525	358	423372	5085930	Marker 113	R495-67
12	42	1526	9	423371	5085930	Bottom of 113	photo 76
12	43	1524	343	423372	5085931	Mkr-113	photo 7
12	44	1524	334	423374	5085933	Looking around at Mkr-113.	
12	48	1525	209	423373	5085933	bacteria traps Mkr-113	R495-68
12	49	1525	204	423372	5085933	Really good fixes.	
12	50	1525	215	423373	5085932	Bacteria traps mkr 113	R495-69
12	50	1525	212	423373	5085932	Looking for a good spot to sample.	
12	50	1524	285	423372	5085932	New VCR tapes.	
12	54	1524	222	423378	5085928	Still looking for a good spot to collect fluid samples.	
12	58	1525	38	423370	5085933	Returned to Mkr-113 looking for a spot to sample water, up on top near a bacterial trap and tube worm area with good flow of water.	
13	0	1525	41	423370	5085933	Looking for a max temp with the probe. good fixes.	
13	3	1525	43	423370	5085932	bag 1 w/filter max t 20.3, T1 just lost coms. Pump is still on. Temp is now 21. T2=1.8 Starting again 13:07	HFS-11_dfl _R495-13
13	8	1525	43	423368	5085932	good fix. Still sampling bag w/filter. R495-13	
13	11	1525	40	422723	5085298	Stopping max T was 2.6 C.	

13	12	1525	41	423370	5085933	bacteria traps. mkr 113	R495-70
13	13	1525	44	423369	5085933	gas tight port side starting 13:14 done 13:14	gtb_dfl_R495-14
13	15	1525	40	423370	5085932	13:15 unfiltered bag 16 on 13:16:32, temp is going up 0.27 C, stopping 13:21:4	HFS-16_dfl_R495-15
13	22	1525	40	422430	5084988	ROPOS is lifting off in order to reposition for suction sampling.	
13	25	1525	100	423371	5085933	ROPOS has settled back down. Starting to flush the suction sampler.	
13	29	1525	91	423371	5085933	Suction sampler bottle 1 begin sampling mat near bacterial traps for Moyer. 13:32 stopping bottle 1 is full.	SS-1_mat_R495-16
13	32	1525	90	423370	5085933	Continuing to sample same mat area. pump on 13:34 . Hose has become disconnected from end of suction probe. 13:35	SS-2_mat_R495-17
13	36	1525	90	423377	5085939	broken hose of slurp sampler	R495-71
13	36	1525	87	423376	5085917	Laser dot on sampled area	R495-72
13	45	1525	57	423371	5085934	Mkr-113 with filamentous bacteria growing on it	R495-73
13	46	1525	37	422726	5085300	ROPOS is repositioning to pick up MTR	
13	48	1527	48	423370	5085931	photo of tube worms on the MTR line	photo
13	48	1527	54	423370	5085931	tube worms growing on line	R495-74
13	49	1527	43	423369	5085930	Releasing SS, 5 function arm is picking up the VEMCO (no #) MTR.	
13	51	1527	32	423369	5085930	Vemco MTR with tube worms on the line. Opening bag to deposit sample. Stuffing MTR and worms into the bag.	MTR+bio_R495-18
14	8	1527	29	423369	5085931	Opening the bag with the 5 function arm while bringing the lose, floating end of the MTR line in with the HFS probe. Not able to secure the line yet.	
14	11	1527	29	422726	5085299	holding the MTR line and the suction sampler handle in the 5 function arm. This secures the line.	
14	13	1527	32	423370	5085931	The bottom at the base of Mkr-113.	photo
14	13	1526	350	423373	5085932	More bacteria traps, mkr 113	R495-75
14	13	1526	6	423370	5085930	ROPOS is moving. Doing a survey of the base of Mkr-113. Looking for bacteria traps.	
14	14	1527	5	423372	5085931	bacteria traps.	photo
14	15	1526	328	423370	5085929	Area around bacteria traps at mkr 113	R495-76
14	15	1526	308	423372	5085933	base of Mkr-113.	photo
14	15	1526	304	423372	5085933	bacteria traps mkr-113	R495-77
14	15	1524	356	423372	5085933	ROPOS is moving back to the cage.	
14	21	1524	186	423358	5085855	Leaving Mkr-113	Photo 82
14	22	1523	184	423355	5085850	Sub heading 185.	
14	22	1522	175	423360	5085853	lot of diffuse venting on bottom , lots of staining.	photo 83
14	24	1523	181	422792	5085287	White staining, diffuse venting.	photo 84
14	24	1523	177	423363	5085843	Highlights on.	
14	24	1524	182	423348	5085843	Lobate flow, with staining, mats and worms,	
14	25	1525	179	423380	5085860	staining white, active vent sites.	photo 85
14	26	1524	175	422602	5085096	White staining and Fe staining. Diffuse venting has been mostly continuous so far.	photo 86
14	26	1524	174	422396	5084985	Lateral back to the right. No more staining.	
14	27	1525	170	423361	5085803	lobates, not active for venting.	photo 87
14	29	1525	182	423366	5085788	Traveling over lobates, no sign of active venting.	

14	30	1526	183	423386	5085798	Lots of orange sediment collected in lobate cracks. Crab.	Photo 8
14	31	1526	168	423373	5085762	Orange sediment indicates that there used to be active venting in between lobates. Possible that some of the holes are still active.	
14	32	1526	173	423380	5085749	Lateralizing to the right and orange sediment is decreasing.	
14	39	1530	177	423357	5085636	More signs of venting with increased orange sediment in cracks. About 140 m from Joystick.	Photo 89
14	41	1532	181	423485	5085150	collapse & pillars	R495-78
14	41	1532	182	423485	5085150	Jumbled, broken flow with some pillars.	Photo 90
14	43	1531	189	423349	5085571	Water continuously cloudy. Less staining in cracks.	
14	44	1532	186	423348	5085559	Some white staining in cracks now. About 50 m from Joystick.	
14	45	1531	183	423351	5085545		Photo 91
14	46	1530	191	423347	5085535	Thick white mat on the side of a ridge, broken/jumbled flow. Lots of milky water coming out - looks like what Easy/Milky/Magnesia looked like last year.	Photos 92 - 94
14	50	1534	67	423354	5085520	We are at Joystick - positioning to sample.	
14	55	1533	45	423310	5085484	Put new video tapes in.	
14	58	1535	64	423321	5085460	Positioning to fluid sample. Temperature up to 7 degrees C.	
15	3	1535	61	423380	5085501	Turning on piston #2 of the HFS. Temp. up to 9.6 degrees C. Pumping done at 15:09, 630 ml pumped.	HFS-7_dfl _R495-19
15	9	1535	60	423326	5085469	Bag with .45 filter, HFS #14. Starting to pump at 15:1. Max temp. 8.7, but hanging around 6 degrees C. Stopping at 15:17, 643 ml was pumped.	HFS-14_dfl _R495-20
15	18	1535	58	423301	5085430	3 micron/sterivex filter #12 of HFS selected. Started at 15:18. Lost computer connection at 15:21. Back on a minute later. Unsure of whether pumps continued to pump - turned off and back on to make sure. Stopping pumping at 15:33, pumped 150ml.	HFS-12_dfl _R495-21
15	33	1535	43	422836	5085584	0.2 micron filter#6 of HFS, for FISH. Starting to pump at 15:35. Stopped pumping at 15:44, 1 L was pumped. Max temp 9 C	HFS-6_dfl _R495-22
15	45	1534	46	422846	5085596	HFS # 24, gas piston starting. Stopped at 15:47, 150 ml pumped.	HFS-24_dfl _R495-23
15	48	1534	46	422654	5084778	HFS # 15 with a 0.45 filter for lipids is starting. Max temp. 9.8 degrees C. Stopped at 15:58, 820 ml was pumped.	HFS-15_dfl _R495-24
15	59	1534	46	423360	5085461	HFS #3 with a 0.45 filter for xrf. Starting at 16:01. Max. temp 10.1 degrees C. Stopped at 16:05, 570 ml pumped.	HFS-3_dfl _R495-25
16	7	1534	44	423066	5085204	Finished sampling at Joystick (good fix: 423345, 5085486), going back to the cage before heading 250 to Coquille.	
16	23	1529	251	423368	5085478	Better position on Joystick: 423345, 5085495.	
16	25	1533	248	423337	5085464	Starting to move SW towards Coquille. Young ropy lava flows. Jumbled flow with lots of pillars - collapsed area.	Photos97 - 99
16	28	1532	247	423353	5085491	Pillars and collapsed pit - only a 1-2 m drain out area.	Photo 100
16	30	1532	246	423332	5085481	Lobate flows. Probably still young lavas, but some small sponges and ophuroids.	
16	33	1533	247	423216	5085426		Photo 101
16	35	1533	248	423157	5085388	Glassy lobes with accumulated sediment in cracks. Highlights was just on for 2 minutes.	Photo 102
16	37	1534	258	423113	5085376	First patches of tube worms - is this old lava? The tube worms look old. Clam shells. Bob thinks we just went over the contact a few minutes ago.	

16	39	1535	269	423081	5085370	CONTACT with new lava again. Going back and forth between old and new lavas. Difficult to tell - confusing transitions between old and new.	Photos 104 - 107
16	42	1535	274	423042	5085365	Some white mat in cracks, still complex terrain - old lavas with new down in the collapsed area?	
16	43	1536	270	423025	5085362	Orange staining between lobate cracks, some old tube worms and patches of clams.	Photos 108 - 110
16	46	1535	270	422580	5085452	Coquilles vent, blue protozoan mat.	R49579
16	47	1535	309	425368	5085241	#2	R495-80
16	45	1535	270	423146	5085200	Are we at Coquille yet? Yes, we are there! Bush of new worms with an old bunch to the right. Lots of anemones, protozoan mat, tons of limpets. Mats of limpets.	
16	52	1535	283	423538	5085831	#3	R495-81
16	53	1535	292	423641	5085489	#4 Limpet covered area at Coquilles	R495-82
16	55	1536	336	422029	5087122	Fluid sampler probe being deployed at Coquilles	R495-83
16	53	1535	292	423641	5085489	At Coquille - a small pit with TONS of limpets matting the basalt. Some new tube worms to - reinvigorated venting? Tried to fluid sample here but couldn't reach the flow, going to find another spot.	Photo 114 - 115
17	2	1537	350	422970	5085359	Found a new area of flow - T= 5.8 C. A sunken pit surrounded by tons of limpets with a small bush of new tube worms in the middle. Trying to position the HFS intake in a good, warm stream of flow. Couldn't get it - moving again to another spot	
17	1	1536	353	422932	5085326	Depression at Coquilles.	R495-84
17	9	1536	63	423348	5085740	Tube worm bush with good flow. Temp around 19 degrees Celsius	R495-85
17	16	1536	55	423074	5085445	Close up of tube worms and limpets Coquilles.	R495-86
17	18	1536	54	422983	5085374	Close up view of tube worm with limpets at Coquilles	R495-87
17	21	1536	54	422979	5085364	Sea anemone, blue protozoan patch and clams at Coquille.	R495-88
17	9	1536	63	423350	5085764	At a new tube worm bush, again trying to fluid sample. Temp. up to 19 degrees C. HFS #19 with 0.45 micron filter for chem/sulfur. Starting to pump at 17:12. Fix for this sample: 2973, 5358.	HFS-19_dfl _R495-26
17	24	1535	40	423094	5085459	1716-1723 - great close up highlights of Coquille vent area. Limpets (<i>L. fucensis</i>), anemones, tube worms, <i>Provanna variabilis</i> , protozoan mat, scale worms (<i>L. piscesae</i> and <i>Branchinotogluma</i> sp). Heading to Bag City venting area - heading 255 for about 300 m	Photos 119 - 121
17	29	1534	113	422938	5085318	On the periphery of Coquille still. Waiting for the ship to move.	Photo 122
17	30	1534	113	422970	5085324	Looks like new tube worms (reinvigorated venting) is restricted to center of Coquille field - mostly older worms on the periphery.	Photo 123 - 126
17	35	1535	116	422986	5085301	Older tube worm bush	R495-89
17	34	1533	98	422981	5085303	Beginning to move towards Bag City. Passing over old lobates with old tube worm bushes. Clams in cracks between lobates.	Photo 128.
17	36	1534	100	423006	5085309	Good fixes.	
17	39	1535	107	423031	5085295	Traversing over old lobate flows to Bag City. Some sparse clam shells.	
17	41	1534	101	423047	5085300	Just crossed the CONTACT, into new lava now.	
17	44	1533	101	423463	5085624	Older lava with sponges in between new lavas. Collapsed area, up onto the roof.	Photo 129 - 130
17	46	1532	95	423264	5085438	Jumbled, broken lobates. Old lobates with quite a bit of sediment in cracks. Into cloudy water. Orange sediment getting thicker in-between lobates.	Photo 131 - 133

17	48	1533	98	423133	5085271	Orange sediment in crevices. Approaching the venting area. Highlights on.	Photo 134
17	50	1534	102	423174	5085256	Lava whorls and steep slope. Still 10m from Bag City.	Photo 135 - 137
17	53	1532	109	423212	5085242		Photo 138
17	56	1534	94	422833	5084658	White bacterial mat on ridge structure. Tube worms on the roof of a collapsed pit. Lots of bag creatures I think. Looks like old worms. Bad fixes.	Photo 140 - 141
18	2	1534	51	424587	5083247	Preparing for fluid sample with in a tube worm bush.	R495-92
18	1	1530	88	423254	5085190	At Bag City, Mkr-36. Highlights off. Going in to fluid sample just next to Mkr-36.	Photo 142
18	4	1534	63	422886	5084792	Probing temp. for fluid sampling. Temp max. is 2.7 degrees C.	
18	22	1534	196	423163	5085082	HFS working in tube worm bush @ Bag City	R495-93
18	16	1534	196	423039	5084456	Starting to pump into piston #20 of HFS. T1 hanging around 2 degrees C. Really steady temp at 2.6 degrees C. Stopping at 18:23, pumped 683 ml. Max temp was 23.2 degrees C.	HFS-20_dfl _R495-27
18	23	1534	193	423163	5085082	Starting to pump #23, gas piston of HSF. Stopping sample at 128 ml, max temp. 23.4 degrees C.	HFS-23_dfl _R495-28
18	25	1534	196	423163	5085082	Starting to pump HSF 0.45 micron filter #21 for xrf. Keeping the same position in tube worm bush for a HFS samples here. Finished at 1828, pumped 50 ml. Max temp 23.3 degrees C.	HFS-21_dfl _R495-29
18	32	1534	196	423951	5085648	3 micron/sterivex Filter #13 of HFS started at 1830. Stopping pumping at 1839, filtered 1 l of water. Tmax was 23.4 degrees C.	HFS-13_dfl _R495-30
18	40	1534	194	423412	5085338	Starting to pump bag #9 with a POC filter.	HFS-9_dfl _R495-31
18	45	1534	196	423250	5085182	R495-30: 53 ml pumped, stopped at 18:45. Starting to pump 0.45 micron filter #7 (for lipids) of HFS at 18:45. Stopped sampling at 1854, 1 L, Max. T 23.2C.	HFS-7_dfl _R495-32
18	55	1534	191	423108	5085049	HFS sampler #1, FISH filter at same place at Bag City. Started at 1856. Stopped sampling at 1905, 1 L, Tmax 23.4C NOTE: Date on video overlay is wrong. Reads 07-04 and should read 07-05 (American date system).	HFS-1_dfl _R495-33
19	17	1534	193	423501	5085431	Northern transponder appears to have turned off by itself. Turned back on.	
19	27	1534	194	423501	5085431	Vemco temp probe being dangled over tube worms	R495-95
19	33	1534	190	423087	5083893	Lost T-bar and end of suction sampler (previously separated from hose) while manipulating rope on Vemco recovered at Mkr-113.	
19	35	1534	172	423257	5085194	Deployed MTR at Bag City tube worm bush where fluid was sampled. Looking for end of suction sampler. Cannot retrieve it. Photo of Bag City site. Good (awesome! even) fix of 3278, 5220 at Bag City site.	Photo 143
19	44	1526	183	423251	5085182	Leaving Bag City on 190 course for 80 m along line of depressions in lava surface. This line continues the line of vents further north. Doing tether management first.	
19	50	1534	194	422428	5085029	Starting traverse in lobate lava. Lots of large drain structures. Asked bridge to move ship along the line.	
20	4	1531	106	423784	5085655	going from uncollapsed roof to deep collapse area	
20	4	1533	103	423233	5085212	moving ship to Bag City, then will start traverse to bearing 190 for 80 meters (along the apparent vent line that includes Mkr-113, joystick vent, and bag city). Jumbled sheet flow.	

20	5	1533	117	423257	5085211	staining found en route	R495-96
20	5	1531	121	423257	5085211	ROPOS in back in bag city. SE Mkr-36 at bag city.	
20	7	1530	112	423207	5085282	whoops, nope we just went in circles back to Mkr-36, Bag Man City	R495-97
20	7	1531	184	423230	5085172	Ship now starting the traverse at a bearing of 190. Lots of bags around bag city.	
20	9	1533	189	423211	5085255	Still white staining between lobes. Small collapse pit.	
20	10	1533	192	423262	5085149	Lobate surface with very large drainouts. White staining on rocks. Large narrow deep rift >10 m dep. White stain on both walls which are a few m apart. May be main eruptive area. Depth of vehicle 1534 m. Lots of particulates in the water column.	
20	17	1536	190	423123	5084672	Still in narrow crevice. 8 m deep beneath vehicle at 1539 m depth. Water column is murky. East and west walls here have no evidence of venting.	
20	20	1535	160	423258	5085076	Walls on both side are solid with no reentrance caused by drainouts. Clearly tectonic. Lots of centrimetric-size rubble. Some large sheets of lava have slide down into crevice without breaking up. Little white staining. x= 3246, y=5207 good fix	
20	25	1540	176	423375	5085287	Eastern wall of crevice - broken tubes. Photo 161 - no strobe.	Photo 160
20	26	1536	152	423230	5084991	Very tectonized on west wall. FeOxide sediment on ledges. Up on top at west side, see lobate flows passing into ropy and curtain drape sheet lava as we continue west. NO evidence of tectonism. Depth 1540m.	
20	30	1540	195	423197	5084946	Continuing south. Sheet flows with pressure ridges forming jumbles of folded lavas. Proceeding back to east now.	
20	31	1539	193	423187	5084934	Good fix. Lateralizing east over ropy and curtain drape sheet flow. Whorls in lava. Only slightly broken up.	
20	33	1538	195	423204	5084901	Intact ropy shell lava as we continue to lateral east.	
20	34	1538	172	423012	5084314	At east edge of crevice. Lots of crabs. Good fix x=3231, y=4880 at 20:35.	
20	37	1535	186	425255	5085415	Drainouts near top of crevice. Crevice bifurcates towards the north. Stopping ship to change course. x=3232, y=4843 good fix at 2038.	
20	41	1538	84	423232	5084816	Good fix. Up on flat area to the east of the crevice. Jumbled sheets.	
20	44	1537	130	423185	5084707	Jumbled sheets. Small white patches. FeOxide.	
20	44	1536	100	423238	5084797	good fix. We are to far east. Going back to west over drainouts.	
20	49	1536	187	423214	5084716	another collapsed area	R495-99
20	48	1536	186	423204	5084720	Proceeding west. Lobate flows with some FeOxide patches. Changing ship's course back to 190.	
20	53	1538	194	423285	5084728	more	R495-100
20	54	1539	191	423198	5084685	more of the pillar	R495-101
20	51	1537	194	423191	5084691	Still traversing lobate lava. Some red staining on broken edges and between lobes. Dead worms. Reached large drainout/collapse. Crabs.	
20	56	1538	194	423194	5084670	more pillar	R495-102
20	55	1538	191	423006	5084062	Layering on west wall of a N-S elongated collapse structure. Crabs. 8 m dep. 3194, 4670 good fix.	
20	57	1538	192	423192	5084658	lobe on pillar	R495-104
20	58	1537	192	423191	5084653	Still in collapse. >10 m dep. Lateralizing to west. good drainouts in wall. Murky water.	
21	0	1536	194	423217	5085350	tube worms	R495-105
21	3	1538	192	423176	5084624	crab grab	R495-106

21	0	1536	194	423217	5085350	Vent field. Dead/dying tube worms being eaten by crabs. In crevice. Broken of lobes. Stopping ship.	
21	7	1538	160	423145	5084590	3165, 4617 good fix at newly named Crevice Vent. Looking around the area.	
21	11	1538	104	424114	5085211	subsurface worms (deceased)	R495-107
21	12	1538	94	424044	5085479	some severely confused worms	R495-108
21	13	1538	95	424044	5085479	?	R495-109
21	19	1538	3	423183	5084625	into the tunnel	R495110
21	21	1538	7	423181	5084631	tube worm patch	R495-111
21	22	1538	1	423181	5084631	vent fish	R495-112
21	22	1538	1	423244	5084794	vent fish in a subtly different pose	R495-113
21	23	1538	0	423759	5085070	white polynoid included	R495-114
21	18	1537	94	423553	5084023	Survey of tube worm area. Leave tube worm area quickly to east. Large patches of tube worms to the north. 3181, 4631 good fix at 221.	
21	38	1538	30	423178	5084652	good Fix, sampling rock from Crevice Vent.	Rck_R495-34
22	4	1538	14	423176	5084651	FeOxide and basalt glass beside small tube worm bush in jar J3. Very little sample but enough for SEM. Saw basalt piece that looks suspiciously like the one we just sampled. May be hole in the purse.	SS-j3_FeO_R495-35
22	15	1538	202	423161	5084637	let the vacuuming begin	R495-117
22	18	1538	202	422982	5084340	J2 jar of suction sampler after brief tube worm shake down	R495-118
22	15	1538	203	423158	5084634	Suction sample (with broken hose tip) of small patch of dead tube worms in interstice of lava lobes taken for biology. Lots of FeOxide among tubes, though.	SS-j2_bio_R495-36
22	25	1538	106	423178	5084820	hostile (and stupid, to) crab	R495-119
22	29	1538	103	423152	5084632	Took Vemco out of the bag and held it in the port claw for the rest of the dive so as not to lose it because of the hole in the purse.	
22	34	1539	187	423140	5084606	more tube worms on the way south again	R495-121
22	34	1538	187	423157	5084624	more structures and a crab, to	R495-122
22	35	1538	190	423021	5084511	etc.	R495-123
22	32	1537	157	423149	5084622	Continuing southward traverse. Initially passing over Crevice Vent. Lots of tube worm bushes. Depression here is ~6m dep.	
22	35	1539	191	423021	5084511	A few tube worms on east wall but essentially out of the field.	
22	36	1538	191	423141	5084796	top of .?	R495-124
22	36	1538	191	423141	5084796	On west wall. No obvious hydrothermal activity but water is murky. Crevice is about 6 m deep.	
22	37	1540	192	423180	5084675		R49-5125
22	38	1539	191	423180	5084675	fissure?	R495-126
22	39	1539	188	423176	5084235	more fissure	R495-127
22	37	1540	190	423180	5084675	Broken lava, drainouts. Crevice disappears and then reappears.	
22	41	1540	196	423083	5084571	some sort of feature	R495-128
22	41	1539	193	423196	5084236	hmmm fissure seems to have turned into an inverse fissure	R495-129
22	39	1538	190	423026	5084729	Broken lava lobes on walls. Crevice only 2 or 3 m dep. Fresh looking pillows in bottom. Is this an eruptive center? Looks in places a lot like the SW Rift on Hawaii.	

22	43	1540	191	423204	5084648	Solid lobate surface. Very glassy surface. Looks like 1998 flow. No ROPOS fixes.	
22	45	1543	189	423139	5084576		R495-130
22	45	1544	185	423190	5084611		R495-131
22	46	1541	173	423234	5084624	top of 12 - 13 deep fissure	R495-132
22	44	1542	182	423058	5084513	Depression ~4 m deep. Then another depression 12 m deep as we lateral to the east. No ROPOS fixes but we are getting cage fixes.	
22	48	1542	185	423004	5084622	Bottom of depression filed with rubble. What else would you expect?	
22	49	1543	184	423110	5084499	Depression is about 5 m wide here and 16-20 m dep. Drainout on west wall.	
22	51	1543	180	422640	5084416	a former vent?	R495-134
22	51	1543	187	422868	5084475	Depression still about 5 m wide and 14 m dep. Stopping ship to take a good look at the wall.	
22	55	1544	182	423212	5084512	current venting here to	R495-135
22	55	1544	182	423212	5084512	Venting on east wall. Small tube worm bushes.	
22	56	1546	154	423163	5083996	dead worm pile	R495-136
22	56	1546	163	423163	5083996	Highlight film on. Bag creatures sited in ropy sheet flow.	
22	58	1542	82	423048	5084509	Highlight video off.	
23	2	1528	57	423236	5083897	Not getting good navigation. Might head back to cage. We have a cage fix now.	
23	6	1494	175	423120	5084352	Heading back to the cage and the cage is in view. Just got a new cage fix. The above fix is good.	
23	8	1494	171	423312	5083583	Cage fix with two transponders. We are going to head south and apparently will have no navigation.	
23	11	1515	94	423119	5084352	We will head west now and we are going to look at the fissure below. Is it tectonic or eruptive? We will look for newer sheet flows on top and if it has older lavas at depth.	
23	14	1547	214	422849	5084565	Jumbled lavas near fissure, glassy with some hydrothermal sediment.	
23	16	1543	85	422966	5084677	Crossing the fissure, maybe. There is some question if the lavas are draping over.	R495137
23	18	1543	84	423104	5084355	Tube worms near drop off.	
23	21	1540	273	423119	5084352	Heading west to find big fissure. If we don't find it, we will do a traverse to the southwest. Small groups of tube worms.	
23	22	1544	274	423071	5084280	Tube worms at the bottom of a 5 meter deep hole.	
23	23	1544	267	423094	5084345	good fix with 3 transponders with north net.	
23	24	1544	287	423270	5084979	Continuing to the west to find big fissure. Jumbled sheet flows.	
23	25	1543	284	423119	5084351	Drain out 6 meters dep. Not sure if this is the fissure.	
23	27	1541	271	423119	5084351	Back on lobate flows after we passed the drain out feature.	
23	27	1543	270	423119	5084351	Staining and tube worms.	
23	29	1539	277	423119	5084351	P code took a hit. Now moving to the traverse at 270, 60 meters range.	
23	33	1542	270	423119	5084351	P code back, on bottom again and heading west.	
23	34	1541	273	423114	5084443	Going west to the contact and then will angle to the southeast and cross it again.	
23	35	1544	275	423108	5084360	Heading due west across giant ropy sheet flows with push up structures.	
23	39	1547	280	423042	5084366	Lineated flow with brittle stars.	

23	39	1547	268	423066	5084361	lineated and ropy flows in big flat area	R495-138
23	41	1545	269	423042	5084366	North to northwest lineation on the sheet flows.	
23	42	1544	271	423042	5084366	At the edge of drain out oriented 270.	
23	44	1543	267	423001	5084369	Glass lobate flows very similar to those mapped as the 1998 flows.	
23	46	1544	267	423001	5084369	Flows becoming more pillow like so we might be reaching the end of the flow.	
23	47	1544	267	423001	5084369	Some infilling with iron oxyhydroxide between pillows.	
23	49	1543	270	423001	5084369	Have moved 250 m west so far. Last sighting of the contact was 50 meters north.	
23	50	1542	268	423578	5084718	loads of cracked pillows	R495-140
23	51	1544	268	423578	5084718	another one	R49-5141
23	51	1544	270	423578	5084718	Small drainback in rock.	R495-142
23	51	1544	270	423445	5084429	Just crossed a hole several meters dep.	
23	52	1544	265	423433	5084433	Crossing another collapse area with spires.	
23	53	1544	271	423452	5084166	Drain out 10 meters across. Drain back features on pillar.	
23	55	1544	272	423452	5084166	Drain out might have been caused by flow to the south.	
23	56	1544	269	423411	5084057	Collapse area with alot of finely broken rubble.	
23	57	1545	278	423310	5084343		R495-144
23	57	1545	275	423310	5084343	Entering large pillow lavas.	
23	58	1545	278	423310	5084343		R495-145
23	58	1546	277	422783	5084585	Holothurian sited and in patches of old lava. At contact.	
23	59	1546	282	422787	5084442	contact at west	R495-146
0	0	1546	279	422787	5084442	Ophiris colonizing new lava.	
0	0	1546	278	422680	5084320	Collapsed stuff	R495-147
0	2	1547	278	422656	5084333	A rare couple of ROV fixes.	
0	4	1544	273	422664	5084274	Sheet flow at the bottom of a drain out feature.	
0	5	1546	278	422569	5084305	possible young jumbled sheets to west of what we thought was the contact	R495-148
0	5	1546	278	422569	5084305	Large jumbled piles of lava, all of it young. Lineation perpendicular to our track.	
0	7	1546	278	422568	5084329	Still in young looking sheets. Evidence of N->S flow.	
0	11	1546	277	422517	5084341	Getting some ROV fixes, now over lobate flows. Very glassy could be 1998 lavas.	
0	13	1547	275	422705	5084505	Little sediment, alot of brittle stars seen, an all lobate surface.	
0	14	1548	279	422478	5084345	Transition to pillow lavas.	
0	14	1548	280	422461	5084342	Contact, now into older lavas, continuing west.	
0	18	1549	279	422426	5084354	Photo 172, there are no strobos. More sediment over the old lavas than the young ones seen earlier.	
0	19	1549	278	422481	5084418	Heading 60 meters west and then will traverse at 125 for 20 meters.	
0	22	1549	277	422405	5084356	Almost 10 meters west of contact in old lavas.	
0	25	1549	275	422519	5083551	The ship is stopping. We are about to change heading to 125. 10 meters west of contact.	
0	28	1547	137	422479	5083403	Stern fix was recorded, now heading at 125.	
0	32	1550	120	422410	5084309	Ropos fix is good. We are probably 50 m from the contact. Holothurian.	

0	33	1550	126	422788	5083237	Contact is actually right here and now in the youngest lavas, - pillow basalts.	
0	35	1549	120	422458	5084296	Heading up hill, another contact to an even younger lava. x=2465 y=4294 ROV fix.	
0	37	1548	127	422475	5083852	Altered pillows surrounded by newest (1998?) lobates.	
0	39	1547	126	422509	5084273	ROV fix is good. Very shiny lobates and pillows.	
0	41	1548	127	422434	5084304	Right over a drop of.	R495-149
0	42	1549	128	422697	5083877	Jumbled sheet flow.	
0	43	1548	119	422250	5084044	Down in a depression.	
0	49	1549	104	422680	5084286	lineated sheet flow with sediment in cracks.	
0	52	1551	123	422680	5084286	Might be in intermediate lavas again.	
0	54	1549	113	422680	5084286	Crab seen	
0	54	1549	115	422680	5084286	Drop ofd, drain back features.	
0	55	1548	127	421699	5084246	Drainback features on wall of collapse pit.	
0	59	1548	120	422796	5083988	lava pillar and roof in drainback feature.	R495-150
1	6	1549	127	422862	5084036	Jumbled sheet flows.	
1	7	1549	118	422877	5084023	Into lobates, collapsed lobates and glassy lobes.	
1	8	1549	119	422914	5084010	Another collapse structure then into lobate flows.	

1	10	1551	127	422653	5084171	Very jumbled flows thought to be of intermediate age.	
1	14	1551	120	423107	5083994	More coherent sheet flows, past area of fissures. We didn't see fissures but saw a lot of broken up rubble.	
1	16	1549	121	423035	5083964	Screens have gone black.	
1	22	1549	121	423035	5083964	ROPOS is in the cage.	
1	27	1377	322	423035	5083964	Brief picture before it went dark again.	
1	31	1331	38	423035	5083964	Video back, looks like end of dive.	
1	38	1367	206	423035	5083964	ROPOS out of cage and heading back down.	
1	49	1554	145	423035	5083964	Bottom in view.	
1	56	1556	136	423035	5083964	Kipuka of older sponge-covered lava amidst younger lava	R495-151
1	56	1556	136	423035	5083964	Older lava with many sponges surrounded by newer lava, about 10 m down the track from where we left the bottom.	
1	58	1557	133	423035	5083964	Screen went black again.	
2	2	1557	133	423035	5083964	ROPOS back in cage.	
2	9	1557	133	423035	5083964	Dive is now coming up. Aborted due to telemetry problems	
3	5	1557	133	423035	5083964	ROPOS on deck, due to more telemetry? problems.	
						Dive Summary follows	

						<p>Dive Summary R495: Deployed OsmoSampler Mkr-33. HFS sampling and suction sampling at Mkr-108. HFS sampling, gastight and nissen at Castle. FeOxide sample at Mkr-N5. HFS, gastight, suction samples and Vemco recovered at Mkr-113.</p>	
						<p>Collected 7 HFS samples at Joystick. HFS sample at Coquille. Collected 7 HFS samples at Bag City also. Gathered rock and suction samples at Crevice. A background water sample was collected on the ROPOS ascent - 1300 m depth.</p>	
						<p>The balance of the dive was given over to geologic mapping. A couple of new diffuse vents were discovered. It is believed that we were actually observing lavas from three separate eruptions. The ages of the other 2 flows are unknown.</p>	

							Dive R496	
							Dive Plan: Rumbleometer recovery. Tube worm grab and bacterial trap recovery from Mkr-133 with portable BioBox sitting at Mkr-113	
							ROPOS Configuration: All the bells and whistles necessary to recover the rumbleometer.	
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
UTC	Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
18	18						ROPOS in the water.	
							Ballast is a little light. Coming back up to adjust it	
18	38						ROPOS back on deck. Time is 1859 GMT (UTC)	
19	17	8	28	423035	5083964		ROPOS in water loaded for bear at 19:15.	
							19:21 electrical power to lab lost. ROPOS at 286m. Everything shut down. Back up and running at 19:44. No apparent damage.	
20	49	1492	154	423650	5086742		Cage stopped at 1492 m depth. We have come to wreak havoc.	
20	51	1516	163	423650	5086742		ROPOS on bottom. Moving ship over top of rumbleometer. Starting videos.	
21	0	1518	174	423709	5086781		Rumbleometer in sight.	
21	1	1519	118	423713	5086765		3712, 6769 good fix at rumbleometer.	
21	1	1519	117	423713	5086765		first contact with rumble-o-meter	R496-4
21	1	1519	112	423713	5086765		another one	R496-5
21	2	1520	106	423713	5086766		rumble-o-meter with fish, hold the tartar	R496-6
21	4	1519	173	423723	5086733		Anchor attached last year in sight.	
21	5	1519	20	423716	5086754		good fix over anchor.	
21	8	1519	83	423639	5087271		one for the photo album	R496-7
21	13	1520	111	423708	5086742			R496-8
21	16	1521	158	423745	5087474			R496-9
21	16	1521	164	423695	5086761			R496-10
21	18	1521	173	423710	5086772			R496-11
21	18	1521	172	423710	5086772		Line connected to free leg.	
21	18	1522	171	423705	5086768			R496-12
21	22	1521	200	423709	5086771			R496-13
21	37	1522	191	423696	5086779			R496-14
21	40	1522	175	423708	5086772			R496-15
21	48	1521	179	423706	5086769		threaded the needle	R496-16
21	54	1522	149	424490	5086986		why ask Y"?"	R496-17
21	57	1522	148	423704	5086772		Give a man enough ROPOS .	R496-18
21	56	1522	144	423701	5086775		During the past half hour have managed, with difficulty, to get the large yellow cable around the leg of the rumbleometer.	
21	57	1522	150	423617	5086954	and he'll probably hang himself	R496-19
22	0	1522	146	424285	5087797		the missing link	R496-20
22	1	1522	150	423638	5087267		woo hoo ho!	R496-21

22	1	1522	150	423638	5087267	Snap hook attached to end of yellow cable.	
22	3	1522	147	423744	5087475		R496-22
22	6	1511	310	424494	5086982	Returning to cage unreeling gray line.	
22	7	1502	220	423694	5086786	ROPOS is in its cage.	
22	24	1451	231	424331	5087472	OK a little brinkmanship	R496-23
22	23	1451	239	423724	5086754	Continue to raise cage in order to get gray line out to double red tape marks. Line accidentally in the cutter but got out OK.	
22	34	1451	311	423717	5086767	hooked to the bottom of the cage	R496-24
22	34	1451	314	423667	5086915	Cage end of line drooped attempting to snap hook to bridle.	
22	48	1451	360	423722	5086766	OK this time for sure	R496-25
22	49	1451	5	423722	5086767	Snap hook recovered with difficulty and attached to ring on bridle.	
22	50	1452	6	424269	5087996	Keith S. asks to move the ship 20 meters at 10 degrees	
22	55	1451	320	423728	5086765	waiting for the ship to move	
22	58	1448	270	423668	5086704	reeling in cage at 4 meters/min	
23	4	1435	336	424482	5088083	Hook came off where it was hooked to the cage.	
23	6	1435	348	423703	5087207	The hook with a safety clip was somehow twisted, causing the catch to open, and the hook fell off. Now, we have to go back to the seafloor, try to pick up the hook on the end of the line and re-attach it to the chain beneath the cage. Cage now descending.	
23	10					Visible particle plume while cage descends, at 1470 m	
23	14	1492	358	423734	5086750	Near the bottom, ROPOS ready to come out of cage, when we saw the spectra line floating up in the water. The line is buoyant, so one end is on the rumbleometer, and the other is on the hook on the seafloor, with a loop floating up in the water column.	
23	18	1492	272	423492	5087295	A-1 ROPOS telemetry has died. Network down.	
23	21	1492	272	423386	5087692	asked the ship to move 40 meters west	
23	43	1401	22	423703	5086779	Still attempting to get vehicle telemetry back up. Vehicle is in cage, and line is not attached.	
23	46	1401	63	423708	5086797	Bill is working the cube. The telemetry is back up. Could there be a connection?	
23	55	1478	127	423451	5087613	Saw the spectra line again.	
23	56	1472	115	424308	5088104	Asking the ship to move 20 meters West. Stern of ship is currently about 10 meters W of rumbleometer.	
23	58	1473	284	421212	5086968	Situation: Hook was dropped 30 meters brng 010 from the rumbleometer, with line floating in between. Plan :Come down W of instrument, drive up to it, grab line loosely in the claw and drive up, letting the line slip until the hook is within reach.	
0	5	1517	121	423710	5086686	We are back on the seafloor, looking for the rumbleometer.	R496-26
0	6	1519	119	423694	5086769	Nav puts us 24 meters W of Rumble	
0	9	1522	211	423712	5086775	Back at rumble coming at it from the North.	R496-27
0	12	1520	180	423715	5086754	Grabbing the line attached to the rumbleometer	R496-28
0	14	1506	127	423862	5086426	line is slipping through the claw as we pull it up	
0	14	1496	126	423700	5086759	line slipping through the claw	R496-29
0	22	1463	127	423696	5086776	Recovering dropped line and hook. Tense moment. Halibut for diner. Jell-O for desert.	

0	24	1453	122	423694	5086777	Ten meter mark just slipped through claw.	
0	25	1449	124	423696	5086777	Another marker in claw, 3 meters from the last one.	
0	28	1438	124	424251	5087395	Nearing end of line.	
0	30	1428	124	424048	5087934		R496-30
0	30	1428	125	424048	5087934	At the end of the line. Preparing to grab the hook end.	
0	32	1430	115	423701	5086763	What is it?	R496-31
0	34	1429	126	423705	5086764	It was an unusual jellyfish that we were looking at from one end and couldn't identify it at first. It was black in color.	
0	37	1428	134	423708	5086764	He's grabbed the hook end.	
0	39	1427	127	423709	5086762	The hook is in both hands, just handed of to the (left?) hand.	
0	39	1427	131	423709	5086761	Hand of off hook from 7-function to 5 function.	
0	44	1431	99	423769	5086919	Ropos back in the cage.	
0	45	1431	135	423608	5086909	Drooped the hook. Puled out of the arm by a big surge.	
0	48	1430	33	423642	5087482	Moving the ship 64 meters. Will try to retrieve the hook.	
1	1	1434	319	423726	5086750	At location of hook drop.	
1	7	1490	300	423697	5087462	ROPOS is out of the cage for hook recovery, take 3.	
1	9	1519	354	423731	5086758	We have a good fix on ROPOS.	
1	11	1521	248	423732	5086746	Rumble-o-meter back in sight.	
1	12	1519	298	424492	5088003	Line in the claw one more time.	
1	15	1492	306	423645	5087284	Pulling line through claw as before.	
1	16	1479	293	423722	5086762	Recovering line and hook for second time.	R496-32
1	21	1438	300	424479	5086938	Nearing end of line again.	
1	22	1428	304	423744	5086709	At the end of the line. Preparing to grab the hook.	
1	25	1434	299	423685	5086923	Both claws on the hook once again.	
1	26	1432	304	423716	5086752	Hand of off hook.	
1	33	1440	326	423725	5086762	Ropos back in cage.	
1	58	1406	244	423747	5086756	Hook re-attached to cage, pulled with the winch, tension went up, then slack, then lifting bridle released from cage. Now we are going down to look at the rumbleometer.	
2	0	1406	242	424139	5086273	Moving the stern of the ship to about 25 m west of the rumbleometer.	
2	20	1406	168	423679	5086757	P-code of, so ship position not stable enough to go out of cage. Waiting to see if P-code comes back on.	
2	45	1406	282	423688	5086754	P-code is back, so we can venture out of the cage.	
3	6	1522	125	423627	5087288	Rumble base. Where is the rest? Stay tuned.	R496-33
3	4	1517	129	423687	5086768	On the bottom. Collapse area, pillars. Found the weight, lost the handle. The Rumbleometer is FREE! The weight doesn't show much effect of the flow on it. Mostly it is sitting on top of the flow. Back edge appears to be overlain by the flow.	
3	9	1516	140	423622	5087270	Rubble on top of weight may have been from breaking it away from the lava. Found the line that now holds the Rumbleometer.	
3	12	1481	113	424468	5086951	Going up the rumbleometer line. it is hanging in the water sideways.	
3	14	1466	210	424216	5088122	Yes! Rumbleometer floating in water column from anchor.	R496-34
3	17	1470	138	423714	5086741	Survey of it to see what lines are where. Too late to cut it, because of darkness approaching. Will try to release it tomorrow AM.	

4	25	1518	96	423780	5087057	On the bottom, in lobate flows that look fairly young. Close to Mkr-33.	
4	27	1519	71	423802	5087066	Collapse area in lobates. Flat sheets now with staining on fractures	
4	29	1520	117	425114	5087076	At Mkr-33. Going to pick up BioBox.	
4	39	1525	272	423854	5087040	picking up BioBox that is located near the elevator debris.	
4	45	1525	274	424398	5087491	Picked up box, tried Wallace maneuver now heading to mkr-113. Will be doing an Imagenex line during transit.	
4	48	1525	274	423865	5087082	Testing Imagenex to see if it will work with BioBox in the arm. Resting BioBox on frame.	
4	59	1504	255	424373	5087504	Moving ship to north end of Imagenex line W1 from Mkr-33 site. We will do this line south, then go over to Mkr-113 to collect a bio sample, and then will resume the Imagenex survey.	
5	20	1496	348	423710	5087682	We're actually going to be starting Imagenex line W2 from the north instead of W1. We'll do W1 later.	
6	23	1499	182	423554	5086727	At 05:37 we started at the north end of Imagenex line W2, southbound.	
7	15	1499	217	423555	5085892	End Imagenex line W2 (south end). Ship will now go over to Mkr-113 to collect a bio sample into the portable bio box.	
7	42	1521	21	423326	5085385	ROPOS on the bottom near Mkr-113 (not there yet)	
7	46	1522	86	423356	5085936	We've spotted the Mkr-113.	
7	47	1524	154	422686	5084942	ROPOS on the bottom at Mkr-113.	
7	49	1524	154	423380	5085929	Placing the portable BioBox near Mkr-113 in order to put samples in it.	
7	50	1524	156	423362	5085932	One of the corks in the BioBox is rolling around in the bottom of the BioBox, we think.	
7	52	1524	153	423371	5085939	we can see a group of new tube worms right in front of us, as well as Craig's bacterial traps.	
7	53	1524	146	423369	5085937	We're trying to open the portable BioBox now	
7	54	1524	145	423411	5086201	We have opened the BioBox.	
7	54	1524	148	422799	5085391	The cork from the center of the BioBox is indeed floating about the BioBox.	
7	56	1522	152	423377	5085937	We can see some of the blue protozoan mat, as well as a ton of limpets and maybe some snails and other gastropods.	
7	56	1522	217	423378	5085941	Mkr-113	R496-35
7	56	1522	204	423378	5085941	Mkr-113. Highlights on.	Photo-1 - 2
7	58	1524	210	423388	5086328	We are now sitting right near the marker, to pick up trap # 20 and 21.	
7	58	1524	212	423808	5085957	Highlights off.	
7	58	1524	210	423388	5086328	Bacteria traps at Mkr-113.deployed in 98	R496-37
7	59	1524	213	423384	5085946	Picking up traps. They are covered in polynoids, limpets, and other worms.	Bactrp-20_496-1 Bactrp-21_496-2
8	0	1524	211	423292	5085628	Grabbing traps at Mkr-113- they're anaerobic!	R496-38
8	3	1524	157	423380	5085940	Placing the traps in the portable BioBox.	
8	3	1524	156	422896	5085766	The limpets seem to be settled only around the black area on the bacterial traps.	
8	4	1524	158	425309	5085954	The traps are in the box.	
8	5	1524	157	423666	5085590	Heading back over to the exact same area to take a good tube worm grab.	
8	6	1523	195	423370	5085933	Location where bacteria traps used to be	R496-40
8	6	1524	214	423372	5085933	Mkr-113 tube worms	R496-41

8	7	1524	203	423377	5085934	Getting ready to grab tube worms at Mkr-113	R496-42
8	7	1524	204	422654	5085400	Preparing to take the tube worm grab.	
8	8	1524	202	423373	5085930	3373 5930 good Fix.	
8	8	1524	203	423373	5085930	We've taken a grab	Bio_496-3
8	8	1524	201	423373	5085930	Tube worm grab at Mkr-113	R496-43
8	11	1524	130	423371	5085934	We have placed the tube worms in the BioBox.	
8	10	1524	132	423371	5085932	Placing tube worms in portable BioBox on top of bacteria traps at Mkr-113	R496-44
8	11	1524	121	423371	5085934	We are going back for more worms, but they belong to the same sample number, R496-3.	
8	12	1521	340	423372	5085934	We are approaching from the other direction this time for the tube worm grab.	
8	13	1524	333	423371	5085930	Grabbing again at Mkr-113.	
8	15	1524	8	422477	5085322	Placing this second tube worm grab in the portable BioBox.	
8	16	1524	5	423462	5085601	Going back for a third grab. but if there aren't enough, we'll move a bit to get more.	
8	17	1524	282	423376	5085934	Jean thinks she sees a sea spider (a pycnogonid).	
8	17	1524	282	423376	5085934	Third tube worm grab at Mkr-113 with a sea spider nearby	R496-45
8	18	1524	279	423379	5085930	We just got the third grab, about a foot or two along the crack, facing 280.	
8	19	1524	318	423371	5085932	placing third grab in BioBox and Jean says she is very content!	
8	20	1524	318	423371	5085932	We're closing the portable BioBox.	
8	21	1524	356	423371	5085933	We took a total of three tube worm grabs from Mkr-113 - we are now latching closed the portable BioBox.	
8	25	1524	352	423378	5085931	The portable BioBox is closed. I think that's a record.	
8	26	1524	57	423372	5085933	The box is indeed closed - with a twist.	
8	27	1524	60	423371	5085931	Time for Imagenex. Bill is now in charge.	
8	28	1524	57	423369	5085931	We're stowing the BioBox away before we begin Imagenex.	
8	42	1501	189	423373	5085922	ROPOS driving south on extension of W5 (south of Mkr-113)	
8	43	1501	183	423372	5085888	Now moving ship west 120 m to southern end of Imagenex line W3.	
9	3	1499	5	423488	5085926	0900 - Start line W3 from southern end going north.	
10	38	1496	85	423490	5087405	End of southern part of Imagenex line W3. Ship moving 120 m east to line W1.	
10	53	1496	180	423613	5087127	Start of Imagenex line W1 (southern part), driving south.	
12	52	1498	272	423604	5085904	End of Imagenex line W1 (south end). Ship moving 180 m west to south end of line W4.	
13	5	1498	3	423430	5085900	Begin Imagenex line W4 (south end) heading north.	
14	33	1501	218	423432	5087130	End of Imagenex line W4 (south end). Ship now moving over to Rumbleometer site to release it from its anchor.	
14	52	1452	147	423468	5087042	The Cage	R496-47
15	36	1458	99	422762	5087918	Ship stopped. Heading down towards the rumbleometer. Have to do some BioBox management before we cut the cord and release the rumbleometer. Start taping.	
15	39	1471	131	424122	5086416	Arrived at the rumblometer. Highlights on.	
15	40	1464	135	423708	5086739	Rumbleometer hanging in the deep blue sea.	R496-48
15	41	1463	149	423700	5086743	rumbleometer	photo 3

15	41	1461	155	423700	5086743	rumblometer	photo 4
15	41	1463	156	423706	5086738	another rumbleometer	photo 5
15	42	1462	175	423703	5086757	Rumbleometer again.	Photo 6
15	43	1465	129	423699	5086757	Trying to figure out which is the main cord connecting the rumbleometer to the seafloor. Decided it is the vertical cord - will cut it about 15-20 meters up from the bottom in the water column.	Photo 7
15	48	1519	108	423726	5086620	Bottom is in site - see the anchor.	
15	52	1522	112	423695	5086753	Biobox management - transferring the BioBox from the 7-function to the 5-function arm. Back to the 7 and Grabbing the BioBox on the handle with the 5.	
16	2	1514	69	423709	5086752	Moving up the rope, positioning to cut it.	
16	4	1512	302	425289	5086874	Attempting to cut the rope. Ned to go back to the cage for tether management first.	
16	13	1510	62	423710	5086764	Cut the rope! The rumbleometer is released.	
16	13	1509	104	423518	5087228	Cutting the cord. The rumbleometer is on its way to the surface	R496-50
16	15	1489	282	423683	5086734	Going back to the cage.	
16	17	1492	233	423683	5086734	In the cage. Coming up.	
17	8	1	156	424216	5087322	ROPOS on deck at 17:05	
						Dive Summary: THE RUMBLEOMETER WAS FREED FROM THE 1998 LAVA FLOW!! Also recovered bactraps and tube worms from Mkr-113 and placed them in BioBox.	

UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
						Dive R497	
						Dive Plan: This dive is at the extensometer site on the north rift zone of Axial. The elevator was deployed with extensometer#4 in one tube and 3 empty tubes. ROPOS will first take #4 out of the elevator and deploy it, then will recover the other four	
						extensometers that were deployed in '98 and place them in the elevator, where they will be recovered at some point during, or after, the dive. Two Imagenex lines will be run after the extensometer work, then on to CASM	
						At CASM site for sampling and observations: tube worm grab; suction samples of mats, animals, FeO (if any present) and vent fluid. Collect GTBs; recover Vemco and HOBO - all at CASM. Deploy MTR and sample sulfides at CASM as well.	
						Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions. Only positions on NRZ are acoustic nav. All transit and CASM positions are ship at stern.	
17	32	1	158	424216	5087322	Elevator with 4 extensometers aboard into the water at 10:04. Didn't sink. Have to recover to add more weight.	
17	32	1	158	424216	5087322	10:50. Elevator back on deck. Weights had fallen of.	
17	32	1	158	424216	5087322	11:55. Elevator back into the briney. There is one extensometer onboard. Idea is to take that one down and deploy, recover others to surface for refurbishing and redeployment.	
0	38	0	0	422909	5096312	Dive commenced at 0100	
1	57	1570	184	420888	5096765	Screen picture was not updating. We'll retry on the logger data station.	
1	58	1569	204	420888	5096765	Ropos out of cage, picture taken on frame grab.	
1	59	1568	136	420888	5096765		R497-7
1	59	1566	69	420888	5096765		R497-8
2	0	1568	41	420888	5096765	hosers in action	R497-9
2	5	1590	22	420886	5096774	Line freed from near Niskin pull ring.	
2	6	1594	258	421704	5099332	Bottom in sight. Video started.	
2	7	1598	261	421704	5099332	Rat-tail fish, and quite alot of sediment kicked up when we reached the bottom.	
2	9	1598	256	420865	5096821	Elevator is 52 meters away, bearing 121. The fix is good.	
2	10	1598	254	420867	5096818	Marker was replaced on top of the BioBox.	
2	13	1598	252	420874	5096818	Marker 35 is floating from the BioBox. One end is inside the BioBox. Now we are trying to grab the marker.	
2	17	1598	296	420858	5096844	50 m bearing 122 to elevator.	
2	18	1597	118	420858	5096844	We are now moving with Mkr-35 in the claw. Lobate flows. Now 40 m bearing 137 to elevator. good fix.	
2	20	1596	140	420908	5096807	15 m bearing 070 to elevator.	
2	21	1593	165	420919	5096794	At elevator.	

2	22	1597	168	420923	5096784	Dropped marker. Will pick it up later for the transit to CASM.	
2	26	1597	167	420926	5096780	claw released Mkr-35.	
2	30	1597	158	420897	5096792	Trying to sample a rock at this site. Several previous attempts have failed.	
2	32	1595	147	420852	5096774	Failed rock sampling, now rising up to take extensometer out of tube and deploy it.	
2	34	1591	179	420891	5096808	photo #10 taken of line grab.	
2	35	1590	156	420900	5096813	Photo#1 of extensometer being removed from the tube on the elevator.	
2	38	1597	11	420873	5096817	Getting ready to grab the extensometer by it's base, extensometer on bottom.	
2	40	1598	130	420880	5096828	We have the extensometer by the base and are moving it. We passed a rat-tailed fish on the way.	
2	42	1593	279	418878	5095751	Heading to 9E5 target with extensometer in hand.	
2	43	1592	294	420914	5096763	Three transponder cage fix, range 342 m bearing 283 degrees. No P-code. Target is 99E5.	
2	50	1597	282	420903	5096793	Crossing lobate flows, rat-tailed fish in the distance, heading for 99E5.	
2	52	1597	288	419971	5096996	Eel-like fish.	R497-10
2	51	1596	286	420903	5096793	Fish is under a ledge and the ledge just collapsed on it. We are trying to get it out to identify it while we are waiting on the ship.	
2	54	1596	294	420046	5097164	Going over a jumbled ridge with sponges, might be older than lobates seen earlier.	
2	55	1596	292	420046	5097164	Partially collapsed lobates, probably of the same age as the ridge seen earlier.	
2	56	1594	288	420870	5096793	good ROPOS fix.	
3	0	1595	289	420867	5096786	Lobate flows in this area.	
3	3	1595	282	420846	5096814	heading to west edge of target 99-5 to deploy. In moderate sediment - lobates. some collapse in larger lobes.	
3	10	1594	285	420809	5096818	continuing in lobates toward target.	
3	15	1595	276	420724	5096841	Fairly low relief area of discrete lobates and tubes. Moderately sediment.	
3	25	1594	268	420605	5096853	Looking around in the lobates with light sed cover to deploy on a flat spot. An anemone on the wall of a collapse pit.	
3	27	1600	261	420611	5096856	Landing on lobates, light sed cover, few sponges .Target E-5.	
3	29	1600	235	420588	5096865	good location, deploying 99-E5.	Photo 12-14
3	30	1599	187	420589	5096867	Extensometer deployment	R497-11
3	31	1596	214	420620	5096874	Top end	R497-12
3	31	1598	184	420620	5096874	Deployed extensometer at x=420590 y=5096865	Photo-15
3	32	1593	129	420575	5096909	moving to E-4.	
3	35	1593	122	420676	5096870	Small collapse channels in lobates.	
3	39	1593	129	420688	5096824	Moved into more jumbled flows that are lightly sediment. Unusual white animal.	
3	40	1597	170	420695	5096817		
3	40	1597	184	420686	5096812	Sponge?	R497-14
3	41	1597	164	420682	5096833	Close up of sponge	R497-16
3	41	1597	168	420682	5096833	Strange white creature on lavas.	R497-15
3	41	1597	170	420688	5096817	Just heard that the elevator is back on the surface!	

4	16	1498	196	420728	5096810	cage starboard side	R497-21
4	17	1498	202	420718	5096836	cage starboard side - 2	R497-22
4	22	1498	209	419941	5097056	cage front	R497-23
4	59	1399	193	420704	5096782	Well, the elevator didn't work out as planned. At least it didn't sprout wings and fly. We are now moving south to CASM vent field for a while, maybe some high temperature fluids!	
5	21	1379	190	420667	5096298		R497-34
5	21	1378	191	420673	5096270	cage close, top half (previous frame is bottom half) to be stitched together in post processing. for ropos guys.	R497-35
6	24	1374	195	420638	5095228	About 60 meters from CASM. Yippee!	
						NO ACOUSTIC NAV. GPS SHIP POSITION AT STERN (CASM)	
7	20	1546	300	420638	5095228	About 35 m of the bottom, leaving the cage at 1545. We're facing west as we go down.	
7	21	1574	269	420638	5095228	Bottom in sight.	
7	23	1573	240	420638	5095228	Turning to look east to see if we can see the fissure.	
7	24	1573	95	420638	5095228	We're going to pick up and drive 20 m to the west now.	
7	26	1575	277	420638	5095228	Flat lobates with skylights, many sponges but not much sediment.	
7	27	1575	270	420638	5095228	Lobates have some yellow staining in hollows. Surfaces are very glassy, Lavas look younger right here, hot many sponges compared to other. Very distinct contacts with little kapukas of older lava.	
7	29	1572	267	420638	5095228	Contact lava	R497-36
7	29	1574	272	420638	5095228	Mixed young and old lavas.	photo-17
7	33	1573	273	420638	5095228	White bacterial mat and tube worms.	
7	33	1572	269	420638	5095228	Scattered tube worms	
7	33	1573	267	420638	5095228	A little venting near some tube worms. CASM	R497-37
7	33	1573	271	420638	5095228	Scattered tube worms.	Photo-18
7	33	1571	271	420638	5095228	More extensive fissure near the wall. tube worm patch	R497-38
7	34	1572	272	420638	5095228	Tube worm patch- looks young and springy in the middle, old on the outside.	Photo-19
7	34	1573	291	420638	5095228	The tube worms and palm worms are covered in limpets.	
7	34	1573	279	420638	5095228	Closer view of the tube worm bush. palm worms etc . water sample	R497-39
7	36	1574	290	420638	5095228	Preparing to suction diffuse flow into jar J3.	Ss-J3_dfl_ R497-1
7	40	1574	284	420638	5095228	Positioning the suction tube and preparing to sample this fluid.	
7	42	1574	285	420638	5095228	Ship heading is 25 and we've driven 50 m since the point we set down.	
7	42	1574	284	420638	5095228	The stern of the ship might be right over where this vent is.	
7	45	1574	288	420638	5095228	We're going to let it pump for 3 or 4 minutes, temperature is jumping between 1 and 16 C.	
7	47	1574	284	420638	5095228	Taking water sample over palm worms. near fissure	R497-40
7	48	1574	287	420638	5095228	We stopped pumping.	
7	48	1574	284	420638	5095228	We are done with this sample- we are rotating the jar out of position.	
7	48	1574	286	420638	5095228	Photo of nameless vent we just took a fluid sample from.	Photo-20
7	51	1574	284	420638	5095228	we're picking up and continuing west to the fissure.	

7	52	1573	269	420638	5095228	More scattered tube worms, approaching the edge of the fissure. Se some bacterial mat and dead tube worms, limpets.	
7	53	1572	264	420638	5095228	More venting near fissure	R497-41
7	53	1571	272	420638	5095228	Moving the ship 30 m to the west.	
7	54	1571	270	420638	5095228	Looks the fissure runs 020.	
7	55	1572	281	420638	5095228	SiTting on the edge of the fissure waiting for the ship to move. Traces of venting, worms, etc.	
7	56	1572	280	420638	5095228	The ship has caught up with us so we're going across to the other side then drive north.	
7	58	1573	2	420638	5095228	Proceeding north, we're at the bottom of the fissure.	
8	1	1572	68	420638	5095228	Up on the western edge of the fissure.	
8	3	1572	42	420638	5095228	Moving the ship 30 m to the west.	
8	6	1571	6	420638	5095228	Keeping our head at 020.	
8	9	1572	19	420638	5095228	The sonar isn't being very helpful, so I think we're a little lost.	
8	9	1572	9	420638	5095228	We're going to run north for 20 m, then go west to locate the fissure again. We just went in a nice little circle.	
8	10	1573	10	420638	5095228	Intense diffuse venting- lots of worms and limpets.	Photo-21
8	10	1573	14	420638	5095228	Moving west again.	
8	12	1572	18	420638	5095228	We're going north again.	
8	13	1570	17	420638	5095228	We see the chimneys! These are the lamphere chimneys, we think. We're of on the west side of the fissure still.	
8	14	1571	88	420638	5095228	Lamphere chimney	R497-43
8	14	1570	94	420638	5095228	We see the chain that Verena put on a chimney in 1983. We can see lava lapping up on the bottom of this chimney.	
8	15	1573	75	420638	5095228	Base of Lamphere chimney	R497-44
8	15	1573	69	420638	5095228	Photo of this sulfide structure with the chain on it. There's a little chimney, some venting, on this structure.	Photo-2
8	16	1572	265	420638	5095228	To the west we go.	
8	16	1571	273	420638	5095228	We're at the fissure again- looking for T&S.	
8	18	1572	27	420638	5095228	A little bit of sulfide on the wall - we're right on the rim.	
8	19	1573	21	420638	5095228	We're lost.	
8	19	1574	22	420638	5095228	Moving the ship 30 m to the north.	
8	21	1581	21	420638	5095228	We're at the bottom of the fissure, sort of.	
8	22	1579	11	420638	5095228	Metaliferous sediment, clams, crabs.	
8	26	1570	46	420638	5095228	What's the funny white-shaped donut looking thing?	
8	27	1568	23	420638	5095228	Going a little bit further north, Steve thinks we're cutting through the caldera wall. So we're turning around and going back.	
8	29	1577	194	420638	5095228	Metaliferous sediment again.	
8	30	1574	156	420638	5095228	Old sulfide - bizarre old sulfide.	
8	31	1573	128	420638	5095228	Some breccias on this old sulfide.	Photo-23
8	31	1573	125	420638	5095228	red stuff on edge of wall	R497-46
8	33	1579	193	420638	5095228	Climbing back up the wall to check the tether.	
8	34	1578	203	420638	5095228	Returning to the cage for tether management. The tether is caught on something.	
8	36	1543	150	420638	5095228	Keith had to go southwest to get back to his cage. The tether is ok.	

8	37	1546	141	420638	5095228	Going back down.	
8	39	1571	132	420638	5095228	We're going to go southeast now from the cage.	
8	40	1572	131	420638	5095228	Course 130 to attempt to find the fissure again.	
8	43	1574	125	420638	5095228	Lava contact	Photo-24
8	43	1574	126	420638	5095228	Contact new lava	R497-47
8	44	1575	133	420638	5095228	new lava down in the fissure?	
8	46	1576	77	420638	5095228	Lateralling to the north to get some more tether out.	
8	47	1573	82	420638	5095228	There are a few signs of hydrothermal venting here.	
8	47	1571	81	420638	5095228	Moving the ship 40 m to the east.	
8	48	1574	92	420638	5095228	Looks like there might be some hydrothermal venting? Maybe it's just staining. Quite glassy.	
8	56	1576	87	420638	5095228	Accidental photo	Photo-25
8	58	1552	234	420638	5095228	We're going to move the ship back to where we first were when we saw the lamphere chimneys.	
9	0	1543	263	420638	5095228	We're moving the ship south 30 m.	
9	6	1548	270	420638	5095228	Going back down to the bottom again to look for this sight.	
9	7	1575	270	420638	5095228	It looks like we're in the right terrain this time.	
9	9	1572	276	420638	5095228	Moving ship 30 m to the west - we think we've got it. Lots of dead worms, maybe some are alive.	
9	9	1572	277	420638	5095228	We're at the fissure waiting for the ship.	
9	11	1573	273	420638	5095228	We see some live tube worms, some dead.	
9	12	1572	275	420638	5095228	Going into the fissure and we're going to run north 020.	
9	14	1580	3	420638	5095228	We're down in the deepest part of the fissure. Tube worms, metaliferous sediments. Need to move the ship another 10 m to the west.	
9	16	1582	13	420638	5095228	A plump holothurian crawling about the tube worms	
9	18	1581	14	420638	5095228	The ship is in the correct position, we are proceeding north.	
9	19	1583	13	420638	5095228	We see some clams.	
9	20	1586	12	420638	5095228	The wall is starting to pinch in.	
9	22	1582	24	420638	5095228	We have the east wall in site.	
9	22	1579	17	420638	5095228	Looks like we're back in the caldera, looking at the breccias again. There is speculation that we're back where we were before, which is too far north.	
9	25	1581	196	420638	5095228	Going back to the cage - saw the clams again.	
9	26	1583	188	420638	5095228	Actually we're going back to the position of the cage.	
9	27	1580	211	420638	5095228	Octopus, fish. a lot of predators	R49748
9	27	1580	208	420638	5095228	Looking at some octopus, fish, sulfide, hydrothermal, etc.	Photo-26
9	27	1581	223	420638	5095228	Closer view of octopus and rattail	R497-50
9	28	1581	220	420638	5095228	Octopus!	R497-52
9	28	1581	221	420638	5095228	We're looking at a chimney!	
9	28	1579	216	420638	5095228	Sulfide chimney	R497-53
9	28	1579	216	420638	5095228	Sulfide chimney	R497-53
9	28	1579	228	420638	5095228	Photo of baby crab on top of a chimney	Photo-27
9	29	1581	231	420638	5095228	Little black things on the chimney - snails or something.	
9	30	1581	230	420638	5095228	Photo of sulfide chimney.	Photo-28
9	30	1581	230	420638	5095228	Bottom of sulfide chimney	R497-54

9	31	1581	230	420638	5095228	We're going to try to grab this little spire now. Can see nice shimmery water. He got a little piece of it into the port side of the BioBox.	Sf_R497-2
9	35	1581	230	420638	5095228	Unsuccessful attempt to grab some more of the sulfide.	
9	36	1581	231	420638	5095228	Looking at a sweet looking crab.	
9	36	1581	230	420638	5095228	Crab on top of sulfide chimney	R497-55
9	36	1581	231	420638	5095228	Crab on the chimney	R497-56
9	37	1581	232	420638	5095228	Grabbing the top of the chimney with a crab on top of it.	
9	38	1581	236	420638	5095228	The crab is attacking ROPOS!	
9	38	1581	236	420638	5095228	Crab getting friendly with ROPOS	R497-57
9	39	1581	233	420638	5095228	The crab is attacking the Imagenex now.	
9	39	1581	236	420638	5095228	We see some black smoke now that we've broken of the top of this chimney.	
9	40	1581	237	420638	5095228	Actually not true black smoke - but there is clear fluid coming out.	
9	41	1581	235	420638	5095228	Put the crab and sulfide in the port BioBox	Sf&Bio_R497-3
9	43	1581	235	420638	5095228	Going to look around a bit more.	
9	44	1580	282	420638	5095228	Huge field of tube worms. Beautiful.	
9	45	1580	333	420638	5095228	Huge lush tube worm field.	
9	45	1580	333	420638	5095228	Tons of tube worms	R497-58
9	46	1580	15	420638	5095228	This is T&S.	
9	46	1581	22	420638	5095228	We've found the HOBO at T&S.	
9	47	1581	60	420638	5095228	Moving the ship 20 m to the south.	
9	50	1583	359	420638	5095228	Looking for the MTR.	
9	50	1584	357	420638	5095228	We found the MTR.	
9	51	1583	353	420638	5095228	Sampling site near MTR	R497-59
9	55	1584	352	420638	5095228	Using Jar J4 for this water sample.	SS-j4_dfl _R497-4
10	1	1584	313	420638	5095228	Preparing to do this suction sample- probing for temperature.	
10	3	1584	317	420638	5095228	Temperature isn't so high, going to try a little bit away.	
10	8	1584	286	420638	5095228	Sampling right near this MTR. Starting the pump. Approximately 25 C or so, jumping around. Sample R497-4.	
10	10	1584	284	420638	5095228	Water sample at T&S near MTR	R49760
10	12	1584	285	420638	5095228	Still pumping.	
10	15	1584	283	420638	5095228	Sample is complete.	
10	16	1584	284	420638	5095228	Going to do the port side gastight bottle.	Gtb_R497-5
10	23	1584	286	420638	5095228	We fired it.	
10	24	1584	285	420638	5095228	Trying to pick up some sulfide for Steve- it's breaking a lot.	
10	24	1584	287	420638	5095228	Sulfide sample from T&S - placed it in the port side BioBox. Also taking the other MTR out of the BioBox.	Sf_R497-6
10	27	1584	285	420638	5095228	Placing this MTR near some flow, but not to hot.	
10	28	1584	284	420638	5095228	Deploying the MTR#3017m at T&S	
10	32	1584	287	420638	5095228	Picking up the old VEMCO and putting it in the starboard side of the BioBox.	VEMCO_R497-7
10	34	1584	283	420638	5095228	That was VEMCO 98-13-214	
10	34	1584	284	420638	5095228	Now we're doing a tube worm grab right near where the VEMCO was.	

10	35	1584	284	420638	5095228	Actually, I take it back, we're going to suction particles over the tube worms here first.	SS-j1_bio_R497-8
10	39	1584	288	420638	5095228	Probing the temperature over these tube worms before we suction sample.	
10	39	1584	288	420638	5095228	suction of particles over tube worms	R497-61
10	39	1584	287	420638	5095228	This is log file number 4 for this suction sample of particles over the tube worms at T&S.	
10	42	1584	289	420638	5095228	We are suctioning.	
10	43	1584	286	420638	5095228	The max temp was around 10 C. Still suctioning.	
10	49	1584	287	420638	5095228	Collecting tube worm clump, putting it in stbrd bio-box.	Bio_497-9
10	54	1584	287	420638	5095228	collecting second clump, still the same sample number, also put into the stbd bio-box.	
10	56	1584	287	420638	5095228	continuing to sample SS_497-8, more particles. pump on 1/2 speed at 10:58	
10	59	1584	288	420638	5095228	rustling gently at the worm grab site to continue the particle sampling with the suction sampler.	
11	6	1584	286	420638	5095228	Stopping the suction sample and temp log #4 (J1 was the ss)	
11	10	1584	283	420638	5095228	probe-casm	R497-62
11	8	1584	283	420638	5095228	Repositioning the MTR into the same spot that the worm grab was taken. Bottom of MTR is being moved into the flow.	
11	13	1584	283	420638	5095228	Positioning ss probe to get temp over MTR, max temp 17.9 C.	
11	16	1584	286	420638	5095228	positioning to ss bottle 1, getting ready to sample mat for Moyer	
11	20	1584	276	420638	5095228	begin pumping sample of mat, Tmax so far = 5.4 deg C.	SS-1_mat_R497-10
11	24	1584	275	420638	5095228	Continuing to ss mat material.	
11	28	1584	275	420638	5095228	continuing mat sampling, temp is 5 C.	
11	31	1584	274	420638	5095228	suction sample white fur	R497-63
11	32	1584	278	420638	5095228	max T is up to 6.1 deg during sampling of mat	
11	32	1584	275	420638	5095228	pump of sample is finished for mat. move to flushing jar. flush ss.	
11	35	1584	275	420638	5095228	tapes changed about 1128	
11	36	1584	279	420638	5095228	moving to the HOBO sampler to check out the flow.	
11	39	1581	38	420638	5095228	worms and vent water	R497-65
11	40	1580	60	420638	5095228	tube worms and vent	R497-66
11	40	1580	112	420638	5095228	clasp of vent	R497-67
11	41	1579	121	420638	5095228	smashed the top of the chimney with the s probe, temp spike to 28 deg C.	
11	42	1581	122	420638	5095228	positioning 7 function arm for a gas tight sample near the top of the chimney strbd gas tight	
11	43	1581	120	420638	5095228	stbd gas tight.	Gtb_dfl_R497-11
11	45	1579	65	420638	5095228	moving away from the chimney to find a sulfide sample, found FeO pagodas	
11	46	1580	339	420638	5095228	sulfide sample area	R497-68
11	46	1581	313	420638	5095228	Attempting to collect small turret of FeO from near where the first was collected. lots of debris stirred up. sample fell. trying another piece, no good. third try. sample fell away. giving up on this area. One more try before we leave.	
12	1	1582	280	420638	5095228	Steve's highlight tape was changed.	

12	4	1582	282	420638	5095228	Attempting to grab an FeO sample at the base of the T&S spire. The sample has lots of tube worms on it. Into port bio-box.	Sf_R497-12
12	7	1582	292	420638	5095228	sulfide sample and tube worms	R497-69
12	8	1582	290	420638	5095228	More FeO added, same sample number, more tube worms. Second grab last piece.	
12	9	1582	299	420638	5095228	Stop Steve's video.	
12	10	1580	284	420638	5095228	tube worms!	R497-70
12	11	1581	255	420638	5095228	tube worms	R497-71
12	11	1581	253	420638	5095228	tube worms.	photo 30
12	18	1582	247	420638	5095228	fluid sample in tube worms	R497-72
12	13	1581	248	420638	5095228	fluid sample over the worms Tmax= 29.9 C. bottle#2 w/green mesh. starting sample 1215, temp taken a dive. fluctuating temps. Stop the pump, checking nozzle, pumping restarted Tmax=38.5 C, Texit=27.3 C steady. Logging temp log #6 for fluid. Texit=27.1C	SS-j2_dfl_R497-13
12	20	1582	248	420638	5095228	still sampling	
12	23	1582	249	420638	5095228	still steady at 28 C stop sampling pump and stop temp log # 6. Highlights on.	
12	25	1582	247	420638	5095228	video survey of lush tube worm area where the was sample was taken.	
12	26	1582	245	420638	5095228	tube worms	R497-74
12	27	1582	245	420638	5095228	tube worms	R497-75
12	28	1582	246	420638	5095228	stopping highlights. positioning for ss J2. begin sampling 1231, 10 micron mesh for larvae intake temp 7.5 C	SS-j2_bio_R497-14
12	33	1582	243	420638	5095228	Vareena's highlights are running.	
12	40	1582	245	420638	5095228	start Kim's highlights tape	
12	45	1582	243	420638	5095228	tube and palm worms	R497-76
12	46	1582	243	420638	5095228	stopping the fluid sample. rotating to jar number 3	
12	48	1582	242	420638	5095228	begin sampling at 1249 sampling material on the outer surface of the tube worms.	SS-3_bio_R497-15
12	56	1582	245	420638	5095228	still suction sampling worms and their close associates.	
13	2	1582	242	420638	5095228	end of sample.	
13	2	1582	243	420638	5095228	move to flushing jar. flush suction sampler.	
13	4	1582	243	420638	5095228	Kim's video off.	
13	5	1582	248	420638	5095228	Kim's highlights back on. Beta cam highlight on. Tube worm fields being surveyed.	
13	10	1580	48	420638	5095228	ROPOS is positioning to collect the HOBO sampler using the 7 function arm. Probe is now free at 1313. ROPOS is setting down on the bottom in order to store the hobo in the port BioBox. Highlights off.	HOBO_R497-16
13	16	1583	132	420638	5095228	Attempting to place the hobo in the port bio-box. draped the hobo to the bottom. ROPOS is moving to collect the hobo a second time. Repositioned to collect it again. hobo is in the port bio-box. box is closed.	
13	29	1583	331	420638	5095228	ROPOS is releasing the ss probe. Positioning the 5 function arm to grab the ring.	
13	33	1583	311	420638	5095228	change VCR tapes and stop Kim's highlights	

13	34	1583	311	420638	5095228	ROPOS is moving to the top of T&S to sample with the Niskin. The 5 function arm has grabbed the ring. 1336 sample collected. top of the vent. Niskin was about 6 inches above the outlet.	Niskin_dfl_R497-17
13	43	1584	274	420638	5095228	ROPOS is moving back to the cage. End of sampling.	
13	46	1556	120	420638	5095228	ROPOS has returned to cage.	
13	57	1394	346	420638	5095229	ROPOS and ship are moving back toward the extensometer site.	
13	58	1402	16	420638	5095229	VCR's stopped for transit.	
14	3	1398	72	420638	5095229	Spiny jelly	R497-78
14	3	1398	72	420638	5095229	Spiny jellyfish	R497-79
16	24	0	0	421566	5097898	We're back at the NRZ and will deploy the elevator now (again). We're going to navigate it to the bottom. Elevator over the side now.	
16	28	0	0	421038	5096877	Elevator back in the water at 1624, going back down to the extensometer site.	
17	11	1399	60	420918	5096724	42083 509670 Elevator position.	
17	24	1577	70	420947	5096732	Moving to 98E3	
17	27	1591	94	420962	5096727	98E3 in view and located	
17	29	1593	321	420973	5096724	98E3 is located on top of pedestal of lava	
17	34	1593	311	420972	5096726	98E3 collected by ROPOS/all checks out/moving to then elevator-distance 80 m.	
17	37	1593	314	420977	5096745	ROPOS stopped for a fix: 3 transponders woohoo	
17	48	1593	298	420866	5096811	We have found the elevator/98E3 is being placed in the tube.	
17	49	1590	316	420731	5097981	The score stands at 1-0 Chadwick/98E3 recovered	
17	53	1593	132	421477	5097119	Moving now to collect Rock sample.	
18	3	1596	116	420898	5096759	Rock sample collected 420898/5096759	Rck_R497-10
18	6	1594	117	420898	5096760	Moving the ship(stern) 50 m to 98E4	
18	9	1593	274	420898	5096760	ROPOS on the bottom going between 98E3 and 98E4	
18	34	1591	319	420793	5096742	ROPOS on the move. Looking for 98E4	
18	41	1594	32	420742	5096794	98E4 located and Power outage. Shut down?	
18	45	1597	318	420737	5096807	Sub telemetry lost/Sub is coming up slowly/ Dive R497 comes to an end	
19	40	1597	318	420715	5096806	ROPOS on deck.	
						Dive Summary follows:	

						<p>Dive Summary R497: The dive began with the elevator deployment. Got to the bottom. Removed one extensometer from the elevator and deployed it at position 99E5. When we were heading to recover one of the 98 extensometers Frank noticed that the elevator was</p>	
						<p>was floating behind the ship. We recovered the elevator and proceeded to CASM Vent Field. 17 samples were taken t CASM (suctions for animals and fluids), and tube worm grabs. After many hours at CASM we returned to the NRZ extensometer site.</p>	
						<p>The elevator was redeployed and one extensometer was placed in the tube. We lost power to the sub again and the dive was aborted.</p>	

							Dive R498
							Dive Plan: Short dive to recover the remaining 3 extensometers with the elevator (elevator prematurely surfaced on Dive R497).
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.
UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
20	15					ROPOS launched.	
23	29	1579	346	420752	5096803	the cage is at 1570	
23	32	1594	243	420790	5096800	ROPOS on bottom, 1594, have 3-transponder fix, need to head SE to start target	
23	37	1595	254	420773	5096774	looking for first target	R498-1
23	40	1593	289	420732	5096844	Extensometer in sight, number 5 on top floatation, 98E4	
23	43	1597	206	420735	5096832	base of extensometer designated 98E4 getting ready to pick it up for transport to elevator.	R498-2
23	46	1597	209	420770	5096790	Extensometer is in the starboard arm	
23	53	1596	164	420785	5096800	moving ship position and sub to elevator, taking first extensometer	
23	58	1594	118	420843	5096786	Depth relatively constant en route to elevator, terrain mostly lobate flows.	
0	0	1591	147	420867	5096776	Arrived at the elevator	R498-3
0	1	1589	159	420846	5096822	extensometer 98E4 into elevator	R498-4
0	2	1590	174	420871	5096759	top of extensometer sinking into tube	R498-5
0	3	1593	140	420882	5096770	at elevator	
0	4	1591	197	420878	5096768	Elevator with extensometer	R498-6
0	4	1591	222	420884	5096771	range 145 meters at 103 degrees to next target, extensometer 98E2	
0	19	1597	122	420988	5096748	40 meters to the next site.	
0	24	1590	90	420996	5096730	Approaching extensometer e2.	
0	25	1589	119	420996	5096730	Frame grab of extensometer E2.	R498-7
0	26	1591	145	423284	5095772	Base of 98E2 before pick up	R498-8
0	26	1592	200	423284	5095772	1998 E2 extensometer	R498-9
0	27	1593	229	423284	5095772		R498-10
0	27	1593	228	423284	5095772	Might be slightly tilted to the NW (98E2).	
0	27	1593	229	421037	5096733		R498-11
0	28	1593	226	421033	5096735		R498-12
0	29	1592	234	421032	5096734	extensometer 98e2 in the claw and now being carried to the elevator.	
0	36	1581	329	420965	5096793	The elevator is at 80m bearing 254.	
0	41	1590	266	420911	5096783	Good fix, 30 m bearing 254 to elevator.	
0	43	1594	254	420911	5096798	Mkr-35 in sight, where the elevator used to be.	
0	44	1596	265	420916	5096785	Swimming crinoid in video. We are preparing to pick up Mkr-35.	
0	48	1595	296	420916	5096783	Mkr-35 in the grasp and we are heading for the elevator 32 meters away.	
0	51	1588	237	420916	5096782	We have a good ROPOS fix, the elevator is 30 meters away.	

1	1	1593	302	420898	5096759	Rat-tailed fish sighted.	
1	2	1594	273	420879	5096779	Release of the elevator seen. Now the elevator is in view.	
1	7	1590	212	420889	5096760	Mkr-35 dropped into elevator tube.	
1	9	1590	161	420887	5096763	Extensometer 98e2 dropped into elevator tube. Now heading to pick up 98e1.	
1	11	1592	138	420884	5096765	25 m bearing 102 to the next target.	
1	47	1591	201	421205	5096707	Starfish on rock. good nav fix.	
1	50	1592	39	421202	5096709	Nav says we are on top of 98e1b. We don't see it. good fix.	
1	55	1593	175	421202	5096688	good nav fix, crab seen, Holothurian seen, no extensometer seen	
1	58	1593	80	421245	5096629	1998 E1 extensometer	R498-14
1	59	1594	97	421223	5096680		R498-15
1	58	1593	85	421206	5096673	extensometer located, 98e1 and is at an angle. It is located in a very rough area.	
2	1	1594	97	421223	5096682	extensometer was inclined toward 023 degrees. We are in the process of grabbing the extensometer.	
2	3	1594	93	421227	5096676	Many barnacles seen on rock, also on extensometer. Note that the float is all the way to the bottom.	
2	5	1594	113	421215	5096676	P code lost. Elevator 30 m away.	
2	6	1593	109	421214	5096677	extensometer in grasp and we are heading towards the elevator.	
2	8	1586	80	421182	5096756	Bearing 280 at 30 meters to the elevator.	
2	23	1591	272	420917	5096760	Elevator in sight	
2	24	1592	255	420892	5096760	Back at elevator with last extensometer	R498-16
2	24	1592	249	420892	5096760	Chicken in sight	R498-17
2	25	1590	82	420883	5096760	extensometer (last) going into tube	R498-18
2	31	1569	131	420876	5096769	tether is tangled, trying to get it untangled	

2	35	1588	146	420876	5096774	tether is ok now, back at elevator with extensometer	
2	35	1590	136	424253	5096253		R498-19
2	37	1590	91	421424	5097219	last extensometer not quite in the tube	R498-20
2	37	1592	42	420880	5096764		R498-22
2	37	1592	42	420880	5096764	rubber chicken on elevator	R498-21
2	37	1592	92	420865	5096770		R498-23
2	38	1593	156	420865	5096770	honey bear on elevator	R498-24
2	48	1596	138	420860	5096818	Elevator is not released. Rope pulled off pin. Pin is still in place.	
2	53	1596	152	420863	5096768	pin held in by tie-wrap, trying to pull it out.	R498-26
2	56	1596	147	420880	5096764	Now the elevator is released and on the way up.	
3	3	0	0	421030	5096532	ROPOS on way to surface, at 1540 meters, 23/min	
3	59	0	0	420874	5096849	03:49 UTC Elevator on board	
3	59	0	0	420874	5096849	ROPOS on deck at 0414 UTC	
						Dive Summary: Recovered the extensometers that were deployed in '98. Three extensometers were placed in the elevator (one was placed on the previous dive). Elevator has all four '98 extensometers in tow.	

							Dive R499	
							Dive Plan: Fluid sample northern new lava area at Magnesia, N41, Oxide (near N41), Nascent, Cloud, Mkr-33. Suction sample at Magnesia, OldWorms and Mkr-33. Imagenex. Deploy Osmo at Magnesia	
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples	
3	59	0	0	420874	5096849	ROPOS in the water at 15:09 UTC		
16	27	1526	87	421434	5084283	On the bottom. Lava pillar. Resetting still camera count to zero.		
16	30	1523	87	423372	5088972	Just hanging out for a few minutes while we wait for nav.		
16	30	1523	87	423372	5088972	Lots of floc in the water - did ROPOS stir some up or is it snow output from Magnesia vent? Still waiting for nav, disregard fixes.		
16	30	1523	87	423372	5088972	White spire in the distance - looks like it is hydrothermal in origin. Multiple pillars. We are not at Magnesia yet, we're waiting for a good fix. Looks like there might be some white spots, some venting.	Photo 1 - 4	
16	40	1527	85	423306	5088132	More pillars, covered on top with sediment. Is it hydrothermal in origin?	Photo 5	
16	43	1525	91	423674	5088571	good ROPOS fix.		
16	44	1526	179	423819	5088308	More pillars. Not getting video input to the frame grabber. Lots of floc in the water and fall out on the ground.	Photo 7 - 8	
16	46	1528	187	423897	5088183	At Magnesia vent. Tons of floc coming out of the pit.		
16	46	1530	162	423678	5088534	Frame grab video back on. Still no good nav.		
16	48	1530	164	423676	5088138	Video highlights on. Moving into position to fluid sample.		
16	49	1528	120	423670	5088545	good ROPOS fix: 3669, 8545. Accidental photo.	Photo 8	
16	59	1531	353	423669	5088550	Probing for temperature at Magnesia. Note: Imagenex is not getting data. Maximum temp. at 7 degrees C.		
17	7	1531	357	423674	5088535	Locked the arm for fluid sampling - up to 7.3 degrees C. Starting to suction at 17:08 into filter #3 for xrf of HFS.	HFS-3_dfl_R499-1	
17	13	1531	359	423666	5088550	Finished pumping R49-1 at 17:13, 50 ml was pumped. Starting to pump into piston #4. Stopping at 17:19, 60 ml pumped.	HFS-4_dfl_R499-2	
17	19	1531	359	423670	5088548	The max. temp on the last sample (R49-2) was 7.4 degrees C. Starting to pump gas piston #5. Stopped at 17:22.	HFS-5_dfl_R499-3	
17	23	1531	357	423670	5088537	Starting to pump bag #18 of HFS at 17:26. This is the last fluid sample at Magnesia. Stopped pumping at 17:31, pumped 613 ml. Few seconds of highlights at 17:32.	HFS-18_dfl_R499-4	
17	40	1531	357	423678	5088536	Spent the last 5 minutes panning around looking for animals to suction. We could only find a couple scale worms. We are going to deploy the Osmo first and then go for a suction sample.		
17	45	1531	5	423669	5088545	Deploying the Osmo sampler.		
17	52	1531	18	423668	5088544	Shut off the sub aux. power to try and get imagenex working. It's working now.		
17	54	1530	17	423667	5088547	Still trying to deploy the Osmo. Grabbing the t-handle and placing the intake down into the pit opening.		
18	1	1531	22	423668	5088545	Dropping the Osmo intake into the pit.		

18	12	1531	335	423665	5088552	The intake tip is in place for the Osmo, now need to position the main body.	
18	14	1531	335	423675	5088528	Still at Magnesia. Tripping the Niskin bottle at 18:17.	Niskin_dfl _R499-5
18	22	1530	5	423668	5088546	Osmo sampler Red at Magnesia	R499-1
18	22	1530	26	423669	5088545	Photo of Osmo position.	Photo 9
18	25	1530	216	423668	5088554	Red Osmo sampler at Magnesia	R499-2
18	24	1528	179	423669	5088548	VHS tapes changed. Still at Magnesia.	Photo 10
18	30	1531	24	423194	5088810	Area shot	R499-3
18	30	1531	14	423194	5088810	Venting fluid at Magnesia	R499-4
18	33	1531	350	423669	5088549		R499-5
18	33	1531	348	423669	5088549	Red Osmo sampler at Magnesia	R499-6
18	34	1531	346	423669	5088554	Red osmo sampler at Magnesia	R499-7
18	36	1531	354	423675	5088523	Repositioning for suction sampling of scale worms.	
18	39	1532	43	423669	5088544	Highlights have been off for awhile.	
18	41	1527	325	423658	5088538	Susan-san says a good fix.	
18	49	1529	210	423657	5088548	Still trying to find some polynoids to suction for Jean.	
18	55	1497	286	423661	5088551	Suction sampling abandoned as visibility was poor.	
18	58	1498	42	423661	5088551	Back to cage. Power problems with sub but not lethal.	
19	14	1501	152	423680	5088495	On our way to Old Worms. ROPOS at cage as ship moved.	
19	17	1503	124	423694	5088492	We were in a dense plume. Took highlight video. Now getting out of plume - going from snow to fog".	
19	27	1504	360	423788	5088439	smoke plume	R499-8
19	27	1504	46	423777	5088438	Still in fog" = buoyant plume of fine particulates near Old Worms."	
19	29	1521	212	423791	5088447	On the bottom in worms so must be at Old Worms site.	
19	30	1524	188	423807	5088481	water and worms	R499-9
19	30	1525	187	423791	5088448		R499-10
19	30	1524	186	423791	5088448	Photos of sponges on a pillar.	Photos 1 & 12
19	31	1523	148	423796	5088439	Photo of drainout and tube worms.	Photo 13
19	33	1524	174	423794	5088432	Photo of lobate lava, worms and crab.	
19	33	1523	151	423796	5088428	Last was photo 14 - forgot to enter to right.	Photo 14
19	36	1525	188	423798	5088428	Worms are (barely) alive. Not much venting seen yet.	
19	38	1524	261	423799	5088422	Worms, crab (maybe).	Photo 15
19	39	1524	266	423792	5088422	More worms.	Photo 16
19	39	1525	234	423792	5088424	Appear to at place where we sampled on an earlier dive.	
19	40	1524	313	423780	5088421	Diffuse vent, sponges.	Photo 17
19	45	1526	88	423782	5088427	Parked in front of a tube worm bush looking for fluid to sample.	
19	55	1526	110	423780	5088430	Stuck HFS into tube worm bush. Found only 4.2C and no obvious flow so not a suitable sampling site.	
20	2	1526	115	423784	5088418	suspected venting	R499-11
20	7	1525	175	423785	5088418	yet another spot to check out	R499-12
20	4	1526	116	423783	5088421	Lazy flow in tube worm bush. Not good enough to sample.	
20	8	1525	168	423786	5088417	Moved west and found a better site with lush growth and good fluid flow.	
20	19	1526	148	423787	5088412	Gas piston #24 started at 20:19:40. good fix.	HFS-24_dfl _R499-6

20	21	1526	147	423786	5088412	Gas sample stopped after 1 minute at 20:21. Probably ~150 ml.	
20	23	1526	150	423786	5088412	Max T on previous sample was 7.8C.	
0	0	0		0	0	Not getting an increased temperature on the outlet thermocouple when pumping. Trying to determine why - massive leak? Also, big cloud of hydraulic fluid from ROPOS. Going back to cage. Dive terminated.	
20	37	1481	174	423781	5088406	ROPOS is in its cage and winding to surface.	
21	40	2	41	423705	5088548	21:30. ROPOS on deck.	
21	45	2	41	423705	5088548	Dive Summary: Vent fluid samples, nissen, suction samples of biota and deployment of osmosampler at Magnesia Vent. Video of plume. Vent fluid sample at OldWorms. Leak in HFS folowed by hydraulic leak in ROPOS terminated the dive.	

							Dive R500
							Dive Plan: Continuation of aborted Dive 499. Changed Niskin and a piston sampler on HFS (P4).
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.
UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
23	15	5	303	423705	5088548	Dive went in at 23:14.	
0	32	1526	155	423736	5088471	On bottom. Old Worms 98 m bearing 10.	
0	33	1526	107	423714	5088298	Complete sediment covering.	
0	34	1525	154	423836	5088124	Sediment covering thinning out, . Many sponges on rocks.	Photo 20 - 21
0	35	1523	148	423779	5088458	Photo 23 coming into venting, worms seen Staining, on the western edge of where we were.	Photo 23
0	36	1524	126	423779	5088458	collapse pit with drain back and worms. If there is visible venting, we will take it.	
0	38	1523	222	423790	5088423	Photo 24 of hole with tube worms	Photo 24 - 25
0	38	1525	249	423790	5088418	better site at Old Worms	R500-1
0	38	1525	237	423790	5088418	Many tube worms at old worms	Photo 26
0	39	1526	215	423830	5087842	AT old worms quite a bit of visible flow.	R500-2
0	40	1525	239	423786	5088415	Preparing for sampling. To 8.2 degrees so far.	R500-3
0	42	1526	234	423786	5088416	Getting temperatures to 9 degrees as we are poking under a worm clump.	
0	44	1526	230	423655	5088559	Sampler locked in T1=9.5, T2=7.5.	
0	45	1526	228	423786	5088414	HFS temp probe placed under a skirt of tube worms. flows are reminiscent of cloud Mkr-N6 ; very isothermal	R500-4
0	45	1526	229	423786	5088414	Bag 9 is being used to sample this site. The fixes are good.	
0	47	1526	224	423769	5088326	Sample bag 9 started at 0047	HFS-9_dfl _R500-1
0	50	1526	222	424020	5088693	Baby palm worms on tube worms during sampling of HFS bag 4	R500-5
0	52	1526	223	423784	5088414	Bag 9 stopped, maximum temperature 9.6 degrees.	
0	57	1526	223	423785	5088414	Scale worms covered with bacterial mat, palm worms.	R500-6
0	58	1526	223	423857	5087947	Starting bag 17 at 0:58 .	HFS-17_dfl _R500-2
0	59	1526	220	423316	5087803	Panning camera around to look at site.	
1	1	1526	220	424019	5088696	Shimmering water coming out of tube, distilled water being pumped out of sampler	R500-7
1	2	1526	219	423771	5088327	HFS-17_dfl_R500-2 Tmax=9.8, time stopped at 70 ml, 0105 UTC.	
1	5	1526	222	423567	5088645	Started at 0106. This is a gas piston.	HFS-23_dfl _R500-3
1	7	1526	220	423784	5088414	Stopped piston 23 at 0107.	
1	8	1526	221	423561	5088649	Now changing to suction sampling J3 64 micron mesh	
1	10	1526	222	423741	5088757	Scale worms flying by, preparing for J3 suction sample.	R500-8
1	13	1522	172	423704	5088314	Vacating this site to do the suction sampler elsewhere. We did not take the suction sample.	

1	15	1524	132	423758	5088332	Seeing alot of staining (Photo 27). We are moving to an older bush of tube worms at site Old Worms.	
1	17	1525	151	423741	5088504	Tube worm bushes seen but rejected as a sampling site as being too small.	Photo 27
1	22	1520	90	423762	5088421	This is a four transponder fix.	
1	23	1522	173	423767	5088426	Heading east of field.	
1	23	1522	182	423730	5088482	back to where we took the fluid sample.	Photo 28 - 30 R500-9
1	24	1523	142	423785	5088417	Big bush of tube worms away from fluid sampling site.	
1	25	1525	130	423795	5088395	crab on the right of older tube worm bushes and we will take J3 over this bush.	Photo 31
1	26	1526	137	423795	5088395	Slow to medium suction will be required.	
1	27	1526	141	423793	5088414	good fix on this site. Started 0127 for larvae, sampler J3 for 15 minutes.	SS-j3_dfl _R500-4
1	39	1526	153	423790	5088411	Stopped at 01:39:45 suction sample J3. We will now reposition for Christian's sample. The elapsed time of sample was 12 minutes.	
1	47	1526	169	423793	5088415	Started 01:47:40, sampling at an old tube worms community 10 micron mesh.	SS-j1_bio _R500-5
1	49	1526	174	423793	5088413	Shaking up the tube worms for biota sampling.	R500-10
1	54	1526	175	423795	5088416	Sampling results	R500-11
1	56	1526	171	423798	5088391	The suction sampler is being moved side to side, stopped 0156:20	
2	0	1526	175	423790	5088410	Jar 4 was just turned on briefly.	
2	3	1526	174	423791	5088414	Trying to find clams and other fauna for suction sampling.	
2	7	1526	195	423585	5088647	Suction sample.	SS-j2_bio _R500-6
2	8	1527	195	423799	5088412		
2	10	1520	188	423016	5086805	Lost P-code.	
2	18	1527	232	423804	5088396	Among clam shells.	
2	18	1527	233	423789	5088414	Clam shells at old worms site.	
2	19	1527	231	423792	5088410	ss-j2_bio_R500-6 pump on at 2:20.	
2	28	1527	214	423794	5088409	Sample of J2.	R500-12
2	29	1527	214	423791	5088406	Flush of J2.	R500-13
2	29	1527	217	423787	5088405	Stopped pumping 02:29 and will look for other fauna.	
2	31	1527	207	423792	5088406	Broken hose on the suction sample. We are now done with suction sampling. Hose got stuck on bracket and broke hose.	
2	36	1527	184	423793	5088406	Heading back to the cage.	
2	48	1477	145	423826	5088507	Heading east to start an Imagenex line.	
3	2	1499	177	423923	5088353	Starting Imagenex line 1.	
4	57	1497	248	424064	5087479	Imagenex line complete and we are now moving over to Mkr-Mkr-N41/FeO2. Tom Corbet was here.	
5	20	1521	127	423887	5087434	On bottom in lobate field covered with yellowish hydrothermal? sediment. Some white bacterial mat on edges of collapse. A good deal of particulate mater in the water column.	
5	23	1520	167	423909	5087421	looking for FeO2 site. Water is very cloudy. Mkr-Mkr-N41 found. MTR in view too. Many white patches of biota between yellow stained/coated low relief pillows.	

5	26	1520	355	423910	5087404	Quite an extensive field of scattered Fe oxides on lobates. Some jumbled too.	Photo 32
5	29	1521	166	423913	5087431	Settling down between lobates, looking for venting. Mat of diatoms? all over the tops of lobates. Munch munch munch!	
5	32	1521	281	423919	5087431	Looking for venting site to sample. Seeing a buoyant plume here. Lots of Fe Oxide around.	
5	35	1521	119	423900	5087424	some venting spotted	R500-14
5	35	1521	138	423900	5087424	Quite a lot of diffuse venting from in-between lobates. Fe Oxide all over the tops of lobates. Much bacterial floc in cracks between lobes. Regional warm water is above ambient (2.6C).	
5	39	1522	121	423904	5087423	Diffuse flow with Fe oxide and floc between lobate flows.	R500-15
5	45	1522	133	423905	5087425	Looking for hotter water up to 5.1 C. in a hole between lobates. Temp up to 5.5C. Fix x=3904 y=7423 NE of FeO2. Taking the fluid sample now.	
5	47	1521	129	423902	5087422	5 m NE of FeO2. Sample is 4.5 C inlet, 4.1 C outlet. sampling. Some worms living in the mucus. There was a small fish before too. Small particles caught in the filter that will be analyzed by XRF and STEM.	HFS-19_dfl _R500-7
5	52	1521	133	423905	5087424	Scale worm on top of lobate, Kim confirms. Also pandora worm in tube down in hollow of venting site.	
5	54	1521	129	423904	5087424	Pandora worm in low T vent but not the site we are sampling.	R500-17
5	55	1521	130	423905	5087424	Finished the fluid sampling. Going to take a gas tight here.	
6	3	1521	130	423899	5087438	Can't take a suction sample because the line is broken.	
6	6	1521	130	423900	5087439	Sample gastight #6	Gtb-6_dfl-R500-8
6	10	1518	170	423906	5087430	Taking a zigzag course to get to Nascent vent.	Photo 33?
6	11	1520	162	423906	5087424	Heading south over some collapse pits. Very dense plume, seeing Mkr-Mkr-N41now. Photo of iron stained lobates.	Photo 34
6	12	1520	178	423893	5087394	more bacterial material and some tubeworms, between most lobates, lots of shimmering water. Stopping to sample in this field	Photo 35 - 36
6	14	1521	187	423911	5087385	Many snails and limpets (me thinks) and quite a lot of bags on the lobates. Tubeworms concentrated in more concentrated flow between the lobes. Much diffuse venting.	
6	16	1521	224	423910	5087391	Taking temp. in-between lobes. up in the 5-6C temp range. Halfway between Mkr-Mkr-N41 and Nascent 3911 7391.	
6	19	1521	218	423916	5087399	Higher Temps in the 20 C range. in the midst of a tubeworm clump.	
6	23	1521	221	423905	5087404	Begin sampling	R500-18
6	24	1521	219	423912	5087394	Unfiltered bag sample	HFS-16-dfl _R500-9
6	25	1521	218	423910	5087386	sampling location near Mkr-Mkr-N41	R500-19
6	26	1521	221	423910	5087393	more of the same	R500-20
6	28	1521	219	423910	5087392	Done with that sample	
6	28	1521	220	423872	5087043	Gas tight sample, gtb-stbd side, sample #7	Gtb-7_dfl _R500-10
6	36	1521	221	423897	5087366	Searching same spot for higher temp.	
6	43	1521	220	423902	5087402	Probe is back up in same spot with T's in the 20's. Starting to sample bag number 1 with a filter.	HFS-1_dfl _R500-11
6	46	1521	217	423927	5087415	fluid sampling site	R50021

6	47	1521	218	423912	5087390	Stopping sample, exit T about 14 C. Now doing filter #10 for lipids.	HFS-10_dfl _R500-12
6	55	1521	218	423918	5087403	Still pumping for lipids	
6	59	1521	219	423903	5087396	finished taking sample. Taking filter 13 next. in sample place.	HFS-13_dfl _R500-13
7	1	1521	216	423977	5087763	Now it is working, sample #13 being taken now. DNA filter is 13.	
7	5	1521	217	423928	5087451	sampling site for several recent samples (post GTB)	R500-22
7	7	1521	218	424278	5087191	photo #37	
7	15	1521	220	423908	5087385	bags and more bags	R500-24
7	26	1520	213	423911	5087375	good fix baby	
7	31	1520	280	423907	5087378	deploy MTR	
7	32	1520	274	423909	5087380	MTR 3175, repositioned from R491 at Mkr-Mkr-N41 area. Placed at base of tube worm clump.	
7	33	1520	287	423909	5087380	Checking temp with fluid sampler, Tmax at 15.3 C at business end	
7	38	1520	289	423871	5087743	Moving towards Cloud Mkr-Mkr-N6 next	
7	40	1519	200	423902	5087397		Photo 52
7	41	1519	196	423941	5087467		Photo 53
7	41	1519	193	423941	5087467		Photo 54 - 55
7	43	1518	194	423946	5087466		Photo 56
7	44	1519	182	423946	5087466		Photo 57
7	45	1519	189	423946	5087466		Photo 58
7	47	1520	173	424074	5087661	good fix 23m at 17 degrees heading, temp check at 6.1C Tmax	
7	51	1519	176	423912	5087352	Traversing south from this MTR - coming to the edge of a collapse. Some pockets of white lined venting.	Photo-59 - 60
7	51	1519	157	423912	5087352	Alternating orange and white coverage on the lobate lavas.	Photo-61
7	52	1520	195	423912	5087352	More lobates with white and orange stuff.	Photo-62
7	52	1519	195	423905	5087340	White stains from venting.	Photo-63
7	53	1520	171	423957	5087432	More staining.	Photo-64
7	54	1519	194	423957	5087432	Large collapsed pit.	
7	54	1519	182	423957	5087432	More staining on these lavas. More orange stuff than before.	Photo-65
7	54	1519	194	423937	5087377	Some little tube worms in the pockets.	Photo-6
7	55	1519	171	423937	5087377	Some blue protozoan mat	
7	55	1518	183	423937	5087377	More white staining, little tube worms, etc.	Photo-67
7	56	1519	199	423918	5087309	Quite a bit of shimmering flow here.	
7	56	1519	173	423917	5087312	good fix here.	
7	57	1520	223	424234	5087126	We're 60 m south of the MTR, we're going to probe the temperature here.	
7	59	1520	229	423881	5087414	Little hole with white shimery stuff flowing out. 3918 7310.	
8	2	1520	228	424674	5087293	Sampling, Temp 7.5C	HFS-4_dfl _R500-14
8	8	1520	227	423914	5087301	Stopping sampling	
8	12	1520	243	423915	5087306	Reposition, temp at 9.5C, pump on	
8	17	1520	224	423915	5087300	Done sampling, ~60 cc sampled, Tmax 11.3C	
8	18	1520	222	423914	5087301	Sampling site of HFS04	R500-25
9	12	1523	279	423904	5087110	photo 69 at Mkr-Mkr-N4, Bact Traps in view	Photo 69

9	15	1524	248	423902	5087118		Photo 70, 71
9	18	1522	269	423906	5087106		Photo 72, 73
9	19	1523	317	423916	5087114		Photo 74, 75
9	21	1525	335	423917	5087127	Arrive at Mkr-Mkr-N6	Photo 76, 77
9	24	1524	301	423904	5087117	Fluid sampling at cloud Mkr-N6	R50028
9	23	1525	308	423915	5087116	Sample filter 6, temp at 20oC steady. Fish filter	HFS-6_dfl _R500-15
9	27	1525	293	423904	5087113	start sampling	
9	28	1525	308	423903	5087116		photo 78
9	36	1526	304	423901	5087112	Done with the sample	
9	36	1526	306	423906	5087112	Starting filter #12, DNA filter	HFS-12_dfl _R500-16
9	38	1526	299	423902	5087108	Another view of fluid sampling at Cloud Mkr-N6	R50029
9	46	1525	302	423903	5087118	stopped sampling	
9	47	1525	301	423903	5087117	Lipid filter, starting sample	HFS-15_dfl _R500-17
9	56	1524	302	423902	5087116	stopping sample	
9	58	1524	304	423901	5087117	piston #20 started, just another water sample	HFS-20_dfl _R500-18
10	4	1524	304	423902	5087115	Stopped sampling with 675 ml	
10	4	1524	306	423908	5087120	evil-nasty-slurpgun-killing-niskin sample #19, in flow of Mkr-N6 vent.	Niskin_dfl _R500-19
10	23	1523	303	423903	5087114		photo 79
10	24	1522	258	423903	5087105		photo 80
10	28	1521	83	423895	5087108		photo 82
10	29	1521	69	423897	5087122	Mkr-N4	Photo 83 - 85
10	29	1521	58	423894	5087109		photo 86
10	31	1521	114	423896	5087119		Photo 88 - 89
10	32	1521	115	423895	5087120	At Mkr-N4	R500-30
10	33	1521	118	423895	5087119	good fix	
10	38	1521	103	423896	5087119	Transacting across cloud vent area	
10	40	1521	289	423898	5087118	Cloud, Mkr-N4	R500-31
10	44	1520	290	423899	5087120	Survey of Mkr-N4 area, heading 285 to the right, drops off and then there is a hole. Heading for Mkr-21.	Photo
10	45	1521	65	423900	5087118	Video mapping of Cloud area.	
10	46	1522	272	423901	5087117	Back at Mkr-21. Facing heading 285. Waiting for debris to clear. Range the top of the cliff = 9 meters. Adjusting the color camera to look just above the fluid sampler.	
10	56	1523	282	423904	5087116	Making sure we are getting good fixes. Currently we are stopped and sitting on the bottom.	
11	6	1523	284	423904	5087118	Starting video survey. First a lateral to the east, we are going to mow the grass, in steps of 2 meters east and west.	
11	7	1523	283	423905	5087116	Kim's tape is started. Keep a 285 heading. Begin 21:08	
11	8	1523	286	423904	5087117	Bottom at beginning of survey.	photo 92

11	8	1523	287	423902	5087107	edge of basin, up on the wall a little bit. edge large drop of and no more venting. Going back to port.	photo 93
11	10	1523	288	423904	5087113	Lateral west. Past the large patch of worms. Another area of venting, big hole with tube worms. Another basin. Another vent. Now we are at the wall. Move up 2 meters. Now back North.	
11	12	1522	284	423905	5087110	Edge on South side, large drop off, coming over the pit. Photo 97 is directly over the Mkr-N4.	photo 94 - 98
11	13	1522	289	424007	5087648	On the N side. over a large rock pillar, moving ahead 2 meters. 9 going back to S, still heading 285, Camera is dead. Photos 101 and 102 did not flash.	photo 99 - 100
11	15	1523	285	423902	5087113	At the south edge. Turning to N to range on the pillars. New VCR tapes at 1:16. Distance to other side (pillars) is 6 meters. Back to 285 heading, stopping ahead 1 meter only. Lateral to the N, 3 meter distance from cliffs on W extremity.	
11	18	1522	286	423905	5087108	Trying camera, broken. Face of W edge, another area of venting. At the corner of W and N edge. Lost the cliff, then we nudged the pillars on the N side. Move to W and do last pass across the lower face of the cliff. Still on 285. More venting.	
11	21	1522	282	423899	5087123	Moving down, now lateral to the S, passing the marker, lots of worms.	
11	22	1522	278	423898	5087120	Touching on bottom, back at the big cliffs, at edge coming up, turning N. Heading N. There is venting on a small razorback down below. Moving along the wall, past the pillar, the cliff flattens. This is a new pillar, still going N. lateralling to big wall	
11	27	1520	1	423896	5087120	Lateral to N, another bounding wall, not a continuous wall, moving S,	
11	29	1521	360	423901	5087113	Moving over Mkr-21, setting down on the bottom. Turning to 285, to map a hole that we missed earlier.	
11	30	1522	282	423903	5087111	Heading 285 from a point directly south of Mkr-21. Going out of the edge of the field. Big rock, little rock. Going back to the eastern edge of the field.	
11	33	1522	290	423903	5087116	Heading 285, going over the marker, connecting to the other marker, a short lateral to N. Redoing the same run to fill in the final gaps in coverage.	
11	35	1522	287	423899	5087114	Changed Kim's tape, we are at the eastern edge of the field. Doing a little hop (3 meter) to the south, bottom is split by a U shape.	
11	37	1523	286	423901	5087112	Starting last east to west run. over T-bone steak, straight ahead on 285, on the left is the pillar in the distance, running 250 across the last structure in the SW corner of the field.	
11	40	1518	253	423887	5087110	Small amount of venting on top and then the abyss.	
11	40	1517	316	423885	5087107	Flying along the southern edge, heading 105, break to N, other ridge (that defines the field) on the west.	
11	43	1519	342	423891	5087097	just before we went to the large structure, saw the pillar, need to go back to the pillar. Not far from marker Mkr-N4. We are now back to Mkr-21, moving S and W.	
11	48	1520	234	423898	5087119	Still looking for the pillar.	
11	51	1516	278	424367	5087936	Stopping the tape, heading back to the cage.	
11	53	1488	338	424440	5086672	ROPOS is back to the cage. Checking out the Nav. It is ok. Moving the ship 70 meters to the west.	
12	9	1510	264	423867	5087075	Heading to Mkr-33.	
12	10	1522	261	424087	5087596	Sitting on the bottom. Trying to get a fix.	

12	13	1522	254	423880	5087084	good fixes. Moving bearing 297. Coming into some white staining on the sheet flows.	
12	14	1520	290	423874	5087093	Heading 289, 24 meters to Mkr-33.	
12	15	1521	289	423861	5087103	Another piece of broken sheet. Found Mkr-33. Moving lateral before we stir up the bottom. Short video survey along the crack.	
12	17	1521	211	423853	5087104	Mkr-33	R500-33
12	17	1520	213	423744	5086611	Mkr-33	R500-34
12	16	1521	211	423854	5087098	Heading is 215-212. Looking for areas to get temp measurements. Going back to the area where al the osmo samplers sit to take fluid samples.	
12	18	1522	217	423852	5087103	Siting on the bottom. Extending fluid sampler probe.	
12	19	1522	218	423856	5087104	Moving right next to the spot where the hot water is coming out. Positioning probe.	
12	20	1522	228	423855	5087102	6 deg C on probe, 7 deg. Attempting to find max T.	
12	21	1522	235	423854	5087099	Temp is climbing, 13 deg, 18, 34, 42, 54, 60, 65, 69, 73, 74, now back down to 45. Back up to around 70.	
12	24	1522	238	423855	5087102	Number 1 sample FISH, temp is 76, 12:24 start, filter 1 fish.	HFS-1_dfl _R500-20
12	29	1522	238	423854	5087101	T2 is reading 43 deg C.	
12	33	1522	236	423854	5087100	75.5 max T , stopping sample. Filtered 1 liter.	
12	34	1522	243	423857	5087099	starting filter 2 XRF.	HFS-2_dfl _R500-21
12	38	1522	245	423852	5087085	Max T 7.5, vol 50ml, sample stopped 12:38	
12	39	1522	245	423850	5087103	Start sample. Sterevex. T1 6, T2 43. Panning to outlet line to flow. good flow.	HFS-7_dfl _R500-22
12	56	1522	246	423857	5087098	Stopping sample 75.7 was Max T.	
12	58	1522	246	423474	5086596	starting filter 21 for lipids.	HFS-21_dfl _R500-23
13	8	1522	247	423856	5087095	Stopping the sample, Max T 73, 120 ml.	
13	9	1522	247	423978	5087411	Starting piston 2.	HFS-2_dfl _R500-24
13	15	1522	245	423853	5087106	624 ml, 74 max t , stopping.	
13	15	1522	247	423658	5087628	Bag 14 with a filter. starting at 13:16	HFS-14_dfl _R500-25
13	19	1522	245	423859	5087096	Change VCR tapes.	
13	21	1522	245	423856	5087088	stopping at 13:20, T max 73.5 525ml.	
13	21	1522	244	424143	5087726	Removing probe.	
13	25	1522	244	423858	5087090	Mkr-33	R500-35
13	23	1522	244	423858	5087091	Starting temp survey, between where just sampled and bio traps. Max 7.5 was for the sampling. Now start for this area, 15, 20, 25, 30, moving probe to backside, 8, 9,10. Looking SW flow seems be coming out this side of the crack.	
13	29	1522	252	423650	5086840	Mkr-33 slab o' rock	R500-36
13	28	1522	243	424217	5086791	Moving to the other side of the osmo samplers. Repositioning ROPOS to the end of the crack. Down on the east end of the block. Positioning probe. Pump on at 13:3. 10, 7, steady at 7, moving slightly to strb.	

13	32					Moving probe along the crack up to back near the osmos as get closer. Return to port end of crack. Most we got around here was 10.3 Pump keeps going off. Up to 13	
13	37	1522	216	423860	5087100	ROPOS is moving down the other side to look for venting from other cracks. Not much is flowing out of this other side. Moving farther away, looking for any venting. Appears to be a little venting from another crack. Setting down.	
13	41	1522	108	423847	5087099	Positioning probe in the crack. Looks like a broken up pavement. Putting probe in small crack. 3, 5, 6 deg so far. Tmax=6.5 C. Removing probe. ROPOS is moving, reprobng another area Tmax=6	
13	45	1522	125	423849	5087100	Time to come up. ROPOS has left the Bottom at 13:46. ROPOS is moving back to cage.	
13	48	1509	67	423862	5087089	Appear to be getting hydraulic oil in the water. Red droplets.	
13	51	1491	260	423862	5087089	Tapes off.	
13	52	1490	249	423890	5087096	ROPOS is back in the cage and starting to head for the surface. Game over.	
						Dive Summary: HFS, suction, gastight and nissen samples were taken at various vents (Old Worms, Old Flow, Nascent, Mkr-33, and Cloud). 25 samples collected in all. Video mapping of Cloud Vent. Imagenex survey at end of dive.	

							Dive R501
							Dive Plan: "Geobiodive" to finish mapping and sampling the contacts of the 1998 lava deploy the time lapse camera at Mkr-33 and biological suction samples at Mkr-33 and a bag site."
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions. No acoustic nav logged until ROPOS went down second time at JD192 0521. Have nav for rest of dive.
UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
21	37	0	17	423660	5086399	ROPOS in water.	
22	51	1522	143	423791	5087129	ROPOS on the bottom.	
22	53	1521	172	423810	5087146	At Mkr-33 looking for place to deploy the time lapse camera.	
23	2	1523	206	423844	5087107	Camera placed on seafloor. Will be moved into place.	
23	9	1521	238	423839	5087128	Photo of time lapse camera in position.	Photo 1
23	10	1521	345	423839	5087128	TL camera looking from south	R501-1
23	10	1521	350	423839	5087128	Side view of time lapse camera.	R50-14
23	11	1520	348	423840	5087125	Frame grab looking from the south, marker 3 in background	R501-5
23	11	1522	331	423840	5087121	Side view of camera.	R501-6
23	12	1522	78	423840	5087121	looking at TL camera from west to east	R501-7
23	12	1522	69	423837	5087118	Head-on view of camera.	R501-8
23	13	1519	251	423841	5087131	Looking at TL camera from NE to SW	R501-9
23	13	1519	247	423841	5087131	Back view of camera.	Photo 2
23	14	1521	243	423844	5087124	TL camera looking SW	R501 10
23	14	1521	244	423844	5087124	Backside view of camera.	Photo 3 -4
23	15	1522	266	423844	5087124	Back quarter view of camera.	Photo 5
23	15	1522	321	423844	5087124	TL camera looking to NW (Camera is looking West)	R501-11
23	16	1523	328	423837	5087128	Side view of camera.	Photo 7 - 9
23	18	1520	247	423844	5087123	TL camera - ROPOS is looking to SW	R501-12
23	19	1520	237	423844	5087123	TL camera - ROPOS looking to SW	R501-13
23	20	1521	245	423844	5087127	Another one	R501-14
23	27	1522	293	423841	5087131	side view of time lapse camera in position at Mkr-33	R501-15
23	28	1523	295	423841	5087131	close-up of time lapse camera in position	R501-16
23	36	1524	358	423836	5087138	Picked up suction sampler with 5 function.	
23	39	1523	348	423844	5087107	Suction sample in jar 1 of bacterial mats at Mkr-33.	SS-j1_mat _R501-1
23	47	1521	338	423846	5087110	Looking at site to possibly reposition camera	
23	51	1518	199	423984	5086851	Decided to move camera back ~15 cm.	
23	56	1523	236	423846	5087105	ROPOS positioning Time Lapse Camera	R501-17
23	56	1523	232	423846	5087105	Camera moved 15-20 cm back from its original position.	
23	57	1522	233	423753	5087352	Area to south of camera	R501-18
23	58	1522	242	423845	5087111	Area being viewed by Time Lapse Camera	R501-19

23	58	1522	249	423845	5087111	Backside view of new camera position.	Photo 10 - 11
23	59	1522	328	423845	5087108	What camera is looking at	R50120
23	59	1522	330	423845	5087108	Side view of timer lapse camera.	Photo 12
0	0	1521	291	423844	5087107	Mkr-33 vent.	Photo 13
0	1	1523	264	423844	5087115	What NeMO camera would look at	R501-21
0	3	1522	215	423847	5087114	Video survey along crack on heading 215.	
0	4	1521	211	423845	5087118	What NeMO Camera would look at	R501-22
0	4	1520	216	423845	5087118	End if video survey.	
0	8	1498	270	423845	5087118	Traveling 165m on course 213 to south of Mkr-33 to begin geological traverses over new lava. Target name is Geotran."	
1	20	1502	221	422463	5085383	Have arrived at beginning of geotransect, 560m SW of Mkr-113.	
1	22	1520	59	422893	5085729	Descending to seafloor, going to West of contact and going to drive East across it. stay tuned.	
1	23	1527	98	422893	5085729	At bottom. Se sediment in pockets around lavas - Bob says old stuff.	
1	24	1532	91	422907	5085745	Smaller lobate flows look quite black. Lots of sediment. Older flow-old or intermediate?	Photo-14
1	27	1531	87	422891	5085740	Large pillows up at the slope. Moving the ship along this transect due East to look for contacts.	
1	29	1528	93	422911	5085734	Starfish in photo.	Photo 15 - 16
1	30	1529	92	422917	5085741	Holothurian, ophiuroids on lava.	
1	31	1528	87	422911	5085746	good fix. Rattail.	
1	32	1531	85	422917	5085734	good fixes. Older than intermediate says Bill. Quite a bit of sediment, says Bob. Crab.	
1	33	1534	89	422930	5085720	Some sponges, lots of ophiuroids, brown sediment, anemone. Trying to get close-ups of surface to see how old the lavas are.	
1	34	1534	98	422949	5085688	Lots of holothurians.	
1	35	1535	94	422956	5085680	Definite brownish tint on the surface of the larger pillow lavas, although it looks really glassy. Surprising! "Key is to look closely at the lava" - Bob.	
1	36	1534	94	422966	5085689	good fix.	
1	37	1534	94	422974	5085695	Lavas look glassy from a distance, but when zoom in, they do look quite old. Large anemone.	Photo-17
1	38	1534	98	422980	5085699	Another anemone. Holothurians. Lots of ophiuroids.	Photo-18
1	39	1534	93	423001	5085708	Empty tubeworm tube. Ophiuroids. Grayer members of the same lava flow. Rattail. Large pillow lavas.	Photo-19
1	41	1532	99	423011	5085715	Mike Perfit likes the look of the rocks too. Its a geo love fest! Still on old lavas.	
1	42	1531	100	423029	5085716	Anemone, Bob thinks this is the same flow, although there is some discussion that this might be a contact. Anemone again. Bob thinks this is the same flow still. Starfish.	
1	43	1532	116	423033	5085700	As get in close, can see more sediment, little sponges, holos, ophiuroids and they don't look as young as they do from far away.	
1	44	1532	114	423047	5085696	good fix. Tube-like animal sticking out from under lavas. Lots of ophiuroids and holos. Little sponges.	
1	47	1531	112	423083	5085701	Come up about 6 or 7 meters since we've been driving. good fixes. Lava looks glassy, but still older flow.	

1	49	1531	109	423102	5085703	Continuing East, lavas are becoming more lobate-now back into more pillows, but not seeing the larger ones anymore.	Photo-20
1	49	1530	113	423112	5085704	good fixes here. Holos, sediment pockets.	
1	50	1529	113	423122	5085704	Aren't as many sponges and ophiuroids, at contact.	
1	51	1529	115	423128	5085707	good fix. P-code is going down. At contact. Stopping the ship. Zooming in.	Photo 21 - 22
1	52	1530	116	423143	5085705	Contact-the younger lava of the two.	R501-23
1	53	1530	114	423142	5085705	Does look like younger lava, but there are some ophiuroids, a couple of holothurians and some sediment. Ship is stopped.	
1	54	1530	106	422720	5085324	Looks like a very similar type of flow as we've been traversing, but don't have as much sessile fauna on them.	
1	55	1530	86	422721	5085323	We're going to take a piece of rock. Taking the younger rock of the contact.	
1	59	1530	46	423141	5085704	Very glassy rock under surface-can't get a grab. Going to take a suction sample instead.	
2	9	1530	63	423142	5085704	Having trouble with the suction sampling-its stuck.	
2	15	1530	61	423142	5085708	Suction sampler jammed and two lights are out.	
2	22	1530	65	423143	5085709	Sub coming back up. Light on camera is out. Quick turnaround and then back down again.	
3	8	204	7	422440	5086972	Notice: We will not change the dive number, even though ROPOS will come to the surface for repairs. I've been informed that the dive number only changes when we do pre-dives and post-dive procedures	
3	10	146	23	422440	5086972	ROPOS is back on deck to fix the suction sampler and replace the lights.	
3	54	2	145	422440	5086972	ROPOS back in the water. Going down to Contact W10 to continue dive.	
3	54	2	145	422440	5086972	CORRECTION: ROPOS BACK IN THE WATER AT 0413.	
5	1	1253	250	423058	5085723	Continuation of Dive R501. Fixed the connector to the camera light and pulled a large piece of whole rock out of the suction sampler carousel that was jamming the rotating mechanism. Have acoustic nav from this point till end of dive.	
5	21	1531	274	423103	5085725	On the bottom. Looks like older with many sessile organisms. Many brittle stars. wandering around a bit to find a broken piece to sample. Could be 50 m west of contact with Age 2 pillows.	
5	25	1533	16	423048	5085709	prospective samples	R501-26
5	26	1534	22	423074	5085738	3050 5709 was a good fix	
5	25	1533	17	423048	5085709	good fix. Trying to get a sample on large pillow. 3050 5709. Surface looks older.	Photo 23
5	28	1533	30	423048	5085711	really glassy	R501-27
5	29	1533	31	423047	5085709	Taking pillow sample. sample 2	R501-29
5	31	1533	18	423047	5085714	Can't pick up glassy top of pillow so going to slurp glass into Jar J3.	SS-j3_rck _R501-2
5	38	1533	348	423047	5085709	resorting to suction sampler	R501-30
5	42	1533	348	423045	5085709	Finished taking sample 2 of old (age 3?) top of pillow lava.	
5	44	1533	84	422351	5087104	Many dense small stalked organisms on lava surfaces	Photo 23
5	47	1533	70	421936	5085735	surface of intermediate flow	R501-31
5	47	1533	70	421936	5085735	Fairly extensive sponges and sediment pockets. Holothurians, lavas getting more lobate in form.	
5	48	1532	101	423065	5085727	Heading east. Anemone in older lavas.	Photo 26

5	49	1532	62	423360	5085449	Crab and fish. still in old lavas	
5	52	1531	114	423112	5085734	contact between new lava and old(er)	R501-33
5	51	1531	108	423112	5085734	Big sponges and now at contact with large well formed pillows, Well formed pillows and large tubes. Quite glassy with few sessile organisms. A little less sed.	Photos 28-29
5	56	1530	122	422711	5085334	Close up of surface of larger pillow.	Photo 30
6	0	1531	91	423127	5085716	Trying to grab a sample of small tube, toe in lobates but not having much luck. Going for the suck.	
6	2	1531	99	423185	5085742	Going to sample in Jar #7.	SS-j7_rck _R501-3
6	6	1531	106	422626	5085255	Finished sampling slurp 7. Younger of two flows at contact. Age 2 flows.	
6	10	1528	92	423136	5085713	Heading east again. Glassy nature of lobes, not much life a few holothurians, not to many brittle stars. they appear to be smaller in size. Not much sed in pockets either	Photo 32 - 33
6	11	1529	86	423258	5085964	Inter-pillow sediments	R501-34
6	12	1530	122	423149	5085720	Of surface of the large younger pillow.	Photo 35
6	15	1530	194	423152	5085709	Continuing east. Small amounts of Fe sed between lobes and pillows. Quite a few holothurians. Still some large pillows. Area has been flat over a long distance. Some very glassy tubes coming from the pillow bottoms.	Photo 36
6	19	1532	124	423157	5085652	Contact with jumbled flow that has alot of sponges, possible kipuka.	
6	20	1531	69	423178	5085656	Going over a collapse zone with bathtub rings on walls. to the east. along the collapse are lobates that could be the younger lobates	Ph-39
6	25	1532	336	423200	5085668	Archway with new lavas a top older flow	R501-35
6	25	1532	9	423200	5085668	Younger truncated lavas overlying the collapse structure.	Pictures 40-43
6	26	1532	6	423202	5085670	contact of younger on older collapse	R501-36
6	26	1532	6	423202	5085670	Surface contact	R501-37
6	26	1532	354	423200	5085669	another	R501-38
6	27	1531	336	423200	5085670	drip	R501-41
6	27	1530	257	423308	5085147	Drip structure into the collapse.	Photo 45
6	28	1529	265	422062	5085241		
6	33	1531	98	423270	5085708	Taking a sample near the collapse in some broken up lobes. It is unclear if this is underlying older or the same age as the last sample (3). We don't appear to be in the collapse pit now but it is very broken up.	Rck_R501-4
6	35	1532	112	423237	5085669	sample #4, lava chunk	R501-42
6	35	1532	114	423237	5085669	Sample 4	R501-43
6	36	1532	114	423237	5085668	Putting the sample 4 on the proceed BioBox. Far back left division. Blocky sample with good layer of glass and a layer below it.	
6	39	1529	258	423236	5085668	After sampling we are heading east again. Collapse area again to the NE. Driving east in younger lavas. A bit more sediment but not much sessile life on lobates	Photo 46.
6	41	1531	102	422721	5085172	More broken up pillows, appears to be same unit that sample 3 and 4 were in. Looks like an older flow kipuka now.	
6	42	1531	96	423259	5085677	Back into age 2 lavas. Flow must be fairly thin. Mixture of pillows and small glassy tubes and lobes. Some flatter lobes to.	
6	45	1529	100	423326	5085682	Waiting for the ship. Appears to be more sed. between lobes - possibly some hydrothermal sed.	

6	48	1530	106	423335	5085678	Small scale venting activity due to telltale staining on lava flow	R501-44
6	48	1531	103	423335	5085678	Some hydrothermal (FE) staining on lower portions of lobes.	
6	51	1530	102	423345	5085673	Same flow but glass on surface looks more broken up, more glass in sediment pockets. More yellowish hydrothermal sed between pillows. We are on the joystick line.	Photo 48-51
6	55	1529	97	423366	5085682	Venting must be going on. lots of Fe between lobes. Same line as Joystick.	Photo 52
6	58	1530	101	423395	5085682	Getting out of hydrothermal area. Surface is like age 2 again but there are some older sponge covered pillows sticking up.	
6	59	1530	102	423411	5085681	Stopping to get sample of age 2? or is it '98 flow? Hard to tell	Rck_R501-5
7	3	1530	118	423241	5086138	sample #5, port front geobox	R501-45
7	2	1530	117	423411	5085680	Sample from a crust of a hollowed out lobe. Sort of stubby with thin glass, angular edges x=3411 y=5680 position. Went into the front port BioBox.	
7	4	1530	93	423238	5086148		
7	4	1530	93	423238	5086148	Location of sample 5	R501-46
7	6	1530	91	423232	5086164	Heading east after sampling.	
7	7	1529	93	423234	5086163	Still looks like age 2 lavas. No colonization, but light dusting of sed. Not much sed in pockets. Mostly small lobes, not many pillows.	
7	12	1527	91	423432	5085680	This is a good fix. Hanging out waiting for ship to move east.	
7	15	1529	95	423433	5085678	Believe we are still in age 2 lavas with no sessile organisms and light sed cover. Uniformly flat lobates with some shallow collapse, some hydrothermal staining.	
7	17	1528	97	422914	5085159	Some bio. Bacterial Mat on cracks in lobates. More iron staining and sed in cracks. but rapidly getting out of zone of microbial mats. Some yellow staining or sed on lobes.	
7	19	1528	96	423474	5085687	Deep collapse area with plume emanating from the edge.	
7	20	1529	344	423474	5085687	area of collapse with slight venting under it.	R501-47
7	20	1528	341	423475	5085683	Edge of collapse .bacterial mat	R50148
7	20	1528	90	422929	5085152	On edge of collapse. can see sheet flows on base of collapse. Lineated sheets trending SW.	
7	23	1530	86	422980	5085846	Stopping to get sample from eastern edge of collapse in lineated sheet flows. Moderate sed. cover. Sample 6.	Photo 56
7	26	1530	88	423491	5085695	Suction sample of glass from sheet flow	R501-49
7	23	1530	85	423493	5085695	good fix. Taking a suction sample in jar #8. Sheets in bottom of collapse looks age 2.	
7	27	1530	89	423493	5085694	Sucking lots of sheet flow glass	SS-j8_rck _R501-6
7	31	1530	82	423492	5085695	good fix	
7	32	1530	83	423492	5085695	Niskin sample	
7	34	1529	80	423491	5085695	aborted niskin	
7	36	1528	92	423503	5085699	collapse area, pillars	
7	39	1528	95	423524	5085680	lobate flows, seds more evenly distributed due to larger flat areas	
7	40	1528	93	423534	5085680	lobate flows	photo 57
7	42	1528	96	423550	5085680	collapse area, pillars	
7	43	1529	86	423557	5085679	SE-NW trending collapse area, sheet flows in bottom	
7	45	1531	93	423579	5085680	good fix, sheet flows, jumbled lava at edge of collapse	

7	47	1529	99	423591	5085680	In collapse area, jumbled lava in bottom, broken lava toes/tubes, still interim age lava	
7	49	1529	96	423614	5085683	small sponges on jumbled lava surface	
7	51	1529	94	423628	5085684	good fix	
7	54	1529	100	423655	5085682	back out to small section of roof, then back into ropy floor of shallow collapse	
7	57	1530	92	423687	5085680	good fix, collapse area, jumbled lavas	
8	4	1530	93	423752	5085670	Continuing in very jumbled and chaotic sheets, a bit of hydrothermal sed. in pockets. Should be nearing the new flow contact. Could be a edge of collapse zone.	
8	5	1529	93	423774	5085668	Jumbled up flow with hydrothermal sediment. Now we're back into the regular jumbled folded up crust.	Photo-58
8	7	1529	98	423797	5085666	Still in the collapsed area filed with jumbled lava.	
8	10	1529	97	423830	5085666	Murky water in the sit camera.	
8	11	1529	92	423834	5085666	Some ropy lavas mixed in with the jumble.	
8	11	1530	91	423839	5085667	Looks like a bit of a drop of here- the sheet is tilted down.	
8	12	1530	96	423842	5085667	More flat sheet surface.	
8	12	1530	92	423846	5085668	More lineated lava. 3847 5668	
8	14	1529	91	423862	5085667	We're stopping the ship to take a sample.	
8	14	1530	88	423862	5085667	Slabs of lava where we're going to sample.	Photo-59
8	15	1531	100	423864	5085667	Slab of rock	Rck_R501-7
8	15	1531	101	423869	5085666	We're at the edge of a shallow collapse-a jumbled broken up area- trying to get the sample.	
8	16	1530	100	422776	5084539	3865 5668 good fix for this sample.	Photo-60
8	17	1531	100	423865	5085668	Chunk of rock from collapse	R501-50
8	17	1531	99	423865	5085668	Placed sample in starboard BioBox. Slaby piece of sheet flow with glass on the top- longer than it is wide or thick.	
8	19	1528	88	423864	5085667	Continuing east. Lobates on top of jumbled sheet flow. Light sediment cover. No sessile fauna living here.	
8	21	1530	88	423877	5085670	Lineated, folded, a few curtains.	
8	21	1529	96	424086	5086092	Lots of collapse around pillars, a few lobates stuck out on top of it.	
8	23	1529	102	423904	5085672	Out of the collapse area, into some continuous roofs and lobates.	
8	24	1528	94	423910	5085668	Large deep skylight.	
8	25	1529	91	423917	5085667	Extensive field of lobates. Looks very solid.	
8	26	1529	94	423928	5085664	Shallow collapse with lobates.	
8	28	1529	94	423937	5085660	Ropy textures on the surface, drop down where big pieces have fallen down the little pieces. More sediment down in the collapse.	
8	29	1529	84	423749	5085626	Big pillars, slabs.	
8	30	1529	96	424329	5086033	More lobates. Strobe didn't work on picture.	Photo-61
8	31	1529	96	425196	5085578	Deep collapse area with lobates on the top	Photo-62
8	32	1529	94	423968	5085661	Fair amount of sediment on top of collapsed and jumbled pieces on the bottom.	
8	33	1529	97	423964	5085658	Looks like we've found some contact. Black stuff over lightly sedimented lobes.	
8	33	1529	98	423973	5085662	Contact new lava. lightly sedimented lobes	R501-51

8	34	1529	92	423995	5085660	Stopping the ship to take a sample. Last 5 strobes on the camera didn't work.	Photo 63 - 65
8	35	1529	104	423993	5085661	Dark, reflective, hydrothermal sediment on these new "lavas."	
8	36	1529	136	424323	5086076	Some brittle stars on this new "flow."	
8	37	1529	128	424323	5086076	We're going to look around a little bit more before sampling to make sure this really is contact - Bill is not convinced.	
8	39	1529	94	423992	5085652	Having difficulty figuring out what this really is. Sediments in cracks of lobates, few organisms.	
8	41	1529	90	424054	5085932	Going to drive 50 m to the west then driving back this direction to see if we can find the supposed contact.	
8	41	1529	352	423998	5085660	White staining on some exploded lobe.	
8	42	1528	274	423995	5085662	Back into collapsed areas again.	
8	43	1529	278	423995	5085662	Turning back east again, heading a little bit north so we don't go over the exact same stuff.	
8	44	1529	88	424147	5086082	Light dusting of sediment.	
8	45	1528	93	423995	5085667	Not really striking new flow. A little bit glassier. Heading east, a collapse with lots of sediment on the fallen blocks.	
8	45	1529	84	424000	5085670	The batteries are dead in the camera again.	
8	46	1529	83	423214	5084939	Computer lock up.	
8	47	1529	83	424014	5085670	We're coming up of the bottom to try to reboot.	
8	51	1484	252	423995	5085654	Going back down now.	
8	53	1461	316	423998	5085653	We're going back up to the cage now, not the bottom.	
8	54	1451	336	423069	5085182	Going back down to 150.	
9	2	1504	59	423024	5084699	Doing some tether management.	
9	3	1527	140	423024	5084699	Going back to the bottom again.	
9	4	1528	103	423024	5084699	Well formed lobates, sediments in the pockets.	
9	4	1529	99	423974	5085644	3974 5645 Pretty glassy, with sediment. Skylight.	
9	4	1529	102	423978	5085644	Heading east.	
9	6	1529	104	425206	5085559	Glassy surfaces, light sediment cover, accumulated sediment between the lobes. Some brittle stars.	
9	10	1529	95	423528	5085914	Some brittle stars on these lobates. Continuing the line east.	
9	18	1530	101	425194	5085574	More sediment right in here, still looking for the contact.	
9	22	1529	104	422892	5084422	Ropy lineated flow with a lot of sediments at the bottom of this collapse.	
9	23	1528	101	424098	5085653	Back onto the lobate surface - similar looking surfaces.	
9	25	1529	101	422871	5084368	Old flow sticking out - near the contact.	
9	25	1530	100	424033	5085651	Pockets of old lava sticking through the new. Jumbled lavas.	
9	27	1531	112	424123	5085645	4120 5647 good fix of where the contact is.	
9	28	1531	113	422879	5084349	Area near contact where there are a few patches of jumbled older flow sticking through.	
9	30	1531	105	424146	5085644	Contact	R501-53
9	30	1531	105	424146	5085644	Contact is found. Stopping to sample.	
9	31	1532	101	423726	5084996	Grabbing an old jumbled piece of lava. 4178 5646	Rck_R501-8
9	44	1533	157	424183	5085645	Still trying to sample this rock.	
9	39	1533	146	424114	5085646	Will try to grab a chunk of this old flow lava	R501-54

9	50	1533	162	424967	5085437	Placing the rock sample in the starboard BioBox.	
9	53	1533	152	423168	5085064	Moving to get a piece of the new flow from the contact.	
9	54	1533	153	423168	5085064	Contact new lava. will try to get a sample	R501-55
10	2	1533	267	424178	5085632	Sampling the new flow	
10	3	1533	263	424123	5085633	Trying to get a sample of new flow	R501-56
10	5	1533	248	424196	5085631	Instead of a grab, we're going to try to slurp this rock sample.	SS-4_rck_R501-9
10	7	1533	233	424111	5085630	x=4188 y=5637 Where we are suctioning.	
10	8	1533	252	425206	5085564	Suction sample of glass on newer lava	R501-57
10	9	1533	255	424190	5085634	Jar 4 is filled with little pieces of basalt. Very successful suctioning.	
10	10	1533	255	424133	5085633	Now we're going to head north, 35, and follow the contact. Where we sampled we could see the little tube that fed this lava pillow. Neat-o.	
10	12	1533	254	423168	5085048	We're going 350, 40m.	
10	12	1533	316	423204	5084746	heading north, about 350 degrees, along the contact	
10	18	1530	358	424180	5085707	younger flow contact appears to have jogged to west	
10	21	1530	5	424136	5085723	following contact between jumbled older flow and darker new flow, to NW	
10	23	1529	352	424126	5085730	4126 5730 good fix.	
10	25	1528	353	424124	5085751	Jumbled sheets, lots of sediments in the pockets, lobates.	
10	27	1528	348	424116	5085778	Not seeing tubes or jumbled flow. A bit flatter now.	
10	29	1528	353	424118	5085791	Furry stuff growing on the lavas. This is older.	
10	29	1528	351	424115	5085794	Transitioned rapidly from the boundary into flat lobates and sheet flows with a lot of sediment pockets. Moving the ship so we can move west more now.	
10	31	1528	348	424111	5085823	Lots of brittle stars, furry stuff, sediment pockets, etc.	
10	32	1529	353	424113	5085836	Looks like new lava filling up an old collapse.	
10	33	1529	359	424114	5085842	New flow filling in a collapse	R501-58
10	33	1529	351	424114	5085842	We've lost p-code. We're still going north, northwest. Looking at the new lavas.	
10	34	1529	355	424118	5085850	Still in the newer lava, little bits of sediment pockets. Surface of the glass is fairly clean, glassy tubes and fingers extending out.	
10	34	1528	353	424120	5085854	Can see contact.	
10	36	1528	357	424122	5085872	They think we have P-code back now. We're hanging out until we figure out if we can move the cage.	
10	39	1529	352	424125	5085882	We're in an older area with collapses, sheet flows, nice pillar with a hole down the middle.	
10	40	1528	322	424124	5085884	Massive lineated sheet flow with a lot of sediment. It is heading to the southwest.	
10	42	1530	338	424119	5085898	ROPOS is east of contact. Over sedimented ropy lavas.	
10	43	1530	342	424114	5085902	Push up structures. Large blocks. Higher to west. Sheet flow down below. End of tether.	
10	45	1530	334	424100	5085919	Extensive area of sheets. Except for sediment it doesn't seem that old. Jogging to the East.	
10	46	1529	331	423972	5086186	SE SE seems to be the lineation direction. Changed to broken up, folded sheets. Up a short wall. Very jumbled pile of sheets at the top.	
10	47	1528	330	424099	5085958	Jumbled sheets do not have much animal cover. Back into lobates with a lot of sediment in between. Looks old, more brittle stars and sediments.	

10	49	1527	329	424084	5085986	Low relief lobates, lots of sediment between the lobates. Rattail. Back into jumbled sheets. Back into lobates again.	
10	51	1525	330	424065	5085998	Jumbled flows with sessile animals at the tops. A little collapse, a few short pillars. Contact with new lava, lobates. Mixed area, old jumbled with new lobates. A few brittle stars. Sediment in the cracks of lobates.	
10	55	1527	334	425217	5086016	Back into the sheet flow. Lots of sediments. Lineations running the WNW. Trying to determine if sed are hydrothermal. No indication that they are.	
10	57	1527	337	425215	5086034	Back up to lobates. Pretty glassy.	
10	58	1526	335	424048	5086070	Contact. Ship will stop and turn to due west. Large fish rat tail. good contact. Turning west now 1100	
11	2	1526	280	424025	5086074	contact, blacker and glassier on left	R501-61
11	1	1526	273	424040	5086080	Crossing southern most area that we saw last year. Big block, talus drain-out area. Jumbled area, lobates lapping up against older lobate drain out. Contact w/ blacker and glassier with older reddish lavas.	
11	6	1525	268	424010	5086074	Drain out. Moving again. Sediment almost covers the ropes. Piece of roof. Up onto the young lobate flows. Real glassy, very little on them. crab, flatter lobate, still glassy fronts to the lobes. Sheet flow, collapse.	
11	9	1524	272	423986	5086069	Slope coming from the right. Ropy and lineated sheet flows coming down the slope. Broken up sheets. Some collapse. Jumbled ridge. Some staining on jumbled rocks. Heading west. Collapse in the jumbled flow. Very chaotic.	
11	12	1524	269	423928	5086067	Huge, not sure what it is. Big blocks. Large ridges. About 3 meters of relief. Sediment on the top of a ridge. Big depression. We have gone down a couple of meters. Push up ridge with orange oxide deposits. Looks like a wick.	
11	16	1524	262	423889	5086065	In an area of deep depression. Some flock in the water.	
11	18	1525	268	424057	5086481	Jumbled lavas, with ridges. Looks like it's getting deeper. At the edge of deepest part of basin. Lineated flows at the bottom. Lineated flows trend S to SW. Some of the sediments here are hydrothermal. Pieces of white flock.	
11	21	1529	269	423844	5086057	Deepest was about 16.5 meters, now back up. Looks like mat coverage. Big plates, turned up on their side. Pahoehoe lava. Stop the ship. Plan to take a sample.	
11	25	1529	276	423829	5086069	Attempting to take a sample in the mat covered, ropy sheets. Grabbing with claw.	
11	26	1529	277	423831	5086069	rock sample into forward strb.	Rck_R501-10
11	28	1529	275	423830	5086069	Second pieces, (rock broke into two). Both in strbd front. Check gauges.	
11	33	1529	276	423812	5086071	new or interim flow, mat on surface	R501-62
11	31	1529	276	423215	5085317	Panning camera. Mat on the surface. Looks like deflated bag creatures.	
11	34	1529	277	423214	5085313	closer view of mat on rocks	R501-63
11	34	1529	276	423833	5086069	Will attempt to take a SS j4 of mat. Kim's highlight tape. Flushing the hose into bottle 4. Positioning to J4. Start sample pump 11:40, material is not being sampled yet. Need to get closer to surface. Now getting material. Pump off 11:50	SS-j4_mat_R501-11
11	52	1529	275	423828	5086066	Going to head West across the new lava field. Small mounds of hydrothermal iron. Some white floc? A lot of iron deposits. Ridges of jumbled lava. Patchy mat covering. Big piles of jumbled, large ridge several meters high.	

11	58	1524	276	423786	5086068	In a venting area now. White mat, large crab, lots of floc, more mat. Waiting for the cage. Cage motor off. White filmy mat.	
12	1	1523	273	423789	5086069	Moving west again. White staining, bacterial mat, so far no major flow areas w/ tube worms, etc. Some tube worms. Down in an inaccessible pit area. Shimmering water. Lots of Fe sediments, perhaps some active places. Lots of iron sediments.	
12	6	1524	271	423867	5085664	Getting out of venting area. Lineate going S. Flat lineated flows. Lots of orange-tan sediment. Flows are glassy when they do crop out.	
12	9	1525	264	423720	5086056	Continuing west over ropy, lineated flows. Ropes becoming larger. Lots of mounds of orange hydrothermal sediment. Thick pockets of iron rich seds.	
12	13	1524	274	423661	5086047	Fe mat, orange seds	R501-65
12	12	1524	255	423671	5086049	Thick deposits of iron rich seds. Moving west again. Jumbled ridges of pahoehoe lava. Lots of sediment. Steve's highlights on. Back into jumbled. Coming out of depression. Into glassy lobates. Collapse pit. Lobate on the other side.	
12	17	1521	268	423578	5086056	Big lobates, younger, lightly sedimented. Brittle stars. Big drain out.	
12	19	1521	271	423554	5086068		R501-66
12	19	1521	266	423554	5086068	Pit large drain out. Stop Steve's tape. Looking older. Back over lobate. Don't see the mat. Another drain out w/ lots of sediment at the bottom. At least 2 meters dep. Almost looked like a contact.	
12	24	1520	274	423500	5086064	thin roof near collapse	R501-67
12	22	1521	276	423515	5086063	Lobates w/ brittle star, small sponges and holothurians. Drain out skylight. Don't see large sponges. Deep drain out pit, thin roof 10 cm. Big blocks in bottom. Younger against older? Small pockets of sediment.	
12	25	1521	287	423475	5086064	"Older" spire in collapse lots of large sponges on it younger lavas nearby	R501-68
12	25	1521	270	423481	5086065	Drain out. Spire with lots of large sponges. Older spire with lots of glassy debris. one with a crab on it. Spires appeared to be older, because they had so many sponges on them.	
12	27	1521	271	423456	5086069	Back over lobate, with small sediment accumulation. No mat. There are brittle star. Collapse area w/chaotic lava. Lots of sponges on lava. Stop the ship on ridge of jumbled lava. Will try to grab for a rock.	
12	30	1522	291	423442	5086093	Grabbing a rock, older w/ sponges, attempting to place it in the port box. Right front of port box. Into the box. Free sponge included.	Rck_R501-12
12	33	1521	304	423441	5086088	Starting the ship again. Drain back, on the top is a lineated flow w/ sponges on it. Still in a collapse area. A couple levels of collapse.	
12	34	1520	301	423411	5086077	Change VCR tapes. Lobates w/ holothorian and gorgonian. Water is murkier. Black glassy lobate flows with small amount of sediment. Drain pit. 1 meter collapse area. Gauge check.	
12	38	1523	283	423353	5086075	contact, very fresh now - so previous wasn't 1998	R501-70
12	38	1523	284	423353	5086075	Contact with new flow. Stop the ship to take a core sample.	
12	41	1523	252	423348	5086076	good fix. Looking at contact. Brittle stars on older, small sponges. New black, glassy overlapping new lava. Will try to get one core on each side of the contact.	
12	47	1524	257	422335	5085068	Will take core with the black stripes first. Grabbing w/ 5 function. Transferring to 7 function. Taking core, 12:49.second try, still not much, still trying, got it.	Rck_core_R501-13

12	54					Mashing glass into wax on the bio-box at a glass free spot. Going back for more glass on the chapstick corer. Mashing into BioBox, but it seems to reduce the amount of sample on the chapstick. Sample complete 1302	
13	4	1524	263	423348	5086073	Moving to older side of the contact. Much lighter albedo, more seds. more brittle stars. Breaking up the surface. Lifting the chapstick corer (yellow striped). Grabbing corer with the 7 function arm.	
13	7	1523	296	423349	5086075	Attempting to collect core. Again attempting to mash the glass into the wax on the bio-box lids. Lost much of sample, will try to smash and smear back on. It seemed to work. Good amount of sample. Will go into bag directly, positioned on the other side	Rck_core_R501-14
						of the bag from the first sample. Appear to scrape some wax on BioBox. Finished with sample in the bag at 1314	
13	15	1524	295	422336	5085066	Attempting to trip Niskin. Tripped at 13:16. Evil Niskin strikes again. Ring is caught on 5 function. Free. Grabbing suction sampler handle.	Niskin_R501-15
12	41	1524	254	423349	5086075	close-up of contact, likely 1998 flow	R501-71
13	19	1523	292	423348	5086073	Ready to move West. Young lobates. Flat surfaces on the top. Telling the ship to move. Not much on lobates. Not much sediment cover. Holothorian. Waiting for the cage. A few brittle stars. Lobate flows.	
13	25	1523	283	423291	5086082	thin roof, at collapse area	R501-72
13	24	1523	283	423311	5086072	Continuing West. Black glassy lobes. Collapse area, sediment covered blocks at bottom. Back to lobates. White areas on lobates. Big lobes. Glassy lobes. Lobates on flatter area.	
13	29	1523	286	423249	5086080	Lobates tops flat with rounded bottoms. More brittle stars. Lots of yellow iron sediment. Very glassy. Flatter area.	
13	32	1523	269	422600	5085461	Lots of broken up lavas, nav not good right now,	
13	33	1523	271	423201	5086066	good fix. Flatter flow, bucked up sheet flow. Broken up plates, big brittle star.	
13	37	1523	272	423162	5086068	Fairly glassy lobate flows w/ little sediment and some brittle stars.	
13	38	1524	277	422534	5085484	Still going over the same kind of lava.	
13	41	1525	279	423099	5086072	More sponges, more sediment, looks older. Higher density of brittle stars, may have crossed the contact. Still look like glassy lavas. Whole bunch of sponges.	
13	44	1526	306	423067	5086079	Ship is stopped. Getting ready to collect last chapstick sample.	
13	46	1526	308	423066	5086078	good fix. Picking up chapstick with 7 function arm. Core has two white stripes on it. Transferring to 5 function arm, regarding with 7 function arm.	
13	51	1526	304	423066	5086078	Core sampling, purple core, sample number 16	R501-73
13	49	1526	306	423066	5086078	This is the purple striped chapstick sampler (not white). Starting to core the glass. Attempting to do a light smush into the bio-box. Seems to have worked well. The key is the light smush. Attempting to place the core in the bag. In the bag at 1357	Rck_core_R501-16
14	0	1526	305	423066	5086078	Adjusting cores position in the bag. Bag closed. Regarding the suction sampler arm. Will be returning to cage.	
14	6	1500	323	423100	5086078	Back at the cage. Will be doing a 1.5 km transit.	
14	11	1423	20	423057	5086016	Beginning transect range 1475 meters, bearing 175 at 1 kt.	
15	24	1490	227	423214	5084635	Reached end of transect, going down to the bottom.	
15	27	1538	317	423188	5084617	On the bottom. Regrouping the suction sampler because it was flapping. Heading to Crevice to take a dead tube worm grab.	

15	33	1536	2	423478	5083771	Moving the ship 40 m to the NW.	
15	41	1537	328	423190	5084637	We are approaching a crevice, not THE Crevice. Big Keith is doing the air drums.	
15	42	1536	322	423175	5084649	good fix. A small, scraggly bush of tube worms. Maia is getting greedy - waiting for the big bush.	
15	44	1536	323	423169	5084655	Lava really isn't looking any different from the newer stuff that we've seen all along.	
15	45	1536	318	423157	5084638	We are looking around for a good grab - down into the collapsed area. Lobates still with a light coating of sediment/debris.	
15	48	1537	140	423399	5084861	Old tube worms and crab on edge of crevice.	R501-74
15	47	1538	101	422817	5084266	Crab full of eggs. Nice view of the wall of the crevice. Some scanty tube worms on the wall. More crabs.	
15	49	1537	79	423163	5084654	Hit the edge of the crevice. Lateralizing back along the crevice - moving east now. Crevice is around 5 m dep.	
15	51	1538	129	423152	5084633	Turned the corner in the crevice -now hdg almost due south. Finding a few larger tube worm bushes on the wall. Some larger bushes on the lobates on the roof. Tube worms all along the cracks between the lobates. TONS of crabs.	
15	54	1536	48	423166	5084617	Still on the roof. Looking for the crevice again. Jackpot - down in the crevice there is a huge clump of tube worms. A couple vent fish and a couple crabs.	
15	57					A bit of flow, but doesn't look like there is much fauna besides a few live tube worms and a couple scale worms. x=3177 y=4620 good fix. Going in for the grab at 1557	Bio_R501-17
16	10	1539	35	423178	5084641	Just had a little bit of an avalanche on top of the tube worm bush. Finished sampling. Keith just said that this is NOT part of the crevice, but just a hole in the roof.	
						Taking a quick look around to see what the area looks like - if there are any more large tube worm bushes about.	
16	13	1538	269	423171	5084630	Tubeworm bush lacking much of the other fauna you normally see.	R501-75
16	12	1538	243	423170	5084630	All the tube worm bushes on top of the lobate roof look smaller - possibility that they are new worms since the eruption. Can't see any other fauna on the bushes. But the worms of the grab we just took look too large to be new since the '98 eruption.	
16	15	1531	87	423175	5084631	End of dive. Heading back to the cage and coming up.	
						ROPOS on deck at 1711 UTC	
						Dive Summary: This dive began by deploying the time lapse camera at Mkr-33 and collecting a suction sample. Next ROPOS transited to the west side of the 1998 lava flow, SW of Mkr-113 and started a geologic traverse due east.	
						ROPOS started the dive in older lavas and drove east to the contact with younger lava when the dive had to be temporarily stopped because the connector to the color camera light got pulled out and the suction sampler jammed.	

						<p>After a quick turn around, the dive resumed at the western contact - driving east and taking rock samples all the way to the eastern contact between younger and older lavas. ROPOS then drove north along the eastern contact for about 400 meters and</p>	
						<p>then traversed back to the west in lavas known to be '98. A section of clearly older lava was crossed just north of Mkr-113, then back into '98 lava, and finally back into older lava again. 13 rock samples were collected during these two traverses.</p>	
						<p>Finally, ROPOS transited 1.5 km south to the Crevice Vent site to collect a tube worm grab.</p>	

UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples
Dive R502							
Dive Plan: Objectives of ASHES Dive: 1) Sample high temperature fluids at Hell, Inferno and Virgin. 2) Sample diffuse flow at 2 diffuse flow sites. 3) Suction sample FeOxide and it's fluid at west wall.							
4) Suction sample sulfide worms at base of Hell (Porkchop) and Hillock/Phoenix. 5) Sulfide worm behavioral observations at Phoenix. 6) Suction sample clams and other large animals, if encountered.							
7) Suction sample particulates for edifice tube worm grab site. 8) Suction sample oxides to south of vent field. 9) Recover High temp HOBO at Virgin. 10) Recover SOSUS sound source.							
Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.							
						In the water at 00:30	
1	17	462	213	421651	5087115	Fluid Sampler and flush pump now up and working.	
1	54	1245	70	421651	5087115	Lost P-code.	
2	12	1513	353	421457	5087153	Ropos is out of its cage. First sampling target, diffus vents.	
2	14	1542	318	421457	5087153	Bottom in view. Older lavas with sponges. East side of field with oxide deposits.	
2	16	1542	317	421458	5087159	1.5 kilometers from summit. Photo 74 from the landing site.	
2	17	1543	267	421441	5087181	First target Gollum, but we have virgin mound in view.	
2	18	1544	232	421426	5087164	Temperature probe in sight, landing at Gollum.	
2	19	1545	237	421411	5087170	Highlight tape in.	
2	22	1545	242	421418	5087163	Gollum Vent	R502-1
2	22	1545	242	421418	5087163	More views of shimmering water at Gollum.	
2	26	1545	220	421414	5087151	Three bacterial traps at Gollum, up to 26 degrees last year and so far we have reached 21 degree.	
2	32	1546	287	421426	5087160	Probing for temperature, flush pump keeps shutting down. Now at 16 degrees.	
2	38	1546	286	421434	5087168	Having some trouble finding the sweet spot - for temperature, local max about 15 C. Behind the worms it's 22 C. Locking the probe in.	
2	41	1546	286	421422	5087167	Gas piston 0241:23 started port side, 0241:13 stopped, max. temp. 2.3.	HFS-5_dfl _R502-1
2	44	1546	288	421197	5087614	Moving probe again, just locked it to stay out of the current. Temperature 20 C. filter started at 0245:32, FISH filter 19 degrees T1, 16 degrees T2	
2	51	1546	288	421423	5087160	Lost coms on sampler, no call out when the FISH sample filter 6 was completed. Now the screens are dark.	
2	54	1539	217	421425	5087156	Vehicle telemetry problems, vehicle drifting south. Video just came back.	
2	56	1543	70	421412	5087163	Drifting over Dave's vent.	
2	58	1544	330	421426	5087156	Now we are back at what we think is Gollum with bacterial traps, buried tripod marker and ropes, one of which might be attached to a temperature probe.	

3	2	1546	286	421426	5087159	Maximum temperature measured so far on this second go-around is 10.5 degrees.	
3	4	1546	278	421426	5087159	In the video, a bacterial trap can be seen in the lower left and part of the tripod marker in the upper center.	
3	5	1546	276	421426	5087160	Description in the previous entry into the log. We are presently testing arm control.	R502-2
3	7	1546	279	421415	5087160	Still probing around for maximum temperature, up to 13.5 degrees.	
3	8	1546	276	421415	5087160	17.5 degrees, This is the second landing at Gollum. Sampler is now locked into position.	R502-3
3	12	1546	278	421414	5087160	FISH sample filter #6 had 680 mls before it was interrupted.	
3	14	1546	278	421413	5087160	0313:4 filter #6 restarted, sample HFS6_dfl_R502-2 continuation.	HFS-6_dfl_R502-2
3	15	1546	278	421414	5087162	Sampling HFS6_dfl_R502-2 continuation.	R502-4
3	17	1546	278	421414	5087161	03:16:56 stopped sample, maximum temperature 2 degrees 1020 ml pumped, started fluid sample Sterivex DNA filter #7.	
3	18	1546	279	421410	5087161	Sterivex DNA filter is HFS7_dfl_R502-3.	HFS-7_dfl_R502-3
3	21	1546	279	421408	5087160	View in the video of what looks like bags growing on the bacterial trap ropes.	
3	22	1546	278	421410	5087160	Temperature record is the rope in the video with the loop. There are three bacterial traps here one of which was seen in the last frame grab.	
3	23	1546	277	421415	5087160	Filter is slowing down showing signs of loading.	
3	27	1546	277	421411	5087159	Stopping sample 03:27:12 maximum temperature 20.2 degrees. HFS7_dfl_R502-3 1450 ml.	
3	28	1546	278	421416	5087160	Bacterial traps are located about a meter away. There was little flow near the bacterial traps. T2 on HFS7 averaged about 16 C. 03:30:0 started filter 13 HFS13_dfl_R502-4 3 micro sterivex combo filter.	HFS-13_dfl_R502-4
3	37	1546	278	421414	5087161	1029 ml sample stopped at 037:40 maximum temperature 23.5 C. Next is HFS15_dfl_R502-5 started 038:4. This is a lipid filter.	HFS-15_dfl_R502-5
3	44	1546	278	421411	5087161	Photo of Gollum sampling site, #76.	
3	45	1546	277	421413	5087161	Tube worms at Gollum.	R502-6
3	46	1546	275	421415	5087160	Palm worms, gastropods and tube worms at Gollum	R502-7
3	48	1546	275	421416	5087161	Frame grab of bacterial traps.	R502-8
3	49	1546	278	421412	5087162	Palm worms at Gollum.	R502-9
3	49	1546	276	421412	5087159		R502-10
3	49	1546	277	421412	5087159	0349:10 max T 24 C as it took 1 minutes. Frame grab was unintentional.	R502-11
3	50	1546	275	421412	5087160	Piston 2 about to be taken. Sample pump stopped back on at 03:51:10 or so. Then back of again.	
3	52	1546	278	421412	5087159		R502-12
3	52	1546	275	421414	5087161	Pump back on at 03:52:20. Piston 22.	HFS-22_dfl_R502-6
3	56	1547	278	421408	5087163	Suctioning first. Suction sample of gastropods , tubeworms and polynoids.	
4	1	1546	294	421407	5087160	Suctioning for all that lives here.	
4	6	1546	286	421414	5087165	Something is stuck in the suction tube.	

4	16	1546	284	421410	5087161	finished sucking at one spot and now moving to suck from a slightly different spot. ROPOS did not move however. Filling the bottle with diffuse warm fluid for a minute.	SS-j4_dfl _R502-7
4	19	1547	282	421412	5087162	Finished sampling.	
4	24	1546	300	421410	5087158	Traps at Gollum	R502-13
4	24	1546	296	421407	5087153	Putting the MTR probe that was deployed at R471(1998) into the purse (thanks to Mike Perfit who invented the Perfpurse!).	MTR_dfl _R502-8
4	30	1546	287	421417	5087150	Moving sub N-NW to Marshmallow. Low relief vent with fairly focused flow next to a small chimney. Next to a pile of jumbled sheets.	
4	36	1547	38	421404	5087174	Waiting to adjust elbow control.	
4	36	1547	40	421404	5087174	Marshmallow vent	R502-14
4	38	1547	39	421403	5087175	Knocked over the small chimney to stick temp probe in. T's shot up into the 60-70s. Sampling hot water using the fluid sampler. Piston 24. max T 74.3C	HFS-24_dfl _R502-9
4	43	1547	40	421412	5087179	Sampling filter 21 now.	HFS-21_dfl _R502-10
4	54	1547	39	421418	5087175	Max temp on sample was 74.4C. Finished sample R502-10.	
4	55	1547	38	421413	5087180	Sample filter 12 for DNA.	HFS-12_dfl _R502-11
4	57	1547	38	421417	5087175		Photo 7
5	2	1547	39	421416	5087175	Sample 12 is done - 1 liter pumped - 75.8 max temp.	HFS-9_dfl _R502-12
5	6	1547	38	421397	5087183	Correction: Started, rather than finishing pumping for sample 12.	
5	8	1547	40	421414	5087176	last sample was stopped starting HFS 04 now R502-13	
5	9	1547	42	421415	5087175	starting pumping HFS04-dfl-R502-13	HFS-4_dfl _R502-13
5	13	1547	40	421415	5087175	Sampling at Marshmallow	R502-15
5	13	1547	41	421413	5087178	Sample finished. Max temp 71.8. Now taking filter #1	
5	14	1547	38	421413	5087178	Started filter 1.	HFS-1_dfl _R502-14
5	16	1547	42	421412	5087175	Temp up to 80.7 while taking this sample on filter #1.	
5	20	1547	41	421413	5087175	Close-up of Marshmallow vent	R502-16
5	21	1547	37	421414	5087174	finished sampling max temp 80.1.	
5	22	1547	38	421414	5087175	Temp up to 151 C as the probe is moved deeper into the flow. Moving to Mkr-I which is next to this vent.	
5	26	1547	33	421407	5087173	going to sample at Mkr-I for fauna and water. Mostly jumbled and folded sheet flows surround the site. Turn Jean's video on.	
5	28	1547	320	421402	5087175	Suction sampler J3 will be used for sucking up these poor defenseless animals.	
5	33	1547	317	421411	5087175	Suction sample from Mkr-I	R502-17
5	32	1547	318	421408	5087179	Starting to suck. Can se a little diffuse flow. At Mkr-I. Running T recording program. Sucking a group of tubes and snails.	SS-j3_dfl _R502-15
5	41	1547	322	421404	5087175	Stopping suctioning.	
5	42	1547	334	421409	5087175	Mkr-I	R502-18
5	43	1546	336	421412	5087174	Mkr-I in view	R502-19

5	43	1546	21	421412	5087174	Leaving Mkr-I and heading to virgin mound to pick up hobo and sample water.	
5	45	1547	68	421425	5087169	Virgin with Hobo	R502-20
5	45	1546	68	421425	5087169	There are now some animals on the base of the chimney at Virgin mound. appear to be palm worms. Chimney is now 50 cm tall and 10cm wide. Knocking over the anhydrite chimney. Lots of clear to gray smoky water emanating from the orifice	
5	49	1547	64	421423	5087177	open vent in Virgin mound chimney	R502-22
5	49	1547	60	421423	5087177	another shot of sampler	R502-23
5	52	1547	62	421421	5087171	130 degree spot. se HOBO in background	R502-24
5	58	1547	61	421430	5087171	Flushing line #8, T is over 30 C. Probe is stuck right down into the hole with most concentrated venting. Stb. gastight will be taken next. 306.4 max T.	Gtb-7_hfl_ R502-16
6	1	1547	63	421425	5087179	Next is bag 18 with the filter. Taking T1 309.8 T2 is 140 C.	HFS-18_hfl_ _R502-17
6	7	1548	63	421432	5087171	Finished sampling bag 18 with a filter started at 6:02 max T 309.9 C.	
6	9	1547	66	421429	5087172	Picking up the Hobo here and taking it to Inferno.	
6	10	1548	50	421430	5087170	Highest T's ever measured at Virgin Mound. Grabbing Hobo. it seems to be stuck in mound.	
6	13	1547	51	421429	5087172	Leaving virgin mound, photos of transect heading 248.	Photos 83-85
6	14	1544	245	421423	5087172	Traversing to Inferno, taking some photos. At Mushroom vent, looks fairly similar to last year. Beehives on top. Little bubbles too	Photos 86-87
6	16	1546	297	421408	5087173	Top of Mushroom, bubbles!	R502-25
6	17	1546	0	421397	5087164	Mushroom top	R502-26
6	18	1546	153	421390	5087167	Mushroom	R502-27
6	18	1546	153	421390	5087167	side shot of Mushroom.	R502-28
6	18	1546	176	421397	5087165		R502-29
6	18	1546	181	421397	5087165		R502-30
6	18	1546	178	421397	5087165	Top of Mushroom vent	R502-31
6	21	1544	246	421384	5087164	Hobo on top of Inferno	R502-32
6	21	1544	246	421384	5087164	Inferno vent	R502-33
6	21	1544	9	421391	5087162		R502-35
6	21	1544	2	421391	5087162	Inferno Vent with high temp probe	R502-34
6	21	1544	23	421391	5087162	At Inferno vent. photos of top with Hobo. Many dead worms at base of chimney. Can't see any shimmering water at base. Photo of base is Photo 90	photos 88-90
6	23	1548	114	421177	5086842	Mkr-7 in view. Lavas are folded sheets. Moving over to area of concentrated microbial mat.	
6	24	1546	354	421991	5086680	Vent is much less active with less life than seen previously.	
6	25	1544	314	422154	5089405	We lost communication.	
6	26	1543	276	422154	5089405		R502-36
6	27	1543	194	421393	5087160	Inferno vent	R502-38
6	27	1543	192	421393	5087160	Flow out of top of Inferno. Seems slower than last year.	R502-37
6	28	1544	181	421392	5087162	Communication is back now. Going to sample.	
6	30	1544	198	421387	5087162	Inferno with HT probe	R502-39
6	30	1544	198	421396	5087153	Hobo spot in vent orifice with chalcopyrite lining.	R502-40

6	31	1544	192	421390	5087158	Lost communication with sub again.	
6	31	1543	199	422156	5089404	Inferno before excavation	R502-41
6	33	1544	174	421388	5087167	Knocked of top behive chimney at top of Inferno - the one next to the Hobo probe.	
6	36	1544	244	421394	5087158	Vigorous venting at Inferno	R502-43
6	38	1544	222	421389	5087160	Venting with worms of a different color	R502-44
6	38	1544	227	421389	5087160	Looking at top of Inferno- Jet of clear-ish water blasting out where top spire was knocked of. Sulfide worms with Orange stalks-Strange?	R502-45
6	44	1544	229	421387	5087162	Unusual yellow colored tube worms (casings) on top of chimney.	
6	45	1544	226	421389	5087159	sampling Inferno	R502-46
6	46	1544	228	421389	5087159	Temps over 30 C! broke previous record.	
6	47	1544	225	421390	5087160	Going to start with bag #14 with filter.	
6	52	1544	234	421381	5087164	Still probing Inferno for a good temperature.	
6	54	1544	233	421386	5087162	We're locking in here to sample. Bag #18 starts 6:5	HFS-14_hfl _R502-18
6	58	1544	233	422228	5089424	crap! that was bag 14 , stops at 6:59	
6	59	1544	235	421387	5087160	HFS 16	HFS-16_hfl _R502-19
7	2	1544	234	421386	5087160	finish bag 16 at 7:05	
7	3	1544	235	421387	5087161	Preparing to do gas tight port at Inferno	Gtb-2_hfl _R502-20
7	7	1544	234	421382	5087162	Flushing the bottle	
7	8	1544	233	421380	5087159	Just fired the port gas tight	
7	8	1544	236	421388	5087160	Preparing to filter	HFS-2_hfl _R502-21
7	10	1545	232	421387	5087161	Starting to filter at 07:10	
7	12	1544	233	422360	5089449	Stopped filtering (476 ml). T max 289.6	
7	16	1544	238	421390	5087164	We're going to try to measure the temperature on a different orifice at Inferno.	
7	19	1545	238	423673	5087079	Probing temp at another orifice at Inferno.	R50247
7	20	1544	238	421386	5087165	Trying to get the HOBO out. Temp at the other orifice came to around 82.5, but we couldn't get into it completely.	
7	25	1544	245	421377	5087166	Retrieving hobo from Inferno	R50248
7	34	1544	245	421388	5087161		HOBO_hfl _R502-22
7	35	1544	242	421387	5087163	HOBO 137 from Alvin dive 3246 (1998)	
7	36	1544	3	421390	5087162		Photo 91, 92
7	40	1548	48	421381	5087160	Heading for Crack Vent next. Moving ship 20 m south.	
7	42	1547	51	421392	5087162	Bacteria traps at Mushroom	R502-49
7	42	1547	51	421392	5087162	Checking out the base of Mushroom for bubbles.	
7	44	1548	66	421391	5087168	Mushroom which used to be the bubbler near traps	R502-50
7	46	1546	148	422182	5089407	Lots of active venting around here.	Photo 93
7	47	1547	142	421397	5087158		Photo 94
7	48	1547	145	421400	5087152		Photo 95

7	48	1547	146	421409	5087149	Flat sheet flow.	
7	49	1546	144	422525	5089440		Photo 96
7	49	1546	147	422525	5089440	Bio column cemented down	R502-51
7	50	1546	144	422508	5089428	Checking the Column.	
7	50	1546	147	423961	5088321	Close view of bio column	R502-52
7	51	1546	149	423963	5088320	Column is probably clogged up & no longer flowing.	
7	52	1547	75	423378	5089196	Sampling site	R502-53
7	52	1546	54	423378	5089196	Three vents with anhydrite around them.	
7	53	1547	13	422866	5087564	Close view of fluid sampling site	R502-54
7	53	1547	18	422866	5087564	At Crack Vent - piston 20 some time in the near future.	
7	59	1547	15	429103	5086486	Temperature probe at Crack	R502-60
8	1	1547	14	423098	5089355	piston 20	HFS-20_hfl _R502-23
8	10	1547	46	423112	5089342	after a few minutes of Ian being a bit shy about it, 75 deg water is being pumped	R502-61
8	16	1547	46	421424	5087126	all done (piston 20)	
8	17	1547	43	421424	5087126	filter 10 at crack	HFS-10_hfl _R502-24
8	23	1547	47	421421	5087129	end of filter, time to drive it to Hell Vent	
8	26	1547	5	421421	5087136		photo 98
8	26	1546	281	421421	5087136		photo 9
8	27	1546	239	422235	5087601		photo 10
8	28	1547	274	421658	5086451		photo 101
8	29	1547	249	420468	5085570		photo 102
8	30	1548	240	420468	5085570		photo 103
8	40	1543	11	423295	5089302	Niskin sampling going on.	
8	42	1544	309	423160	5089361	154 m. Niskin done.	Niskin_hfl _R502-25
8	46	1546	234	422215	5088313	Mkr-L sighted.	
8	46	1545	243	422215	5088313	Arrived at Porkchop. Planing to park near the chimneys.	
8	47	1544	244	421894	5087527	Hell vent	R502-64
9	4	1544	231	423876	5088262	Starting filter 3.	HFS-3_hfl _R502-26
9	6	1544	229	423704	5087335	Stopped filter 3 at 30 ml. Max T 294.7	
9	7	1544	231	423704	5087335	Sample #17 starting now.	
9	7	1544	230	423704	5087335	Bag #17 is an unfiltered bag.	HFS-17_hfl _R502-27
9	9	1544	230	423704	5087335	Hell Vent finally	R502-66
9	11	1544	229	423704	5087335	575 ml. T max 294. #19 starting now.	HFS-19_hfl _R502-28
9	12	1544	230	423704	5087335	Fluid sampling at Hell vent	R502-67
9	15	1544	230	421515	5087175	T max 293.1 - 574 ml - #19 over - Starting sample #29.	HFS-23_hfl _R502-29
9	17	1544	229	423325	5089114	156 ml - T max 291.9 - sample #29 done.	

9	20	1543	222	421536	5087144		Photo 105 & 106
9	21	1543	217	421536	5087144		Photo 107
9	23	1543	230	421536	5087144	Another view of Hell vent	R502-68
9	24	1544	135	421536	5087144	A few small spires at Hell vent	R502-69
9	26	1544	53	421536	5087144		Photo 108
9	26	1544	41	421536	5087144		Photo 108
9	29	1546	91	423588	5085086	We may have arrived at Porkchop.	R502-70
9	31	1544	312	421534	5087147	Trying to locate Porkchop.	
9	32	1547	332	421534	5087147	Here we are. Porkchop	R502-71
9	31	1547	332	421534	5087147	If it's this one, it has grown a small spire since last summer. Shifting to the left of spire where the worms are for next sample.	
9	34	1547	339	421505	5087183	Zooming in to compare on video the different worms.	
9	34	1547	338	421505	5087183	Close-up of worms at Porkchop	R502-72
9	38	1547	341	421539	5087146	Close-up of the palm worms at Porkchop	R502-73
9	40	1547	341	421539	5087146	Copepods present with sulfide worms - tiny red dots jumping around. They could be feeding or mating.	
9	43	1547	338	421539	5087146	Scale worms (L. piscesae & Branchiate polynoids) & tube worms present in same area as above.	
9	55	1547	344	424723	5081524	Suction sampling in jar 1 for Kim - trying to get the Copepods.	SS-j1-bio_ R502-30
10	5	1546	341	419478	5080949	Suction sample of worms at Porkchop	R502-75
10	12	1546	342	421537	5087149	Still sampling at the same spot to get more of the stuff.	
10	16	1546	340	421532	5087153	Sampling into jar 1 finished. Dumping contents of vacuum hose into flush jar 4. Moving now to Phoenix.	
10	21	1547	116	421857	5084991	We have arrived at Phoenix.	R502-76
10	22	1547	165	421513	5087149	At Hillock/Phoenix.	
10	23	1547	166	421525	5087134	Baby tube worms at Hillock/Phoenix	R502-77
10	23	1547	166	421525	5087134	Baby tube worms - don't look too healthy.	
10	24	1547	162	421527	5087132	Palm worms at Hillock/Phoenix	R502-80
10	26	1547	168	423597	5085075	Just look - don't touch !	
10	27	1547	166	423597	5085075	Still observing the worms in their natural habitat at Phoenix	R502-82
10	29	1547	168	423597	5085075	Some sea spiders at Phoenix	R50283
10	29	1547	165	423597	5085075	Pycnogonids (sea spiders) present here - they move in as other stuff dies.	
10	35	1547	165	427960	5083553	Sampling palm worms as well as sulfide worms together for Christian in jar 2. This sampling is being done just left (east) of the sanctuary.	SS-j2-bio_ _R502-31
10	39	1546	157	425000	5080661	Sorry the rope is in the way. we are suctioning sulfide worms at Phoenix	R502-87
10	44	1546	156	421288	5081147	Suctioning tube worms at Phoenix	R502-88
10	50	1546	154	421288	5081147	End of sample. Heading to Medusa.	
10	55	1546	21	421503	5087164	Suction sampling of anemones at Medusa?	R502-89
10	56	1546	20	421503	5087164	Attempting to collect an anemone. squished one. Knocked three of but they were attached to rocks. Got one at 1:02, got the second one. Squished one, Got 3 and a rock.	SS-4_bio_ _R502-32
11	8	1546	12	421500	5087164	anemone gulch.	photo 109
11	11	1545	67	421413	5087149	Attempting to dig some clams in a crack close to Medusa. Got some.	

11	15	1545	71	424787	5081518	Getting a few more clams 1:15	
11	18	1545	66	425110	5080695	ROPOS is moving around still trying to find more clams. Last stop. Some shimmering water. So moving to another location. Now in a depression with black sediment. Attempting to suck clams. Giving up. Heading to oxide sampling.	
11	29	1545	177	425177	5080692	Fe sample area	R502-90
11	25	1545	289	422113	5080131	Positioning suction sampler to bottle 1. Looking for oxides. No nav available. Heading south. lots of dead clams. Broken sheet flows. Small FeO. Now a large field of FeO (15M south). Will sample.	
11	31	1545	176	421482	5087178	FeO field	photo 10
11	33	1545	178	421502	5087144	Sampling FeOxide	R502-91
11	31	1545	176	421201	5088131	FeO at a large field. Look like 30cm height 8cm in diameter termite hills. Sucking slowly. Did not see venting. So don't appear to be growing. Sampled three termite hills, hard on outside soft on inside. No fix yet. Sample finished.	SS-1_FeO_R502-33
11	44	1545	176	421437	5087142	FeOxide sample site	R502-92
11	44	1545	178	421437	5087142	FeO termite hills. 30-40cm high	photo 1
11	44	1544	164	421502	5087150	FeO	photo 12
11	45	1543	168	421475	5087153	Couple of meters wide and NS	
11	45	1543	163	421484	5087151	Long distance view FeO	photo 13
11	45	1542	168	421447	5087228	Coming of the bottom to get a fix.	
11	47	1539	169	421459	5087146	No good fixes for sub. Getting cage fixes.	
11	48	1538	167	421486	5087154	Still no fixes. Should be 15m straight S of Medusa. Heading S to see how far it goes. Back to near where we sampled.	
11	50	1543	184	421489	5087140	large piece of FeO	photo 14
11	51	1545	169	421468	5087166	gray-white material, perhaps Barite.	photo 15
11	51	1545	169	421492	5087118	FeOxide sample area, and possible barite deposits	R502-93
11	52	1545	172	421491	5087115	little sulfide chimney	R502-94
11	52	1545	171	421491	5087115	Sulfide chimneys.	
11	52	1545	175	421448	5087218	Sulfide chimney	R502-95
11	54	1545	173	421451	5087217	Repositioning SS to bottle 4 to attempt to suck up the gray-white material.	
11	56	1545	171	421454	5087088	possible Barite rock sample broken and suctioned. still no fixes.	SS-4_sf_R502-34
12	1	1545	173	421493	5087135	Repositioning SS to bottle 2. About to move along the FeO field to the end of it. Heading South.	
12	2	1544	179	421505	5087133	FeO	photo 18
12	2	1544	183	421479	5087134	FeO	photo 17
12	3	1544	176	421399	5087140	FeO some clams.	photo 18
12	3	1544	183	421399	5087140	Fe oxide area	R502-96
12	3	1544	180	421508	5087135	Coming to edge	Photo 19
12	4	1543	178	421463	5087137	Out of the FeO.	photo 120
12	4	1543	177	421456	5087141	Outlier FeO	Photo 121
12	4	1543	171	421488	5087137	Turning to N to look for a landmark.	
12	5	1544	357	421488	5087137	FeO spires.	photo 12
12	6	1544	357	421458	5087216	FeO	photo 123

12	6	1544	358	421458	5087216	Fe oxide spires	R50297
12	6	1544	357	421458	5087216	sheet flow surface scattered with FeO	photo 124
12	7	1544	355	421458	5087216	the crack. 10-15 m south of crack	photo 124
12	8	1544	0	421499	5087097	The Cowen column is the landmark. 10-15 s of that is the FeO field.	
12	9	1544	185	421499	5087097	start of FeO	photo 126
12	9	1544	184	421499	5087097	Rt turn to the west from the middle of the field. Towards the wall.	
12	10	1544	270	421499	5087097	west side FeOxide area	R502-98
12	10	1544	258	421499	5087097	Western side of FeO field.	photo 127
12	11	1545	259	421499	5087097	Looking at a broken piece to see if it is a sulfide spire.	
12	12	1545	260	421457	5087225	FeOxide chimney	R502-99
12	13	1545	259	421494	5087119	Looks like oxidizing sulfides.	
12	14	1545	260	421494	5087119	Sulfide rusting away.	photo 128
12	15	1545	266	421464	5087219	Holothorian with red inside?	
12	15	1544	267	421453	5087217	Fractures with FeO	photo 129
12	16	1544	271	421453	5087217	Broken sheet flow , w/ talus out of FeO. Lasted 10 meters - 10m E-W, last 5m was just scattered mounds. Close to West wall. Talus,	
12	17	1543	267	418319	5088512	More FeO	photo 130
12	18	1543	272	418319	5088512	crossing fractures.	photo 131
12	18	1543	270	421498	5087159	We were not close to the wall before. Heading back to the cage then move over to wall.	
12	20	1537	34	416485	5086953	Steve's tape is stopped.	
12	28	1479	295	421543	5087138	Back at the cage. Will move the ship near to the west wall of the caldera.	
12	32	1489	271	421543	5087138	Going back down to the bottom.	
12	36	1542	271	421464	5087140	Back on bottom near the west wall. Sponges on the wall. Rough terrain. Video on.	
12	37	1543	271	421464	5087140	FeO along w/ sponges. patches of iron oxyhydroxide. Looking for diffuse venting.	
12	38	1543	272	421464	5087140		
12	38	1543	275	421464	5087140	Sponge density is 50/m2. Lots of talus, blocks of lava, very broken up.	
12	39	1544	272	421177	5088160	Iron oxyhydroxide in the cracks. Another pressure ridge. Still have lots of sponges. Wall on sonar. Need to move the ship 50meters west.	
12	44	1544	265	421485	5087143	Moving to west looking for venting. Broken lava, w/ high density of sponges. Basket star. Scattered iron oxides.	
12	46	1543	266	421479	5087141	Clams, tube worms.	
12	48	1545	276	421455	5087141	Moving west along the crack, lots of dead clams. No tube worms. Iron oxide al along the crack in the sheet flow.	
12	52	1544	103	421436	5087148	Continue to the west to find a venting area.	
12	54	1543	266	421431	5087145	Tube worms.	
12	56	1544	247	421448	5087155	Tube worms among iron oxide covered pillows.	photo 13
12	57	1545	297	422119	5085795	Continue west in search of iron oxide and venting.	
12	58	1545	260	422119	5085795	Move the ship 30 meters to the west.	
12	59	1545	269	422119	5085795	Moving west.	
13	0	1544	270	416576	5087463	Lobate lavas, w/ small sponges? at the wall, big blocks of lava.	
13	1	1543	270	416576	5087463	Coarse sediment siting on the wall. Moving up.	

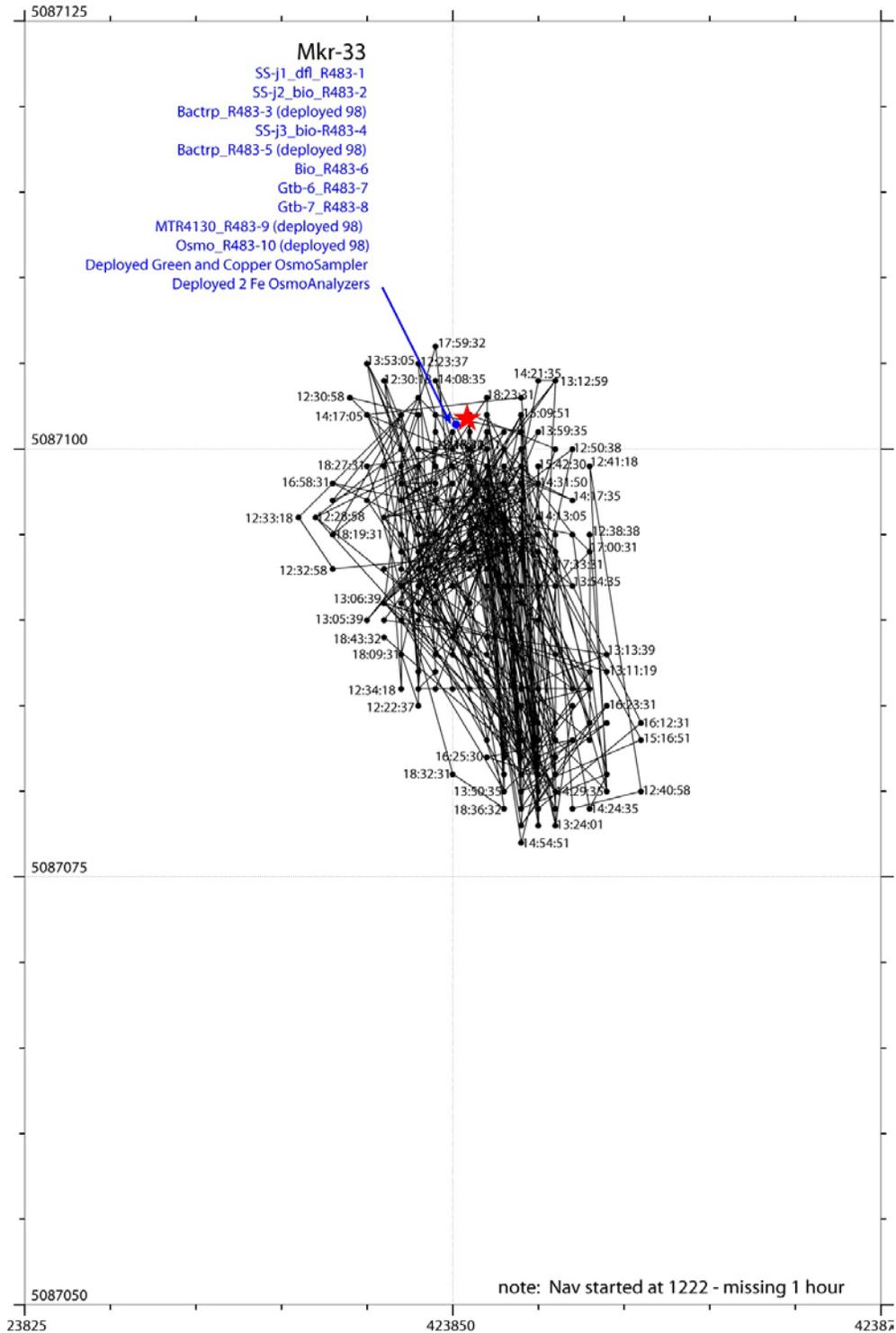
13	2	1540	266	421443	5087147	Red oxide sediments. Looking for venting. Oxidizing sulfides.	
13	3	1537	268	421443	5087147	No evidence of venting.	
13	4	1532	265	421443	5087147	Moving back N, and deeper.	
13	5	1537	264	421398	5087140	Backing away from the wall. Will lateral north. Oxides. Wind is picking up. Looks like a good site. Oxides and venting a very little bit.	
13	7	1543	312	427478	5084592	FeO sampling site	R502-100
13	7	1543	312	427478	5084592	Can't get photos, battery is dead. Venting. Oxides al around.	
13	9	1543	304	423656	5087061	Positioning the arm to get a fluid sample.	
13	14	1543	302	423898	5091215	temp 5 to 6 deg C.	
13	15	1543	300	428622	5086878	5 to 6 degree C, bag w/ filter. max T 6.2 C	HFS-11_dfl _R502-35
13	19	1543	300	428576	5086813	stopped sample 6.2 C vol 601 ml.	
13	23	1543	297	428039	5085391	Suction sample for oxide and bacteria. This is around the site that we took the fluid sample.	SS-2_FeO _R502-36
13	33	1543	300	416511	5087307	Sampling complete for bottle 2.	
13	34	1543	295	416511	5087307	Flushing the line into bottle 2.	
13	35	1543	298	416511	5087307	Some of the same sample for 2 contaminated 3 when the bottle 3 was put into position.	SS-3_FeO _R502-37
13	38	1543	109	416498	5087247	Tube worms at the base of the wall	
13	38	1543	65	416498	5087247	field of senescent tube worms, near west wall	R502-102
13	39	1526	128	416498	5087247	Moving back to the cage.	
13	42	1491	30	421393	5087135	Back at cage. Moving straight to Hell. Steve's tape is off.	
13	53	1499	50	421381	5087136	Arrived at Hell. Leaving cage, heading to the bottom.	
13	55	1541	95	421381	5087136	Bottom in sight, fixes no good.	
13	59	1543	281	421502	5087136	fix puts us south of Hell.	
14	7	1542	296	421415	5087090	Arrived at Hell vent. Collecting hobo sampler.	
14	11	1542	275	421366	5087139	Hobo collected, will ride in the arm until we get to inferno.	HOBO_R502-38
14	12	1542	26	421366	5087142	Heading to inferno.	
14	13	1542	39	421364	5087146	Arrived at Inferno vent.	
14	14	1545	21	421364	5087146	Opening purse, attempting to drop hobo from Hell into purse. Giving up on up on putting hobo in purse. Going to hold it in the 5 function arm to the surface.	
14	24	1545	24	421392	5087165	Putting the hobo on the bottom in order to get a new grip near the top.	
14	26	1544	13	421391	5087163	ROPOS is leaving the bottom, heading back to cage. Dive is over. Will come to the surface. Dive ended due to weather	
15	17	1	207	421417	5087133	Ropos on deck	
						Dive Summary: ASHES Vent Field dive - Deployed HOBO at Hell, retrieved MTR at Gollum, collected 38 samples (HFS, suction, gtb, niskin).	

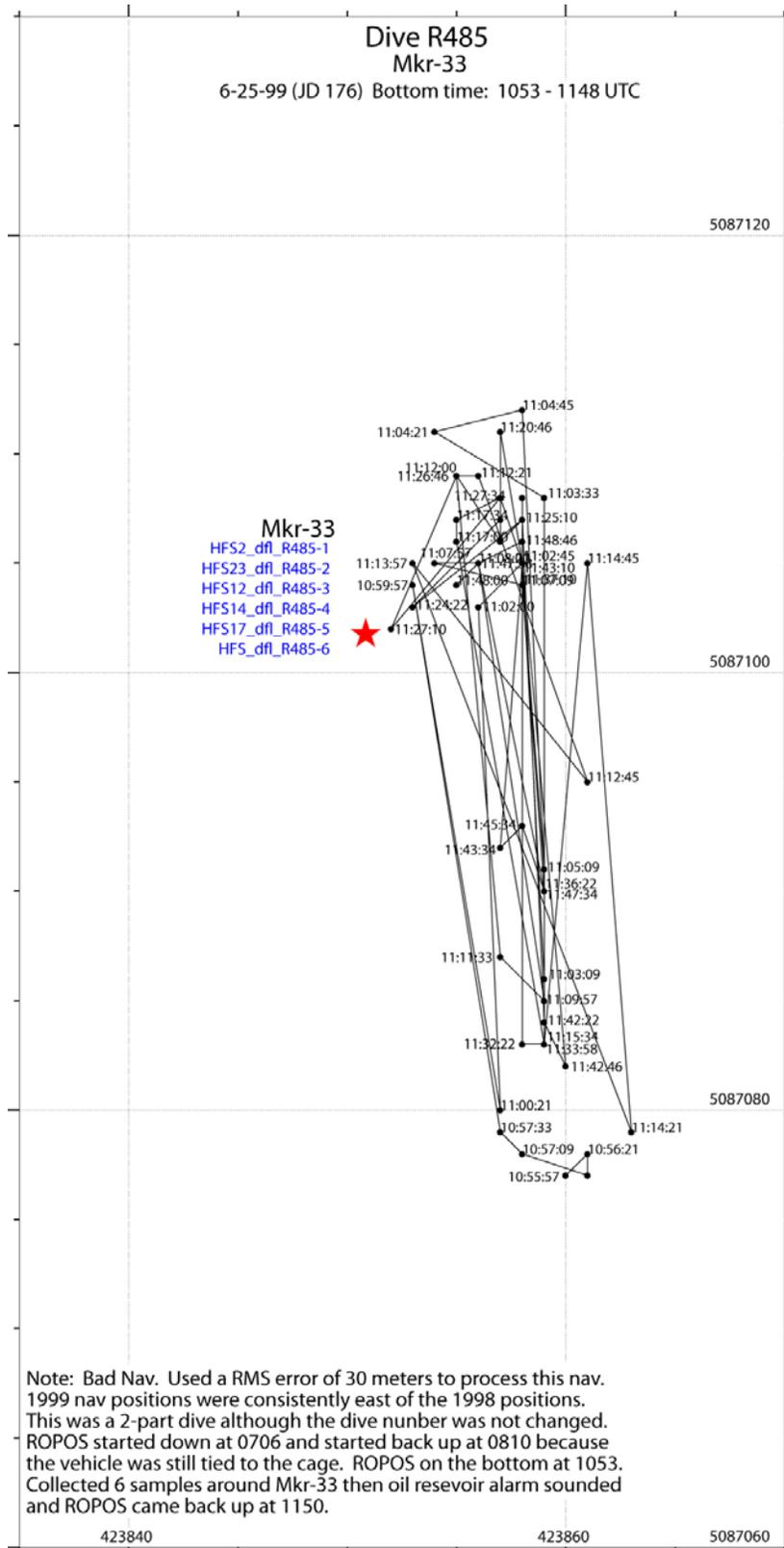
							Dive R503	
							Dive Plan: ASHES Vent Field - 1) Recover 2 high temp. recorders and 2 Vemco low temp recorders. 2) Deploy Osmosampler/HOBO package at Hell. 3) Recover 8-10 bacteria traps. 4) Suction sample bacterial mat at trap locations.	
							Dive Configuration: Suction Sampler, BioBox with 4 microbial trap arrays & 2 high temperature HOBOS. NO still camera.	
							Note: Nav fixes not edited in the logs. All fixes were logged, regardless of accuracy. Use the dive plots to determine actual positions.	
UTC Hour	Min	Depth (m)	Sub Hdng (deg)	UTM X	UTM Y	Comments	Frmgrbs, Photos, Samples	
20	15	20	111	421417	5087133	20:15. ROPOS in water. Wind N at ~2 kt, seas 2 m.		
21	37	1544	254	421333	5087131	ROPOS on bottom.		
21	38	1544	80	421330	5087119	good fix. Looking for Hell Vent.		
21	39	1544	74	421350	5087128	At Hell Vent to deploy osmosampler.		
21	50	1544	237	421371	5087144	getting ready to plant osmo at Hell Vent	R503-2	
22	1	1542	72	421358	5087126	Tried to put osmosampler into vent from which we recovered HOBO on Dive 502 but no go.		
22	14	1544	28	421364	5087133	Released osmosampler's probe at active vent near top of Hell Vent. Now needs to be positioned.		
22	25	1544	108	421363	5087133	a little landscaping at Hell Vent.	R503-3	
22	26	1544	108	421362	5087133	. i.e. knocked over a chimney to expose gaping hole to place osmo	R503-4	
22	26	1544	110	421362	5087133	Highlights on for deploying osmosampler and HOBO at Hell Vent.		
22	34	1542	87	421368	5087138	CANNOT deploy osmo at Hell. Will try next at Inferno.		
22	40	1542	115	421384	5087168	transit to Inferno where a gaping hole was created last night		
22	44	1543	79	421380	5087164	Osmo sampler melted by vent fluid so sampler cannot work. Decision to bring it back to surface for repair and put it down on the next dive, if there is one.		
22	49	1547	80	421388	5087143	Appears to be a problem with the elbow of the 7 function arm.		
23	12	1546	76	421379	5087158	P code GPS was out for 15 min but now back. 7 function arm is sick but useable. Will put Hobo's at top of Inferno and Virgin.		
23	16	1546	76	421378	5087161	HOBO #128 (green tape) to be deployed at Inferno.		
23	19	1546	79	421374	5087160	Inferno	R503-6	
23	19	1546	76	421382	5087160	and associated junk pile	R503-7	
23	23	1543	98	421384	5087163	hobo temperature probe almost deployed at the top of Inferno	R503-8	
23	24	1543	97	421385	5087161	. heading ~96	R503-9	
23	37	1543	55	420310	5084850	hobo probe might be in there (oh)	R503-10	
23	37	1543	55	420310	5084850	HOBO 128 deployed in small vent with well focused flow on top of Inferno.		
23	39	1544	346	421398	5087161	side view of hobo	R503-11	
23	41	1544	78	421388	5087168	Looking for site to take a gas tight bottle on top of Inferno.		
23	42	1540	196	421399	5087162	Cannot do GTB at Inferno without risking dislodging the HOBO.		
23	49	1543	298	421406	5087163	Weather warning from bridge. Will do highest priority jobs first - HOBO, bacterial traps.		

23	52	1543	69	421408	5087201	We arrive at Virgin. No chimney here now because it was knocked over on Dive 502.	
23	58	1546	48	421440	5087172	HOBO #130 to be deployed at Virgin Mound.	
0	2	1546	27	421439	5087172	hobo probe at Virgin Mound, heading 27. Recovered HOBO at Virgin.	HOBO_R503-3 R503-13
0	10	1546	66	421438	5087176	HOBO probe in place at Virgin	R503-14
0	3	1546	30	421439	5087174	HOBO #130 deployed at Virgin Mound. It is lying across the most active of three fluid jets. Now going to Gollum Vent.	
0	12	1545	210	421433	5087159	We arrive at Gollum and are greeted by a covey of bacterial traps.	
0	15	1545	198	423630	5087101	Three bacterial traps (tied together) have been deposited in the BioBox.	Bactrps_R503-1
0	17	1545	193	423615	5087083	Three more traps, covered with snails being moved to the BioBox.	R503-15
0	18	1545	197	423615	5087083		
0	18	1545	195	423615	5087083	Second group of traps in the BioBox.	R503-16
0	19	1545	196	423614	5087082	We have opened the BioBox to grab a set of three bacterial traps for deployment at Gollum.	
0	24	1545	163	421436	5087158	Bacterial trap #45 has been deployed at Gollum in an area of shimmering flow wider than the traps themselves.	
0	27	1545	186	421430	5087165	Frame grab of newly deployed traps at Gollum (#45).	R503-17
0	27	1545	188	421430	5087165	Microbe trap deployment at Gollum. One trap only.	R503-18
0	28	1543	311	421431	5087159	Now heading towards Inferno.	
0	29	1544	55	421431	5087159	Hobo probes seen at Inferno.	
0	32	1546	71	421397	5087160	One Hobo probe with 2 markers? in the right claw.	HOBO_503-2
0	34	1525	260	421397	5087160	Time 0:34:37 dive is ended due to weather concerns. There is a HOBO from Inferno in the right claw and an osmosampler with a #2 on it in the left claw.	
						Dive Summary: 1) OsmoSampler melted at Inferno 2) HOBO 128 deployed on top of Inferno 3) HOBO 130 deployed at Virgin mound 4) Two bacterial traps recovered and one (#45) deployed at Gollum 5) One osmosampler and HOBO recovered at Inferno.	

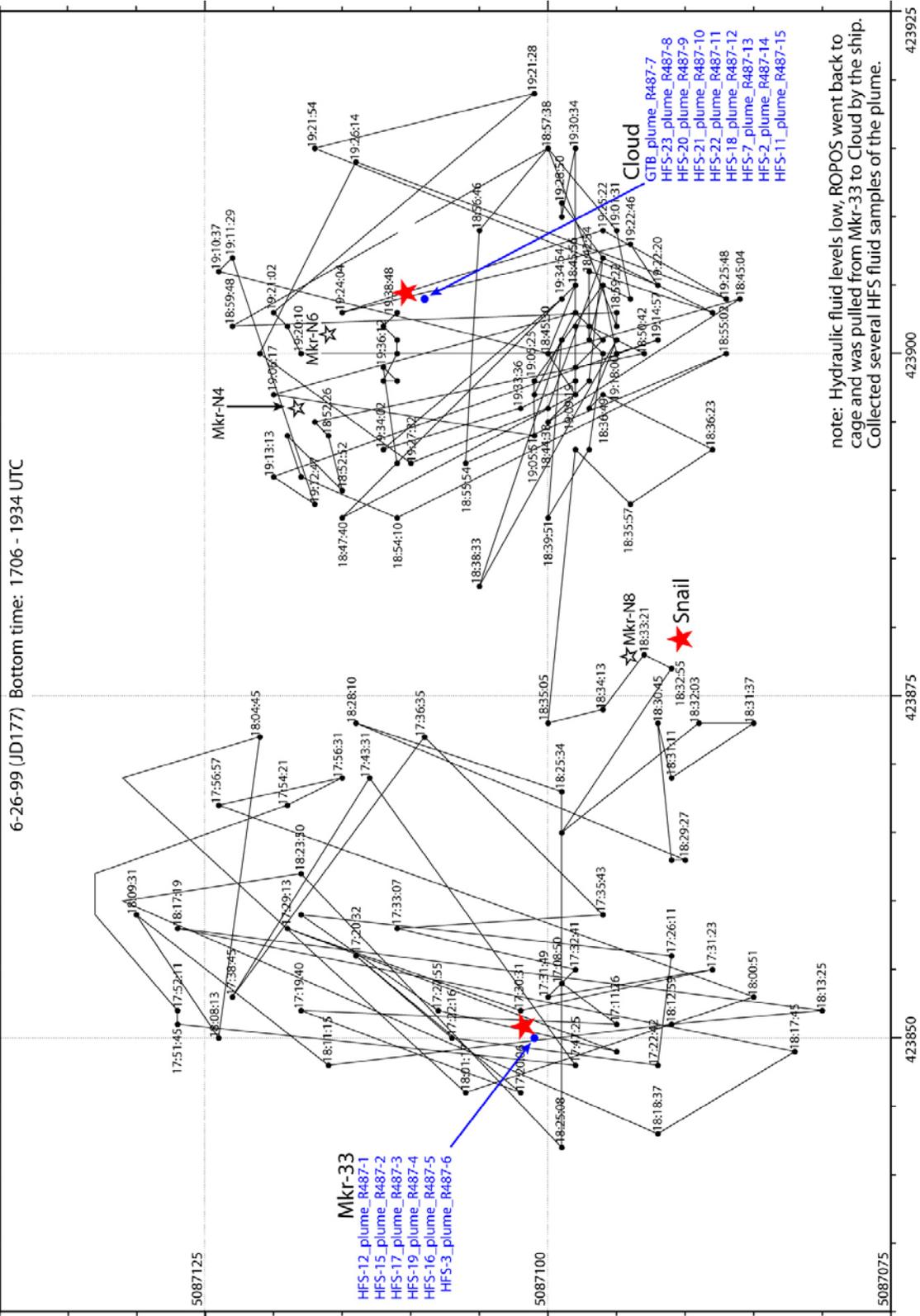
Dive R483 Mkr-33

6-23-99 (JD174) Bottom time: 1100 - 1842 UTC

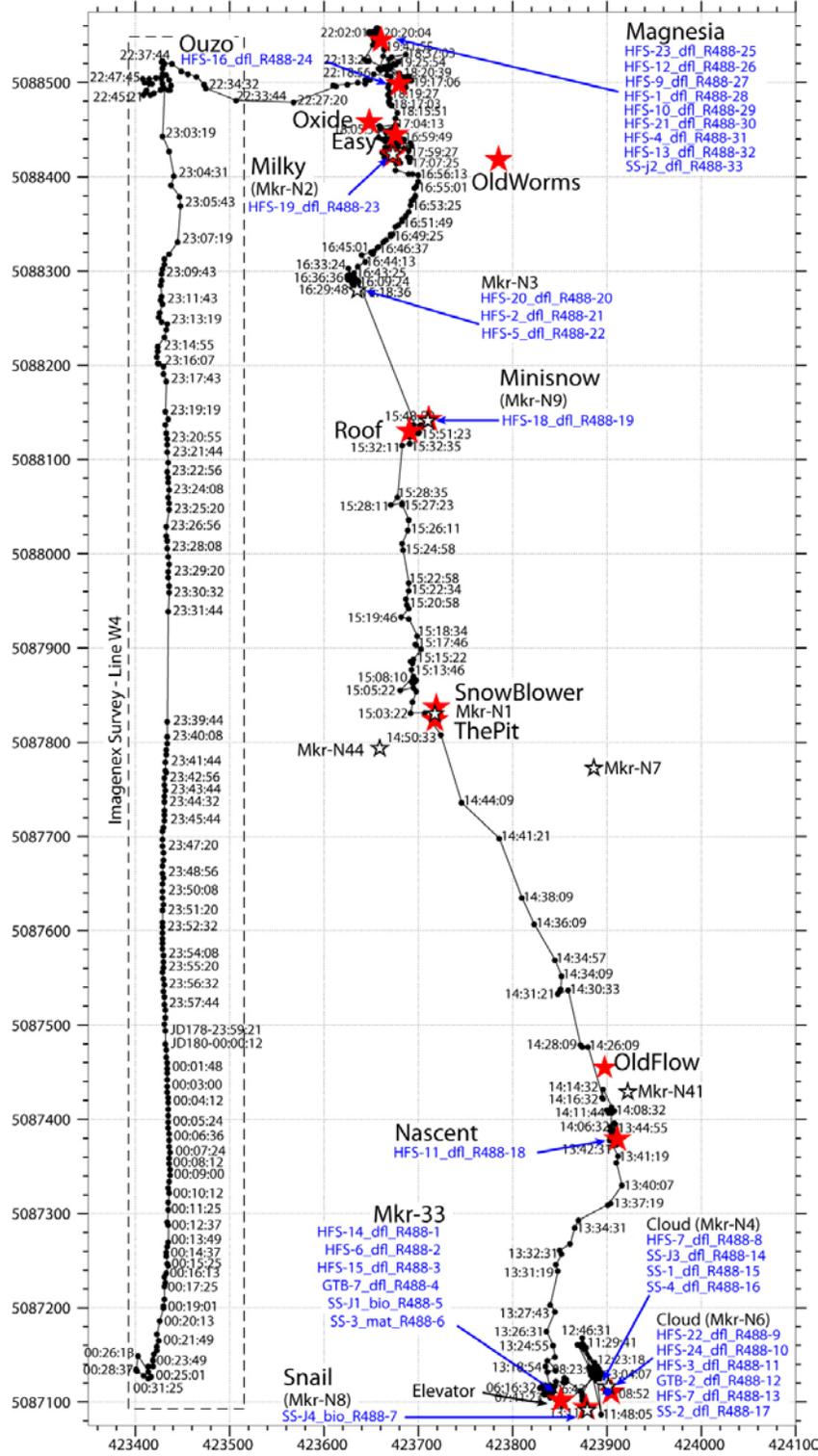




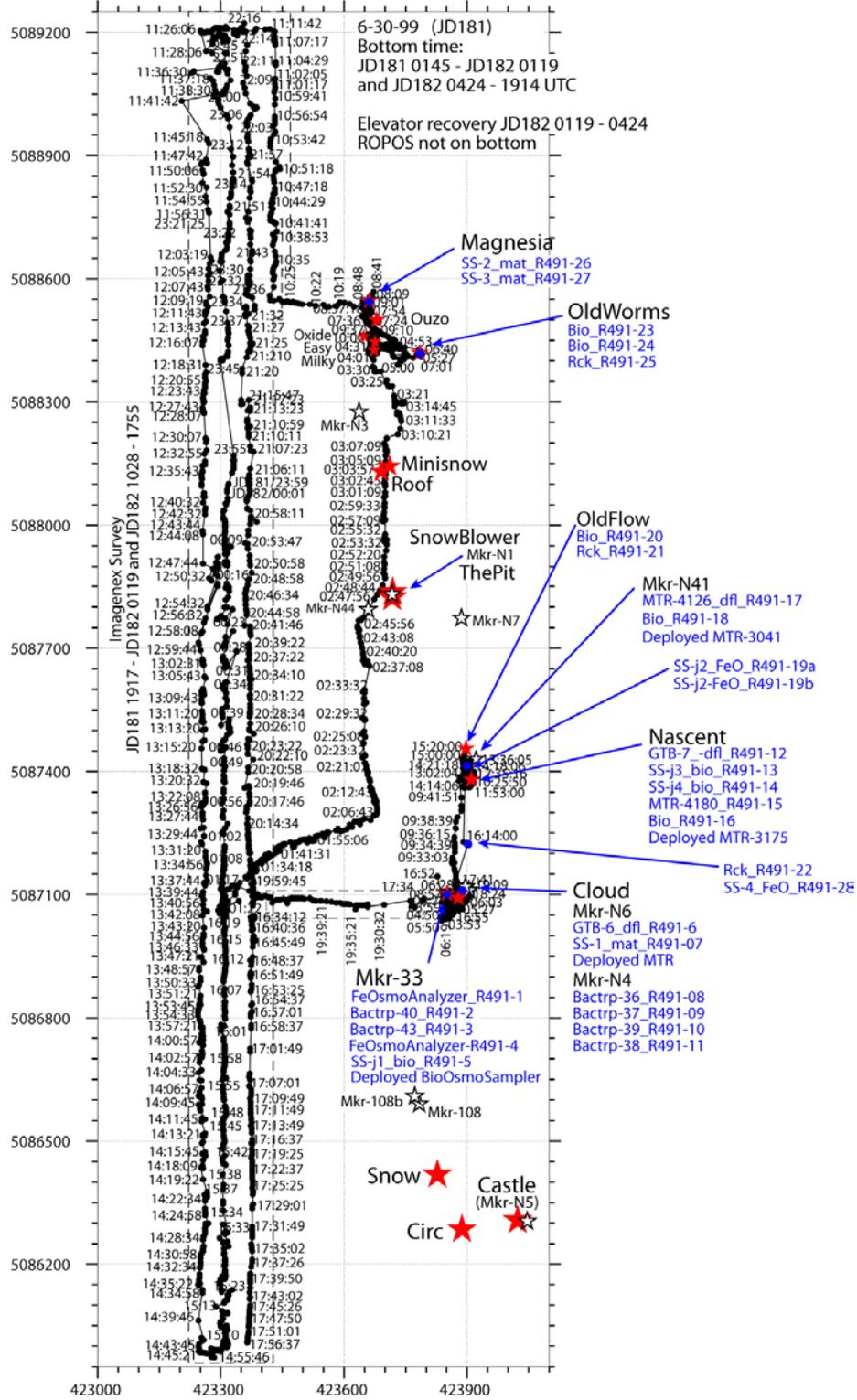
Dive R487 Mkr-33 and Cloud



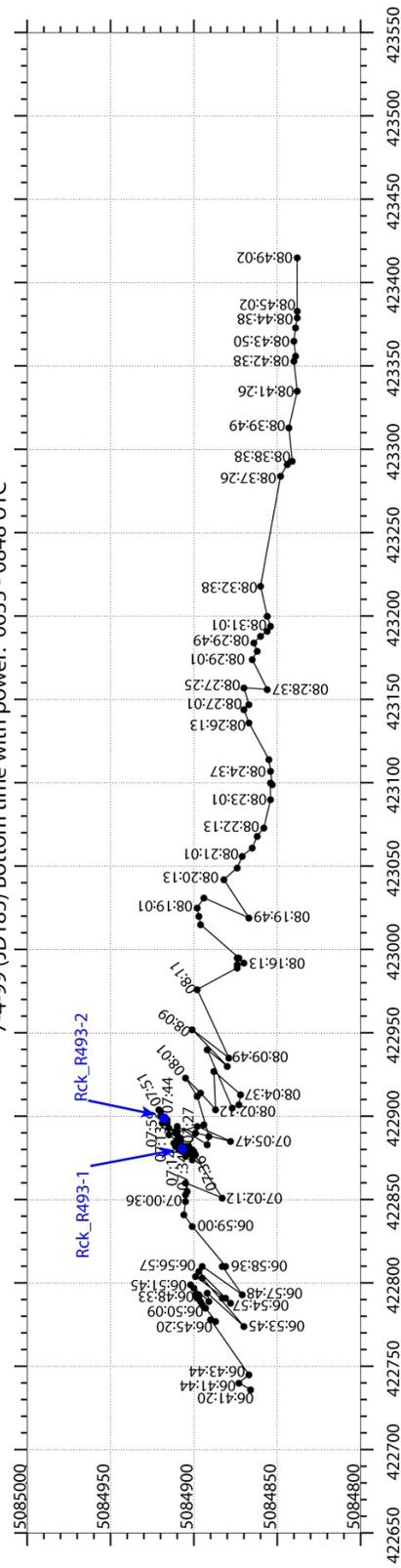
Dive R488
 Mkr-33, Snail (Mkr-N8), Cloud (Mkrs N4&N6), Nascent, MiniSnow (Mkr-N9),
 Mkr-N3, Milky (Mkr-N2), Magnesia and Imagenex survey
 6-27-99 Bottom time: JD178 0601 - JD179 0032 UTC



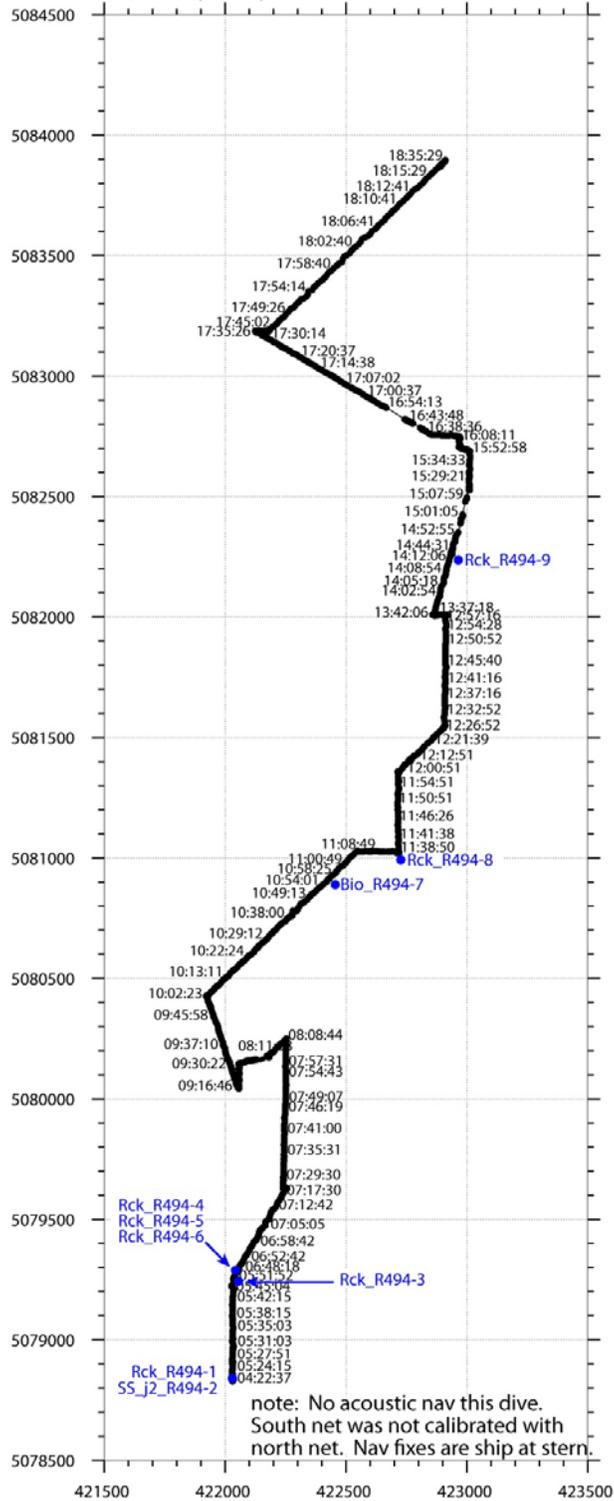
Dive R491
 Mkr-33, Cloud, Nascent, OldFlow OldWorms, Magnesia and Imagenex survey



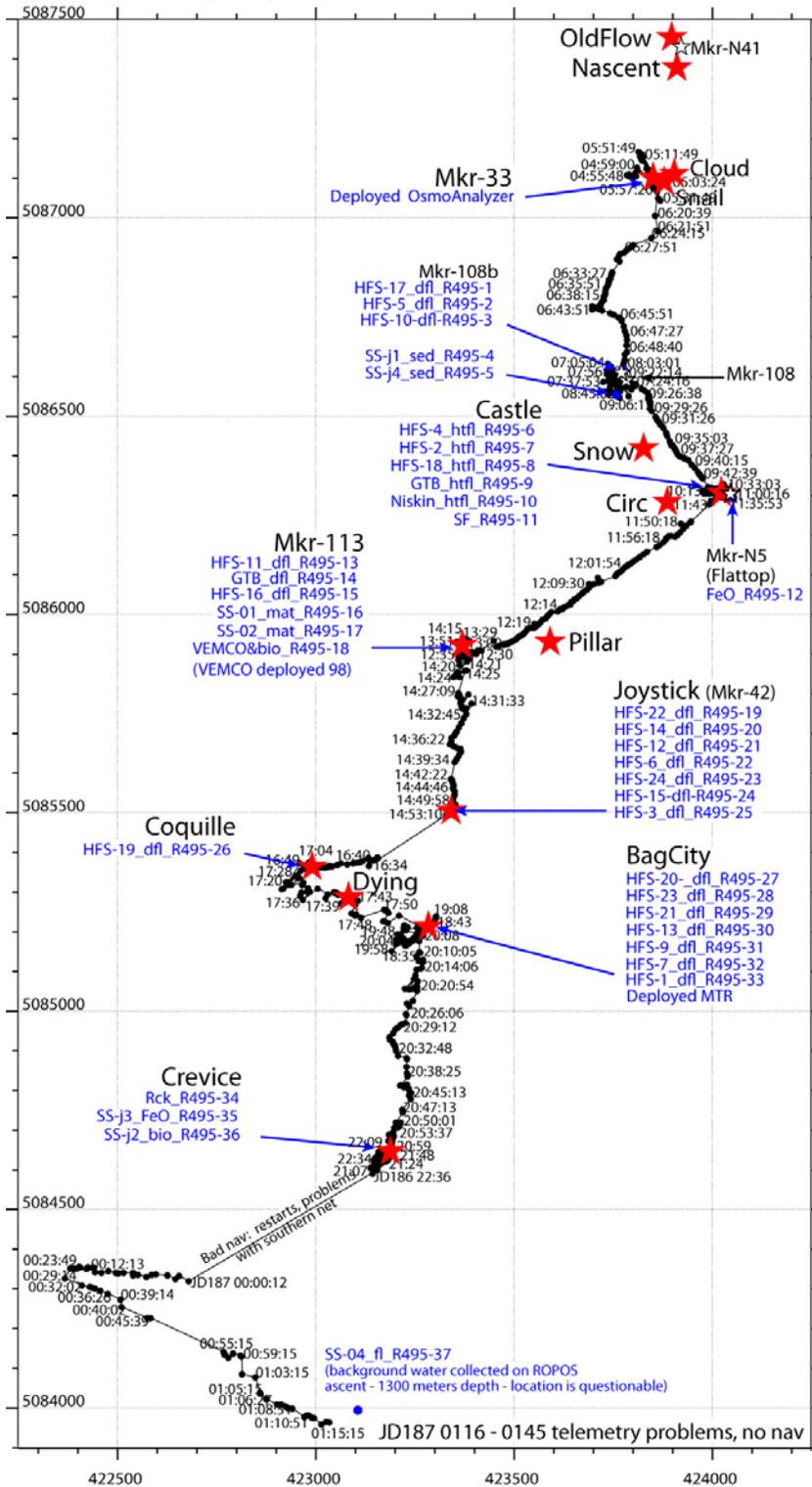
Dive R493
 SRZ Geology dive - extension of dive R492
 7-4-99 (JD185) Bottom time with power: 0635 - 0848 UTC



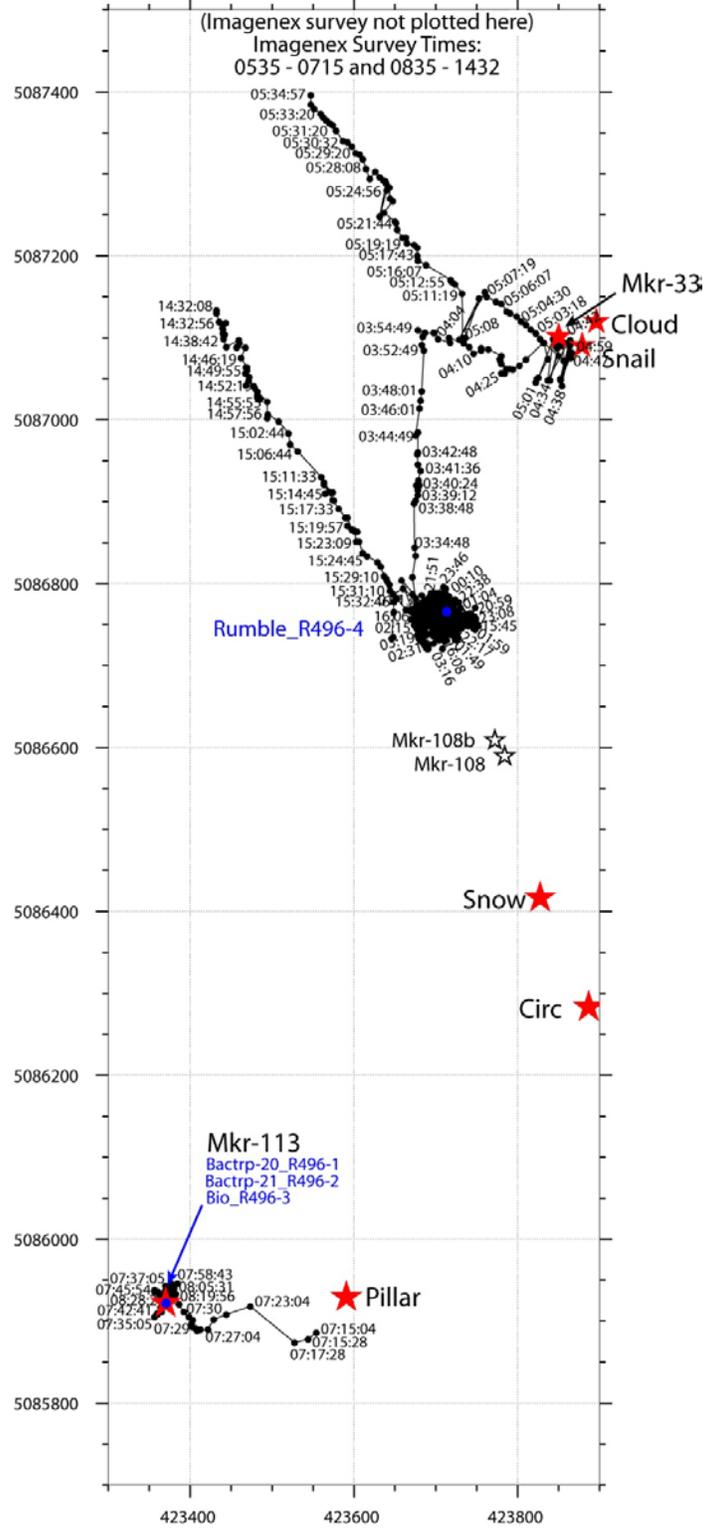
Dive R494
 SRZ - Starting south of SeaBeam anomaly,
 moving north to map limits of 1998 lava flow
 7-4-99 (JD185) Bottom time: 0416 - 1820 UTC

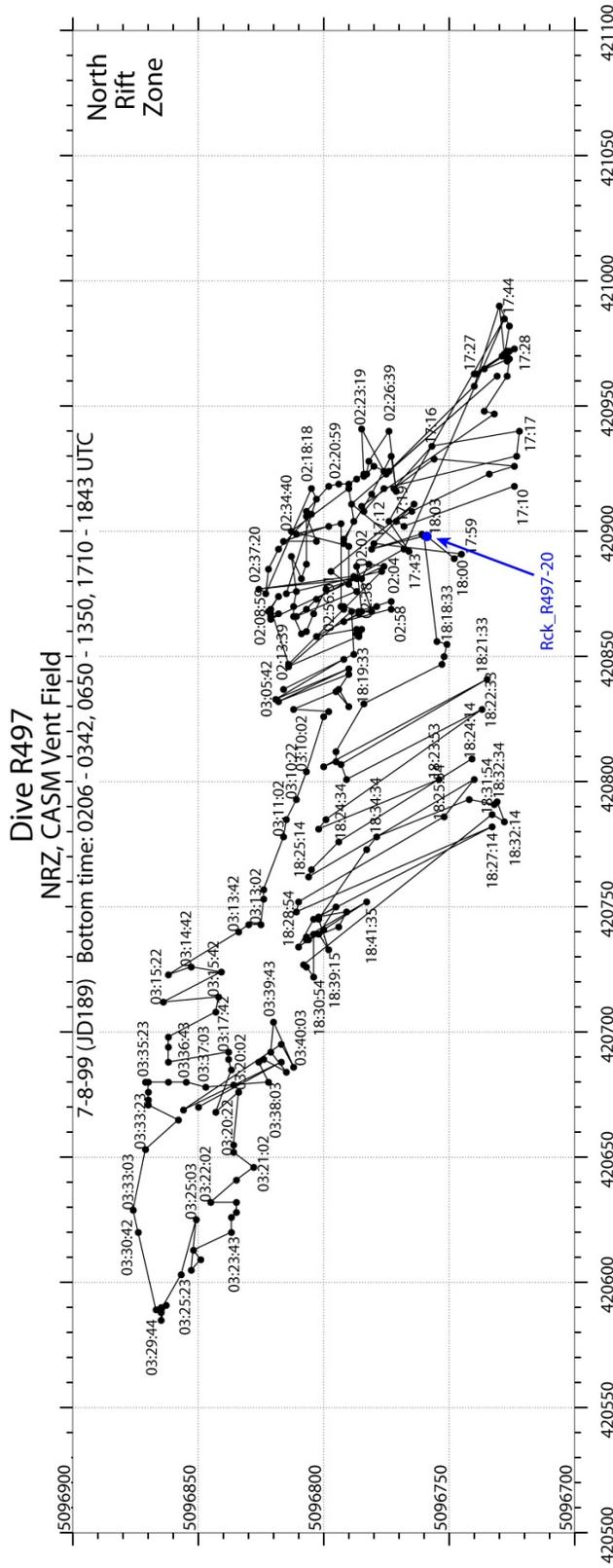


Dive R495
 Mkr-108b, Castle, Mkr-113, Joystick, Coquilles, Bag City, Crevice
 7-5-99 (JD186) Bottom time: JD186 0455 - JD187 0158 UTC



Dive R496
 Mkr-113, Rumblemeter freed from lava, Imagenex survey
 7-6-99 (JD187) Bottom time: JD187 2051 - JD188 1614 UTC



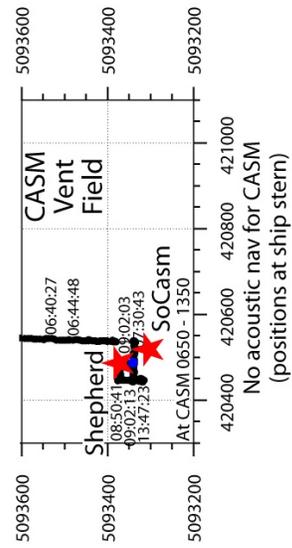


The elevator came to the surface prematurely on this dive. It was recovered and the ship proceeded to CASM.
 After many ROPOS hours at CASM the ship proceeded north again to the extensometer site.
 The elevator was redeployed and ROPOS placed one extensometer in the tube.
 The sub lost power and the dive was aborted.

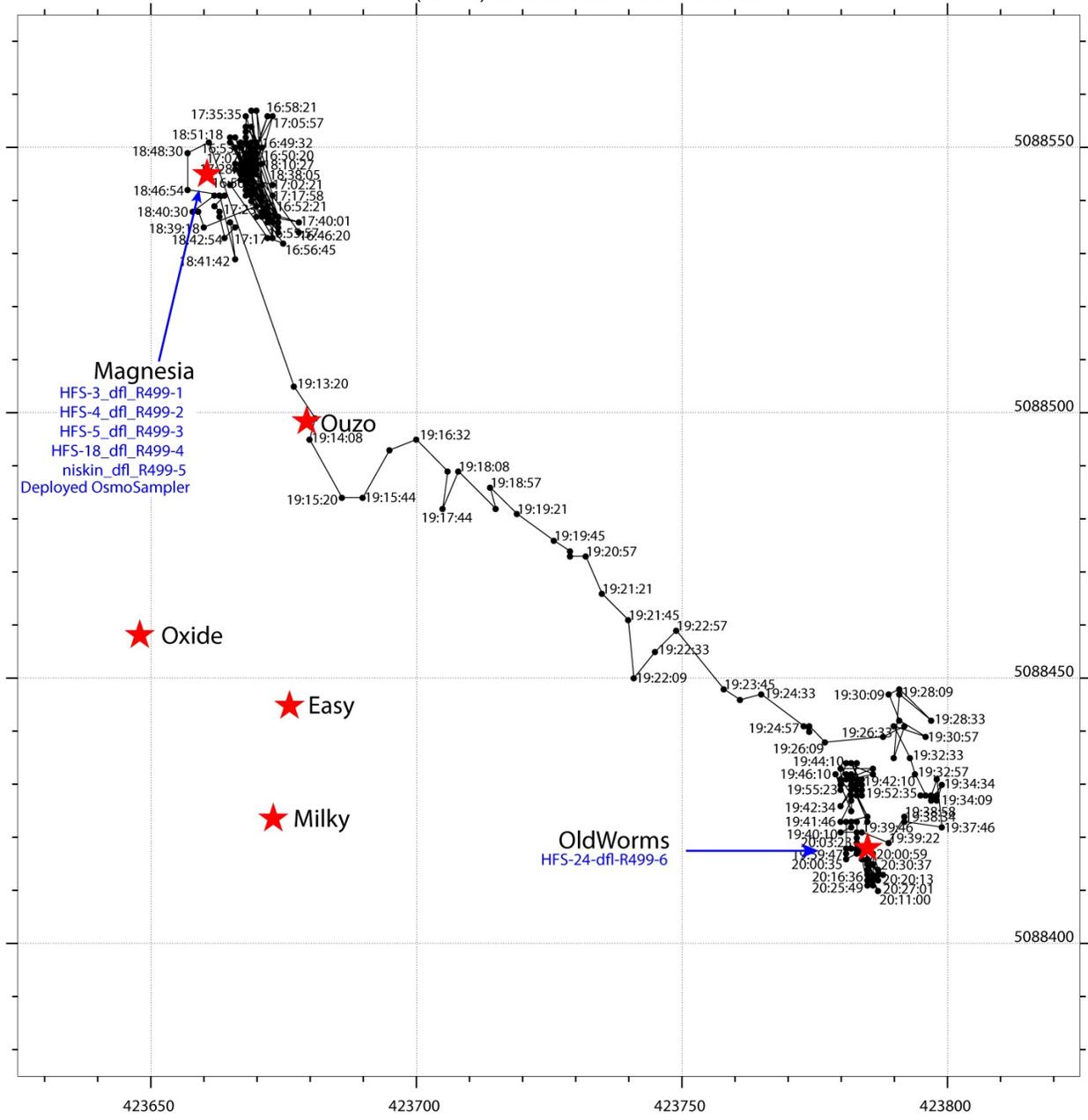
Samples gathered at CASM Vent Field

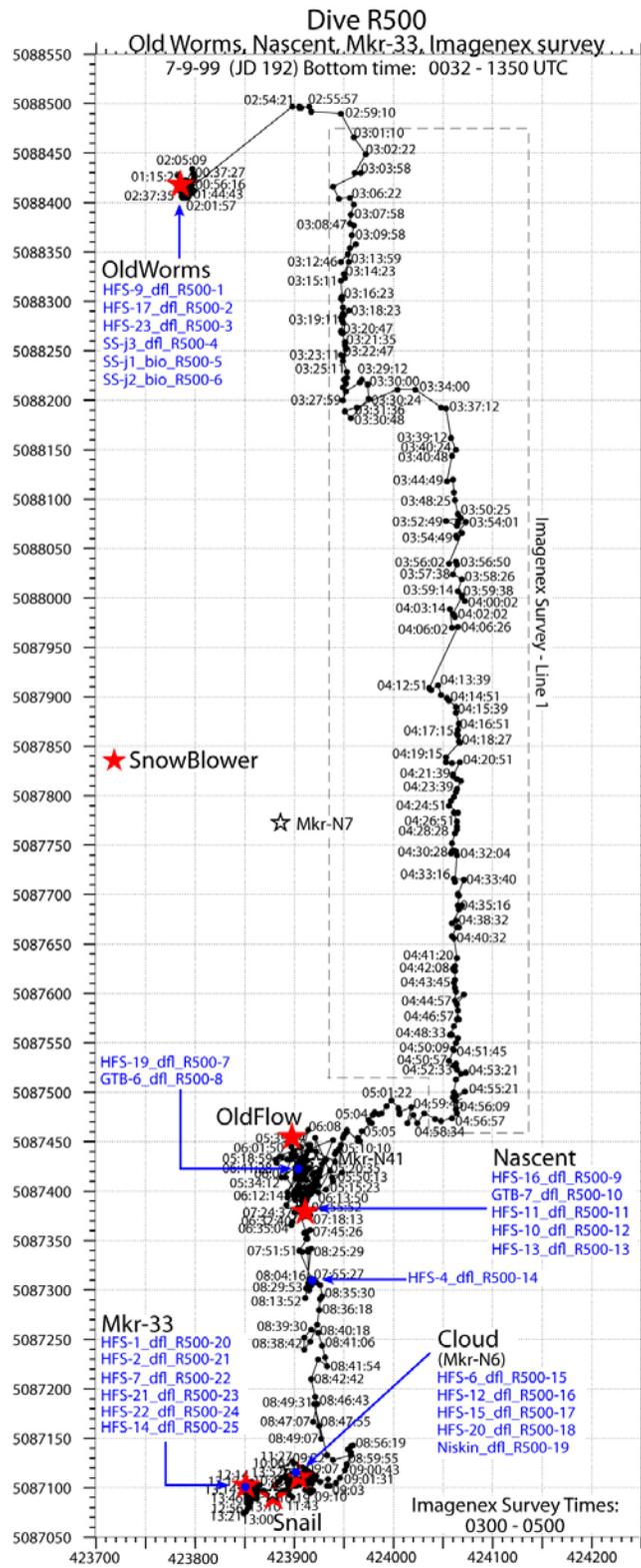
GPS ship position at stern:
 x = 420506, y = 5093338
 x = 420446, y = 5093322

SF8Bio_R497-3	SF_R497-12
SS-j4_dfl_R497-4	SS-2_dfl_R497-13
GTB_R497-5	SS-j2_bio_R497-14
SF_R497-6	SS-3_bio_R497-15
VEMCO_R497-7 (deployed 98)	Hobo_#130_R497-16 (deployed 98)
#98-1113-214)	Niskin_dfl_R497-17
SS-j1_bio_R497-8	SF_R497-18
Bio_R497-9	SF_R497-19
SS-1_mat_R497-10	Sf_dfl_R497-21
GTB_R497-11	Deployed MTR#3017

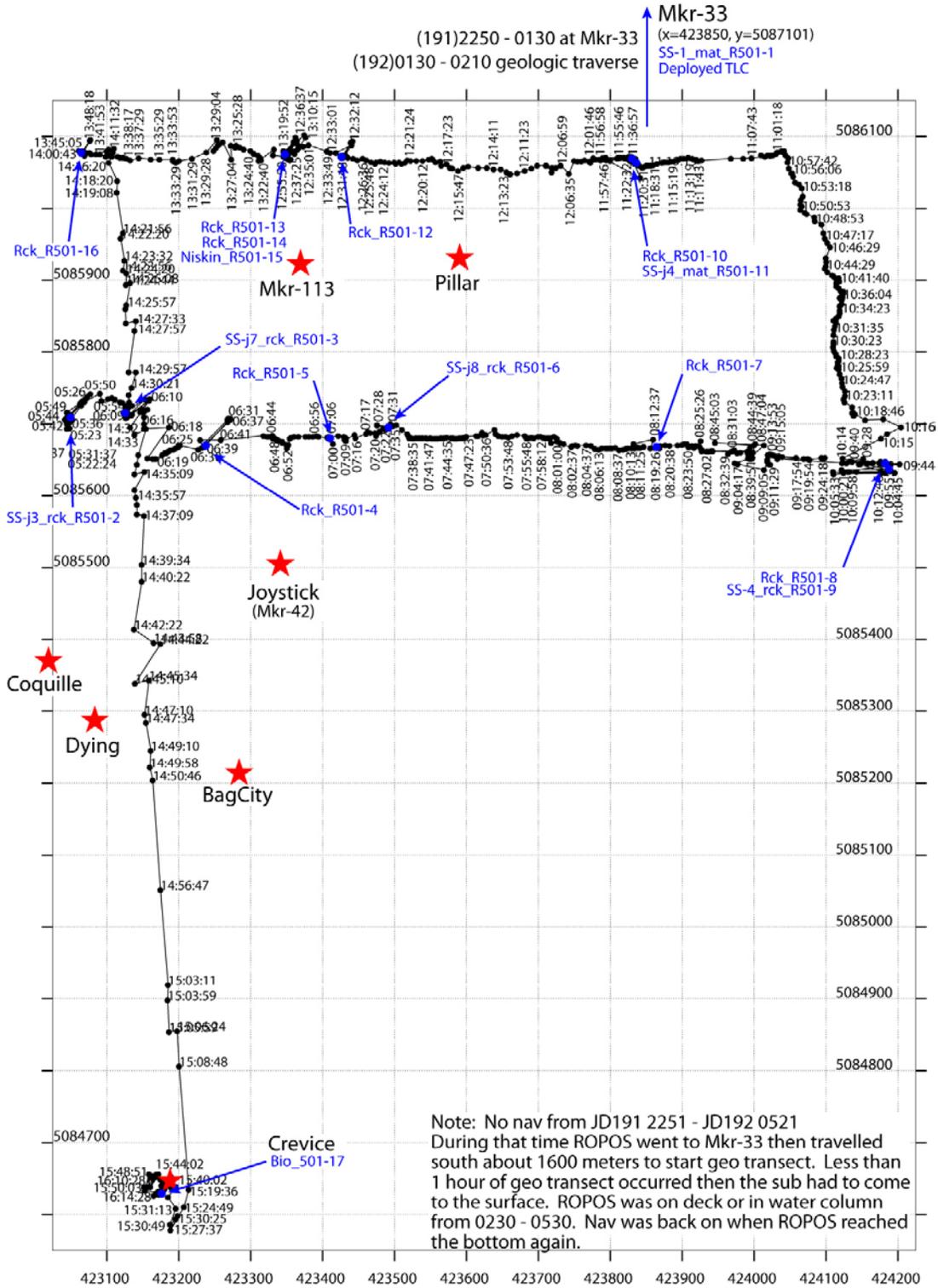


Dive R499
Magnesia and Old Worms
 7-9-99 (JD 190) Bottom time: 1626 - 2030 UTC





Dive R501
Mkr-33, Crevice, and geologic traverse
 7-10-99 (JD 191) Bottom time: (191)2250 - (192)0210, (192)0521 - 1615 UTC



Dive R503
 ASHES: Inferno, Gollum, Virgin
 7-12-99 (JD 193) Bottom time: JD193 2137 - JD 194 0034 UTC

Note: Nav at ASHES was not good. The vent positions were determined in 1998. Our fixes in 1999 were generally to the east of positions in 1998, thus the shift to the east in the nav. There are obvious nav spikes in the data, but there weren't that many fixes at ASHES, so some of the spikes remain. Sample times are included to give one an idea of where the samples were taken according to the nav.

