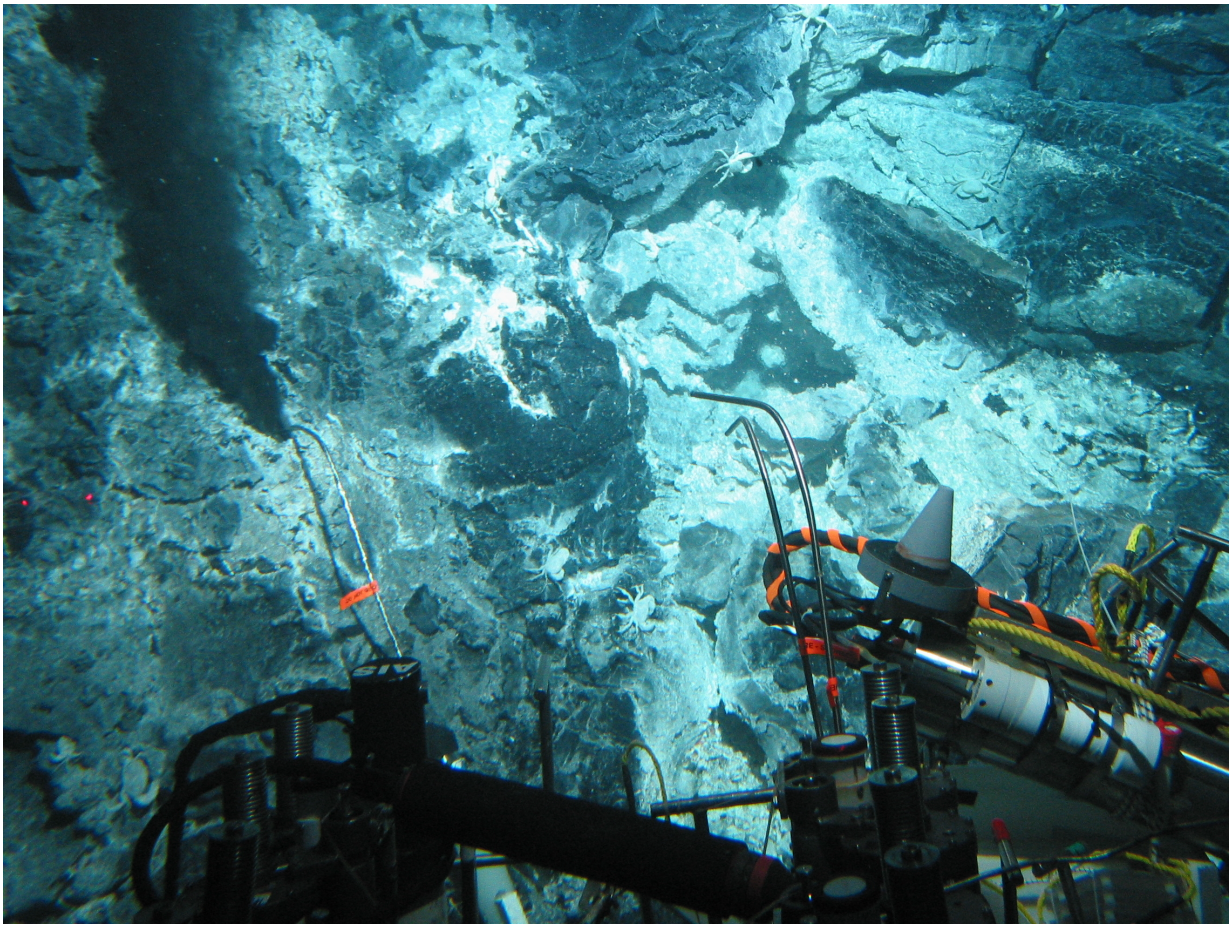
Cruise Report:

RESET06 - AT15-6

A Response Cruise to a Volcanic Eruption
at the Ridge2000 East Pacific Rise Integrated Study Site



June 16 - July 7, 2006

Puntarenas, Costa Rica - San Diego, CA, USA

K.L. Von Damm, Chief Scientist

Research Funded by the National Science Foundation

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Cruise Report for RESET06 (AT15-6) - June 18-July 7, 2006

1. Objectives

From previous eruption studies on the mid-ocean ridges, we have gained an appreciation that the immediate post-eruptive period

- is quite different from the later 'steady-state' behavior of the system
- changes in numerous parameters occur on very short time scales, certainly less than weeks and in some cases days, and even hours and minutes, although at the shortest time scales are records are very incomplete.

The overriding objective of this cruise was through instrument recovery, deployment, and sample collection and observation, to set the base line for future studies at the Ridge2000 East Pacific Rise (EPR) Integrated Study Site (ISS), by characterizing the state of the system as of late June 2006.

2. Overview and Summary of Activities

This cruise was an NSF-funded Response Cruise to the eruption discovered in late April 2006 during *Knorr* (KN182-13), and confirmed in May 2006 by *New Horizon* (6NH), at the Ridge 2000 East Pacific Rise (EPR) Integrated Study Site (ISS), whose 'bull's-eye' is located at 9°50' north latitude.

Through a combination of transferred from already-funded programs, and newly funded dives, a total of 8 *DSV Alvin* dives were scheduled during *Atlantis* Voyage 15 Leg 6 (AT15-6) for this work. The participants named the cruise "RESET06" for "***R***ecent ***E***ruption ***S***tudies ***E***ast Pacific Rise ***T***ime Zero, 20***06***." The *R/VAtlantis* departed Puntarenas, Costa Rica on Sunday June 18th for the 4.3 day steam to the site. Unfortunately the day before we reached station we had to do a medical evacuation, so the first dive did not occur until Sunday June 25th , two days later than originally planned. The cruise was then extended by one day to allow us to make-up one of the two lost dives. The first dive, 4201, reached the seafloor but due to a mechanical failure that became evident as soon as the submersible reached the seafloor, which could not be fixed, the dive returned to the surface and no science objectives were accomplished. Six additional *Alvin* dives were completed, most of which had additional mechanical/electrical problems either on the submersible and its equipment, or with science equipment, which compromised the total amount of work accomplished on the dives.

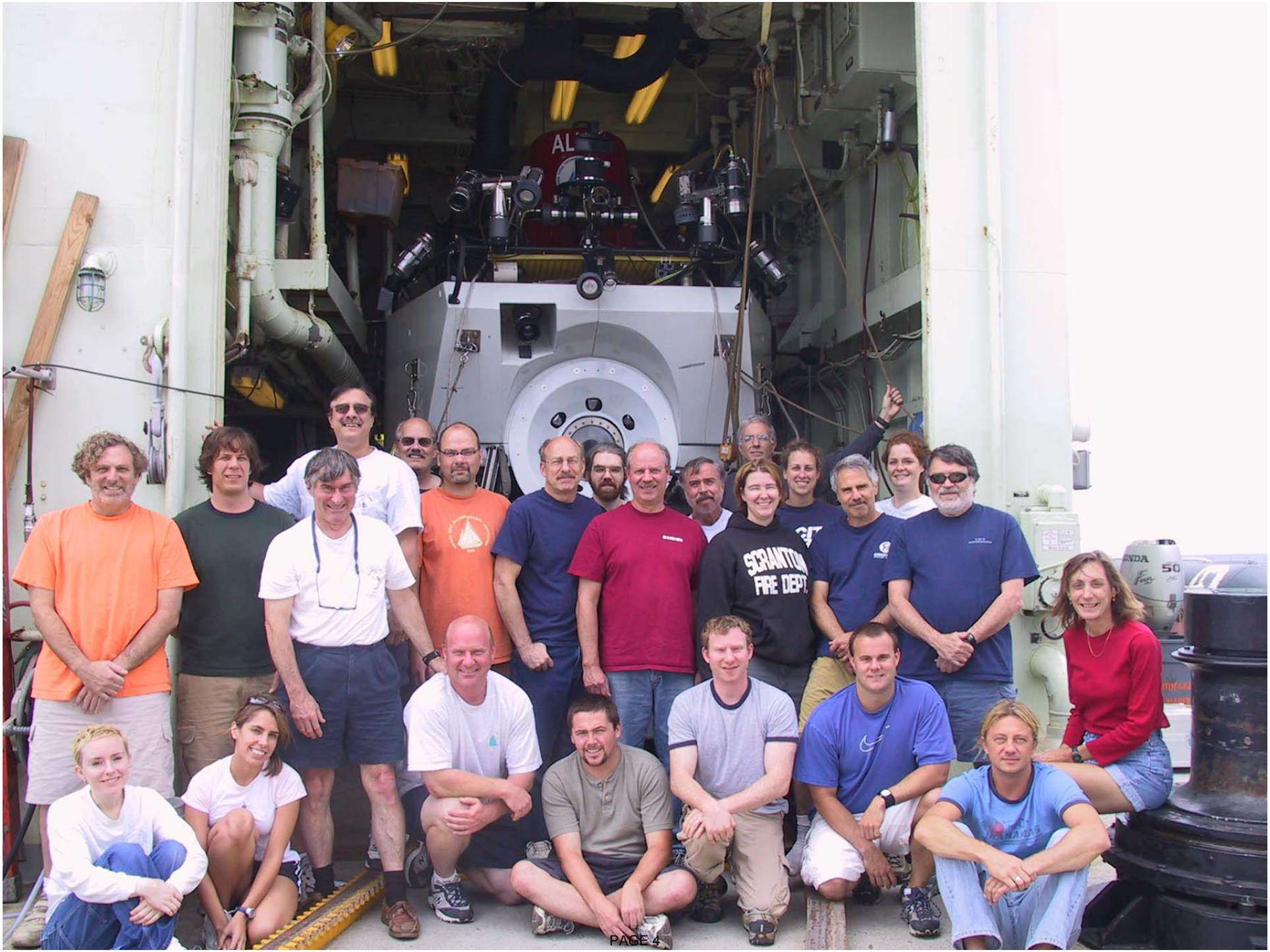
When we arrived on station, the first thing we did was to deploy three transponders as part of the permanent Ridge2000 (R2K) East Pacific Rise (EPR) Integrated Study Site (ISS) array, as the transponders previously at the site had all been recovered. Most of the nights were spent using the TowCam to assess the status of the Ocean Bottom Seismometers (OBS) at the site, as well as to provide information on the extent of the new lava flows and the distribution and nature of the hydrothermal system and associated biological (both micro and macro) communities. The two moorings deployed on the New Horizon cruise were re-covered and subsequently re-deployed. One CTD/rosette cast was also completed. Other night work consisted of deploying the Maclane pumps to pump fluids from diffuse flow sites to trap the microbial material on filters. These pumps were subsequently recovered. The ISEA (In-Situ Electrochemical Analyzer, aka INSECT) was also deployed on an elevator at night, and its

sensors placed in an area of diffuse flow the following day by the submersible for in situ chemistry determinations. This instrument will be recovered in January.

The R/V Atlantis docked in San Diego, CA on July 7, 2006, ending this cruise.

2. Participants - AT15-6

	Affiliation	Status	Discipline
1. Karen Von Damm, Chief Scientist	UNH	Scientist	Chemistry (fluids)
2. Jill McDermott	UNH	Grad Student	Chemistry (fluids)
3. Sarah Carmichael	UNH	Post-doc	Chemistry (fluids)
4. Mike Bates	UNH	Grad Student	Chemistry (fluids)
5. Florencia Meana-Prado	UNH	Grad Student	Chemistry (fluids)
6. Tim Shank	WHOI	Scientist	Biology (macro)
7. Breea Govenar	WHOI	Post-doc	Biology (macro)
8. Kate Buckman	WHOI	Grad Student	Biology (macro)
9. Richard Lutz	Rutgers	Scientist	Biology (macro)
10. James Voordeckers	Rutgers	Grad Student	Biology (micro)
11. Stefan Sievert	WHOI	Scientist	Biology (micro)
12. Craig Taylor	WHOI	Scientist	Biology (micro)
13. Steven Molyneaux	WHOI	Tech	Biology (micro)
14. Sean Sylva	WHOI	Tech	Biology (micro)
15. George Luther	UDelaware	Scientist	Chemistry (in situ)
16. Don Nuzzio	AIS	Scientist	Chemistry (in situ)
17. Tommy Moore	UDelaware	Grad Student	Chemistry (in situ)
18. Marv Lilley	UW	Scientist	Chemistry (gas)
19. Ron Green	NOAA	Tech	Chemistry (gas)
20. Dan Fornari	WHOI	Scientist	Geology
21. Adam Soule	WHOI	Scientist	Geology
22. Mike Perfit	UFlorida	Scientist	Geology
23. Ken Rubin	UHawaii	Scientist	Geology
24. Martin Rapa	SIO	Tech	OBS
Main Shore-Based Collaborators			
Costantino Vetriani	Rutgers	Scientist	Biology (micro)
Roger Summons	MIT	Scientist	Biology (micro)
Rachel Haymon	UCSB	Scientist	Sulfides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4. Summaries of Objectives and Shipboard Accomplishments by Group/Discipline

This cruise was composed of a number of disciplinary and research groups, with different specific objectives. Each group prepared their own statement, and they are presented in alphabetical order by lead PI here.

RESET06 (ATL15-6) Geology/Volcanology Team Report

Dan Fornari (WHOI)
Mike Perfit (U. Florida)
Ken Rubin (U. Hawaii)
Adam Soule (WHOI)

Objectives:

1. Focus on time sensitive observations to characterize the eruption (visual and lava sampling for dating studies).
2. Use Alvin and TowCam (night program) to build on initial geological observations of the new eruption and begin to define its scope and effects following preliminary shipboard studies conducted on R/V Knorr and R/V New Horizon.
3. Collect data on the spatial extent, thickness, volume, and eruption conditions for the new lava flow within the AST and to its furthest distance off-axis.
4. Collect samples from throughout the new flow(s) for geochronological and petrological studies of eruption timing and conditions and to help constrain eruption dynamics. Rapid recovery of high-quality *in situ* samples is essential for short half-life 210Po-^{210}Pb eruption dating.
5. Find and attempt recovery of non-releasing OBSs presumed to be stuck in the new lava flow.
6. Investigate linkages between hydrothermal vent sites (new and old) and the new lava flow (including location of eruptive fissures and effects on AST structure).
7. Interface with investigators from other disciplines to understand the effects of the latest eruption on EPR ISS geological, hydrothermal and biological processes.

Expectations:

1. Fractions of each Alvin dive would be dedicated to lava mapping and sampling.
2. Collect 15-20 geographically well-distributed samples of the new lava flow(s) and characterize their geologic context and contact relationships (collect older lava at contacts).
3. Dedicate portions of several TowCam runs to OBS search, locate and attempt recovery.

Initial Findings of the Knorr and New Horizon cruises and related laboratory studies:

The Knorr cruise observed that OBSs in the EPR ISS were not responding and/or releasing to the surface. Fresh lavas were dredged south of the ISS Bull's-eye site and MAPRs tows showed temperature and particle anomalies near the sea floor. Lava sampling and camera tow work on the subsequent New Horizon cruise showed very fresh appearing lavas on the seafloor over roughly 15 km of ridge axis between 9° 47.5 and 9° 55.7'N. Preliminary radiometric dating of rocks recovered from both cruises indicate that materials erupted within the past year were recovered and that the new eruption may have been a sequence of events spanning about one year.

New Observations and Discoveries on the RESET06 Cruise (AT15-6)

- We have obtained unequivocal visual confirmation that very young lavas blanket a considerable portion of the seafloor throughout the EPR axis and crestal region between ~9° 46'-56'N.
- Visual observations of contact relationships within the new lava flow (i.e., 'newer lava' on top of 'new lava') support a multi-phase eruption sequence, consistent with preliminary Po dating results noted above.
- We found many similarities between the most recent (2005-2006) eruption(s) and the last major eruption documented in this area (1991-1992), including emplacement style, aerial extent, and decimation of existing hydrothermal/biological sites within the AST.
- Although broadly similar to the 1991-92 flow, the latest eruptions appear to be more voluminous. This latest event also appears to have erupted a greater volume of lava to the north (9˚ 53'-55'N), and in at least a few places TowCam surveys show that it extends to greater distances (as much as ~1.25 km in the 9° 49'-51'N area) from the AST. In other areas it erupted solely within the AST.
- In some places within the AST the new flow has completely covered previous markers, biologic communities, and instrumentation. Previously well-characterized geologic features within the AST were not easily recognized during Alvin dives or TowCam surveys.
- Hydrothermal activity continues to be more robust between 9˚ 47'-51'N than north of 9˚53'N.
- The eruption(s) north of 9˚53'N have a different eruptive/structural character. They are associated with a series of narrow discontinuous fissures rather than the continuous AST that exists in the 9˚ 47'-51'N area. In some cases lava has been extruded from the fissures, in others it has filled, but not overtopped the fissures. Some of the fissures are barren of fresh lava. Similar contact relationships were observed by Alvin in April 1992 for the 1991-92 eruption. Previous sidescan sonar mapping and Alvin diving on the EPR axis north of 9° 52'N confirm that it is marked by en echelon fissure swarms in this area.
- Areas where there is greater across-axis flow coverage also appear to have greater amounts of diffuse venting within the AST, possibly suggesting that these axial zones were sites where the eruption focused.
- The new eruption is clearly discontinuous along-axis and eruptive fissures may not have broken the surface along the entire length of ridge axis we investigated. The new flow is patchy and thin, particularly near the top of AST walls and within the floor of the AST.
- The new flows appear to be thin (~1 m thick) both within and proximal to the AST and on the EPR crestal plateau. This is somewhat paradoxical, given the need to efficiently move large volumes of lava across large distances of seafloor at high velocity, as inferred from the often sheet or folded morphology of the new lava surface. Pillow morphogies were only rarely observed and primarily at the termini of flow lobes.
- The new flow is asymmetric, with greater surface area covered east of the AST over the region between ~ 9° 49'-52'N where the greatest data coverage exists.
- Zones of significant off-axis transport of lava have ridge perpendicular channelized sheet flows for much of their length.
- In places, the off-axis extent of the lava is controlled by topographic obstructions of the preexisting lava surface (e.g. pillow ridges, faults, pressure ridges, etc.).

- An off-axis fissure eruption was documented at ~600m east of the AST at 9˚ 53'N. The lava flow it produced is primarily comprised of high effusion-rate morphology lavas (sheets, folded sheets and hackly lava surfaces), has limited colonization and no hot water venting was observed. The axis of the fissure ridge is marked by channelized sheet and curtain folded and hackly flows trending parallel to the ridge axis and some evidence for levee building along the margin of the channel. Orange-brown hydrothermal staining is prominent within the fissure ridge axis.
- This off-axis fissure ridge is very similar to a new fissure ridge investigated on CT#3 during the NH06 cruise at 9° 54.5'N, although the latter has a deep narrow eruptive fissure at its summit. New lavas from both fissure ridges ponded against the first off-axis fault east of the AST which is well documented in the sidescan sonar data for this area.
- The AST has changed (depth, width) in most of the locations we have measured it.
- Extant biological communities and some high temperature vents were covered by lava. In a few places, new flow covers the base of older chimneys and partially covers collapsed pieces of hydrothermal chimneys.
- None of the old Bio-Geo Transect Biomarkers deployed in 1992 were observed. HiT fluid loggers were recovered from M vent, Q vent and Ty vent, providing time series records that span from ~ 2 years before the eruption to a few months after it.
- The new lavas are very glassy and fresh looking; mostly aphyric and have very low vesicle contents (both crystal and vesicle contents are less than the 1991 flow based on shipboard hand specimen evaluation).
- Initial geochemical results suggest the new flow is a typical N-MORB derived from the same or similar source as the 1991-92 flows but that it is slightly more differentiated than the main 1991 flow.

Outstanding Questions:

- Was the eruption a single event, or did it comprise a series of pulses/episodes?
- What was the eruption duration?
- What is the total erupted volume and area covered?
- What causes large differences in erupted volume over short distances along axis?
- Does the eruption extend further south from 9˚ 46.3'N and/or further north of 9˚55.7'N (i.e., the limits established by the Alvin and TowCam surveys).
- Did the eruption concentrate in a few places, particularly where we observe a greater off-axis extent of new lava and areas of channelized flow?
- What is the intra-flow chemical heterogeneity of this eruption?
- What are the temporal and magmatic relationships between the off-axis fissure ridge eruptions (9° 53' to 54.5'N) to the axial eruptions.

Basalt Samples Recovered:

Young Flow	13	Probable Young Flow	6
Older Lavas	1	Probable Older Lavas	7

TowCam Bottom Observations: ~27 hours during 7 lowerings

AT15-6 Volatile Chemistry/CTD/Resistivity Probe Goals and Accomplishments
Marvin Lilley(UW)/Ronald Greene(NOAA/PMEL)

Goals

Our goals were 1) to collect as many gas tight samples as possible so that we could compare pre-eruption and post-eruption volatile concentrations; 2) to conduct a CTD cast and collect samples for helium and methane from a plume to compare with the New Horizon data; and 3) to deploy one or more resistivity probes in high temperature vents for long term monitoring of temperature and chloride concentration until November, 2006.

Accomplishments

We collected 16 gas tight samples which represent 8 separate hydrothermal vents. The gas was extracted from these samples and sealed in breakseal ampoules for return to shore based labs. Helium concentrations and isotopic ratios will be analyzed in the laboratory of John Lupton (NOAA/PMEL). In Marvin Lilley's laboratory (U. Washington) the concentrations of carbon dioxide, methane, ethane, propane, butane, hydrogen, carbon monoxide, nitrogen, oxygen, argon, neon, and nitrous oxide will be determined. We will also do carbon stable isotopic analyses on carbon dioxide and methane and stable hydrogen isotopes on methane and hydrogen.

Preliminary total gas data indicate that major changes have occurred in the volatile compositions of the vents we have sampled. For instance, Q vent now has about one-fourth the total gas as it had in November 2004. The gas concentrations at Q were relatively stable between 1991 and November 2004. The implication is that the connectivity of Q vent to a magma lens has been altered in a major way. In addition, fluid flow at M vent (about 200 m north of Q), which has historically also maintained high gas concentrations, has completely stopped.. In contrast the gas concentration at P vent has increased by about one-third since November 2004.

We conducted one CTD cast about 100 m east of P vent in a complex, four layered hydrothermal plume. The results of this cast have not yet been worked up. When complete the data from this cast will be compared to the data collected on CTD casts on the New Horizon cruise.

One resistivity probe was deployed in Io vent (375ºC) and will be recovered in November 2006 on Karen Von Damm's cruise. The instrument was programmed to record temperature and fluid resistivity data on a 35 sec interval.

Summary of *In situ* electrochemical analyzer (ISEA by AIS) data and discrete sample data
(George Luther, *Donald Nuzzio, Tommy Moore), University of Delaware and *Analytical Instrument Systems, Inc. (AIS)

We have three areas where chemical contributions were made. The first two are real time or *in situ* data collection experiments. First, an ISEA was used from *Alvin*. Second, a second ISEA was deployed at a diffuse flow site (marker #8). Third, discrete samples were obtained to measure Fe(II) and pH. They also were treated with basic Zn(II) to precipitate sulfide for measurement of acid volatile sulfide (H_2S and FeS) and Cr(II) reducible sulfide (mainly pyrite) in our laboratory back in Delaware.

Alvin – *in situ data collection*

Goals/Objectives

Based on our previous published work, we planned to coordinate collection of our chemical with the biological data of Drs. Lutz, Shank, Vetriani, Siefert and Taylor to better understand why different organisms reside in different (or similar) ecological niches. Also, we planned to prospect for warm diffuse flow waters because the detection limit for H_2S is about 200 nanomolar for the gold-amalgam working electrodes used.

Experimental design

To accomplish these goals, an *in situ* electrochemical analyzer (ISEA by AIS) was placed on *Alvin* and was mated with two gold-amalgam working electrodes, a counter electrode and reference electrode. Two gold-amalgam electrodes were mounted in a titanium wand on the port front side of the basket. Temperature and pH probes were also mounted in the wand. The pH probe is a new experimental design and was tested on all dives. The holster, which houses the wand, had an open bottom so that water flowing upwards could be monitored for sulfide and the discovery of diffuse flow and/or vent areas.

Accomplishments

On dive 4201, electrochemistry data showed that *Alvin* caused contamination of the water column as mud from the Gulf of Mexico cruise was still in the aluminum tubes that are the frame of the *Alvin* basket. During the cruise, sulfide was released from the muds and easily detected in the waters at the front of the basket as the submersible descended through the water column. Because a switch in *Alvin* malfunctioned, the dive was aborted. After this dive, George Luther and Anton Zafereo, from the *Alvin* group, cleaned the mud from the insides of the aluminum tubes.

On dive 4202, an electrical connection caused a malfunction that resulted in no data collection. This was corrected and data was collected on all subsequent dives.

On dive 4203, electrochemistry data were collected to maximize biological sampling and video analysis in diffuse flow areas. At the end of the dive, a diffuse flow area near old marker 82 was found with a temperature of 30 ^{o}C. *In situ* sulfide measurements indicated the site had near 1 mM sulfide concentration. Markers (8 and 11) were deployed and this site was eventually selected for INSECT and McLane pump deployments.

On dives 4204 and 4205, electrochemistry data were obtained; however, the electrode wand was not removed from its holster to collect data that would correlate with diffuse flow areas and biological features. The dive plan was not adhered to by the observers. Still, warm diffuse flow waters were observed because the wand was in a holster with an open bottom.

On dive 4206, electrochemistry data was collected to maximize biological sampling and video analysis in diffuse flow areas. In particular, data were collected (1) at coordinates X=4511; Y=77875 before the sediment trap was released and (2) at diffuse flow about 5m from Marker #10 where 3 sandwiches were deployed. Data were also obtained at the colonization area where markers #8 and 11 reside.

On dive 4207, electrochemistry data were collected to maximize biological sampling and video analysis in diffuse flow areas. Specifically, data were collected at the site prior to releasing the Siefert McLane pump near marker #11 (near old marker #82). Then data were collected to properly place TAMS and Rounds. Data were then collected at several areas along the diffuse flow fissure to ascertain optimal placement of the INSECT electrodes.

Unattended electrochemical analyzer for short and/or long term deployments (we use the term INSECT that was coined by one of the *Alvin* pilots) – *in situ data collection*

Goals/Objectives

We planned to deploy an unattended ISEA which would be recovered during our January, 2007 cruise. The system would use four gold-amalgam electrodes to measure O_2, H_2S, iron and sulfur species. Long term monitoring would document the chemical changes at the diffuse flow habitat so that a better understanding of colonization of microbes and macrofauna could be achieved.

Accomplishments

After dive 4206, the unattended ISEA from AIS (INSECT) powered by 4-24 V DC batteries was sent down on an elevator to marker #11 for a six month deployment. Four electrodes and temperature sensors were then placed in different diffuse flow areas at marker #11 on dive 4207. We plan to recover the system and download data in January 2007.

Lab based analyses for Fe(II), pH, sulfide and Cr(II) reducible sulfide

Goals/Objectives

We planned to help with chemical analysis of samples from major pairs. Fe(II) was analyzed by the ferrozine method without the addition of any reductant such as hydroxylamine hydrochloride.

Accomplishments

Thirty samples from major pairs (15 samples with some collected in duplicate) were analyzed for Fe(II) and a selection of these were analyzed for pH. Twenty-six of these samples were from vents and 4 were from diffuse flow. Several of these samples were treated with basic Zn(II) to precipitate sulfide and then frozen for subsequent analysis back home.

One basalt sample from dive 4202 had orange coloration. A few mg of orange material were scraped and placed into a plastic test tube. Ferrozine and hydroxylamine were added. A purple color developed overnight indicating that Fe(III) was present.

RESET06 Expedition R/V Atlantis/DSVII Alvin 15-6 Macrobiology Program Preliminary Summary and Highlights

Timothy M. Shank, Breea Govenar, Kate Buckman
Biology Department Woods Hole Oceanographic Institution

Richard A. Lutz
Institute of Marine and Coastal Sciences Rutgers University

The macrobiological activities and objectives of this cruise were integrated into the fluid and *in situ* chemical, geological, and the microbiological dive activities.

Summary of Activities

Objective 1. Deployment of microbial and metazoan colonization surfaces

The deployment of substrates in areas of active diffuse venting following the eruption was important to initiate studies to examine the linkages among microbial colonization, fluid chemistry, and faunal colonization. In order to collect and identify early colonizers following the 2006 eruption for a variety of future co-located ecological studies, we deployed 12 mesh substrates with self-recording Vemco temperature probes, referred to as TAMS (Temporal Autonomous Multi-disciplinary Substrates) in the Marker 8 (referred to as "TamTown") area, three round stainless steel mesh arrays ("Rounds") for microbial colonization (C. Vetriani), three and three plastic "Sandwich substrates" (L. Mullineaux) in the Bio9 and Marker 8 areas, respectively; and three plastic "Baby traps/sponges" (M. Bright) in the Marker 8 area. All of these substrates (see images below) were deployed either in or adjacent to diffuse venting areas. A short-term (4 day deployment) of two ARCO microbial traps were also deployed in the Marker 8 area to collect microbes associated with the flocculent expulsion of microbes associated with post-eruptive "snow-blower" type venting.

TAMS ROUNDS SANDWICH BABY-TRAPS

Objective 2. Linking microbial and faunal colonization and *in situ* habitat chemistry

Seafloor eruptions provide a unique opportunity to look at the evolution of habitat fluid chemistry and microbial and faunal colonization. In order to document the changes in microbial and faunal colonization

with habitat fluid chemistry over time, co-located *in situ* electrochemistry measurements and colonization studies were initiated to assess diffuse-flow habitat conditions and establish a baseline for future investigations of how these habitats develop chemically and biologically over time. The deployment of several of the substrates listed above as well as the collection of natural diffuse flow habitats where active colonization was occurring were coupled with *in situ* autonomous chemical measurements using the DLK electrochemical wand mounted on Alvin. See the Electrochemistry section of this report for a more complete description. In brief, short-term sampling *in situ* fluid chemistry where Sandwiches were deployed on dive 4206 near "Bio9" and where TAMS were deployed on Dive 4207 at Marker 8 were characterized with electrochemical and temperature measurements.

Longer-term sampling of *in situ* chemistry and coincident correlation with the development of post-eruptive communities was initiated using an autonomous *in situ* sensor, known as the IN situ Electrochemical Analyzer (ISEA or INSECT). This instrument (see Electrochemistry section) was deployed via an "elevator" for a 6-month duration, to be recovered in January 2007. Four working electrodes outfitted with Vemco temperature loggers were placed in two "natural" diffuse flow areas where colonization by "*Tevnia"* was evident as well as positioned adjacent to the mesh of two "non-natural" TAMS colonization substrates.

Objective 3. Larval/sediment Trap Mooring Recovery and Redeployment

To collect hydrothermal particulates and larvae to investigate the evolution of vent plume geochemistry and to quantify larval flux and temporal genetics of larvae, two sediment trap moorings (one with a RCM11 current meter) were deployed during the New Horizon 2006 response cruise were recovered on June 25 and 26 and redeployed on June 29. Each of the sediment traps cycled through the 21 collection cups successfully. Shipboard preliminary assessment (visual observation) of the collected material revealed cups containing flocculent/fuzzy "microbial" material, dark particulates and also crab (megalope) larvae. For the redepoyment, the cups will rotate every 6 days, and the moorings will be recovered in October 2006.

Objectivc 4. Characterization of Early Colonization

In order to identify the processes of initial faunal colonization, the distribution of initial and early colonists, the interaction of microbial communities and faunal settlement, and the subsequent development of biological communities, we collected basalt pieces from diffuse-flow likely to host early colonists (metazoan and microbiological). We imaged and examined the basalt under the microscope (and preserved for future microscopic, genetic, and ecological analyses). Both macro-and meiofaunal size fractions were preserved to provide detailed study of early succession in diffuse-flow habitats.

Objective 5. Establishment of Transect Areas

The establishment of a transect area using seafloor markers was one our biological goals. In the past these markers have been integral to guiding our biological and chemical studies and have provided a great efficiency on the seafloor for sub operations, facilitating our ability to quickly locate experiments and

sampling locations and provide infrastructure for all disciplines in addition to our specific biological goals. We intended to mark study areas and leave them "undisturbed" in order to examine the "natural" changes in communities for comparison with patterns observed following the 1991 eruption and for comparison to "disturbed" areas in this and other habitats. This goal was not accomplished, because the strategy for deploying markers was altered prior to the dive program as well as unforeseen difficulties with the operation of the marker deployer devices.

Objective 6. Trophic Studies of Post-Eruption Colonists

In order to examine temporal changes in trophic interactions (through stable isotope and gut content analysis), we deployed a crab trap on Dive 4203 at the Marker 8 area to collect mobile predator and scavengers. While brachyuran crabs were abundant in this area, neither crabs (and nor any other fauna) were collected in the trap after 4 days on the bottom.

Objective 7. Locating and Sampling Pre-Eruption Communities

In order to identify potential and available source populations for new colonizers in nascent diffuse flow areas, one of our goals was to locate and sample extant or pre-existing (preeruption) vent communities. With the possible exception of high-temperature chimney-associated fauna on chimneys that did and may have preceded the eruption, no confirmed preexisting communities were observed (see below). This objective was not successfully accomplished.

Macrofaunal Results and Highlights

Habitat Setting The 1991 eruption resulted in the formation of a well-defined primary eruptive fissure through which the majority of the macrobiological communities between 9°50.3 and 9°49.6'N were situated. The majority of venting habitats observed after the 2006 eruption are supported by hydrothermal activity through broken sheet flow and collapse talus (e.g., ~9°50.33'N and 9°49.9'N).

Diffuse Flow Communities Nascent diffuse flow communities in fluids up to 30°C consisted of *Tevnia jerichonana* (and perhaps other unidentifiable vestimentiferans) of variable size (none more than ~ 4 cm individual length were sampled or apparently observed), *Paralvinella pandorae*, polynoids, the limpets *Ctenopelta porifera* and *Gorgoleptis spiralis*. Observations of individual *Tevnia* were observed on the exposed surfaces of the basalt *in situ* as well as on the sides and bottom surfaces of collected basalt rocks. In general, *Tevnia* colonized basalt surfaces bathed in fluid flow with the greatest abundance photo-documented at the Marker 8 area. Recovered *T. jerichonana* ranged in size from 1mm to < 4 cm). *Paralvinella pandorae* and *Ctenopelta* were also prevalent with *T. jerichonana* in diffuse-flow areas.

Extant Communities While two disarticulated mussel shells were observed in the old Biomarker #82 area and empty *Riftia* tubes were observed on the western side of the axial trough, no confirmed extant communities were located during the course of the dive or fiber-optic programs. No systematic search was conducted at the BioVent, Mussel Bed, East Wall, Tica, or south of the old Biomarker #82 area within the BioGeoTransect. A and L Vents (~9°46.5'W) were visited and alvinellid communities were present on L Vent. *Tevnia jerichonana* colonists were observed and sampled around eruptive lava at the

base of L Vent. Empty *Riftia* tubes were clumped and scattered up to 200 m outside the western walls of the AST. A single ~0.75 m live *Riftia* was observed on basalt at the base of P Vent. No live *Riftia* colonists were confirmed.

Chimney-Associated Communities Alvinellid communities, including *Alvinella pompejana, Alvinella caudata*, copepods, polynoids (i.e., *Lepidonotopodium fimbriatum*), *Paralvinella grasslei*, *Hessiolyra bergi*, *Hesiopina vestimentifera* polycheates, and *Peltospira operculata* limpets were collected in high-temperature sulfide habitats, including "Q Vent", "P Vent", "L Vent" and high-temperature venting structures were sampled north of new Marker #8. Three mussels (*Bathymodiolus thermophilus*) were recovered from seemingly inactive sulfide structure from A Vent).

Composition and distribution of mobile fauna Small brachyuran crabs (~ 2 cm; much less than commonly observed) were highly abundant in the 9°50.3, 9°49.9, and 9°46'N areas. Zoarcid fish (in a range of sizes) were more abundant than bythidids, although bythidids were abundant as aggregations in "fish holes" at the base of Q Vent. The shrimp *Alvinocaris lusca* was highly abundant in areas near actively venting areas, but not observed directly in diffuse flow. Amphipods (*Halice* sp.) were observed in swarms above diffuse venting through lava remnants and between lobate lavas. Swarms were not observed above rigorous diffuse flow.

RESET06 (AT15-6) Microbiology Team Report

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In general terms, we are interested in studying the response of the microbiological communities to the recent eruption at 9˚N. We are particularly interested in chemoautotrophic microorganisms, which form the basis of deep-sea hydrothermal vent ecosystems. Never is this more apparent than after an eruption, which basically wipes out the lush animal communities typically associated with these systems. Thus, the recent eruption represents a unique opportunity to study the microbial communities after a major disturbance and to follow their succession through time.
During this cruise we investigated the microbial communities in three main habitats: a) sulfide chimneys, b) surfaces of newly exposed basalt, and c) fluids emanating from diffuse flow vents. The obtained samples were shared between the laboratories of Sievert/Taylor/Summons and Vetriani, and subsequent analyses will be undertaken that complement each other. The data obtained in this cruise will serve as a benchmark for future cruises and analyses to document the changes in the microbial communities occurring over time. In the following, we have listed the goals, samples taken, and preliminary results of the two groups (Vetriani and Sievert/Taylor/Summons) separately.

Vetriani, Voordeckers (Rutgers University)

The goals for this cruise were: 1) Obtain samples of hydrothermal sulfides and fluids for a) inoculation of cultures both aboard ship and at Rutgers University laboratories to isolate, identify, and characterize novel microorganisms, hydrogen oxidizers/nitrate reducers (anaerobic) and thiosulfate oxidizers (aerobic and anaerobic) and MPN work and b) survey of functional genes (nitrate reducers and for methanogens/methanotrophs) and RNA transcripts (nitrate reduction genes). 2) Deployment of stainless steel mesh cultivators in diffuse flows in order to promote the growth of biomass for later retrieval and study.

Samples

Sulfides

Dive	Site	Sample ID	Storage	Used for inocula (temp)
4202	Q vent	4205-5 sulfide	-80ºC, 4ºC	Y (65ºC)
4202	Q vent	4205-5 Alvinella tubes	-80ºC, RNAlater	Y (28ºC)
4203	P vent	4203-3	4ºC	Y (65ºC, 28ºC)

4205	L vent	4205-2	-80ºC, 4ºC	Y (65ºC, 28ºC)
4205	A vent	4205-4	-80ºC, 4ºC	Y (65ºC)
4207	Io vent	4207-4	RNA later	N

Filtered samples

Dive	Sample type	Storage	Used for Inocula
4203	Diffuse flow	-80ºC, RNAlater, 4ºC	Y (28ºC, room temp)
4204	Mud slurp	-80ºC, RNA later	N
4204	Ambient seawater	-80ºC	N
4205	Black filaments	-80ºC	N
4206	Diffuse flow	-80ºC, 4ºC	Y (65ºC)
4207	Diffuse flow, piece of filter obtained with large volume pump (Sievert)	RNA later	

Samples for RNA work, DNA work, and later inoculations were stored using RNAlater,

Deployments

- 3 stainless steel mesh cultivators cultivators were deployed in diffuse hydrothermal flows at Marker 8/11 area

Inoculations

Positive enrichments

Dive	Sample type (ID)	Medium/Temperatue	# of transfers	Notes
4202	Sulfide alvinella tube (4202-5)	Nitrate reducing/28ºC	3	
4202	Sulfide alvinella tube (4202-5)	Aerobic Thiosulfate oxidizing/28ºC	3	Acid production
4202	Sulfide (4202-5)	Nitrate reducing/65ºC	1	
4202	Sulfide (4202-5)	Anaerobic Thiosulfate oxidizing/65ºC	1	
4203	Sulfide (4203-3)	Nitrate reducing/65ºC	3	
4203	Sulfide (4203-3)	Aerobic Thiosulfate oxidizing/28ºC	1	Base production
4203	Diffuse flow (major 20)	Aerobic Thiosulfate oxidizing/28ºC	3	Acid production
4203	Diffuse flow (major 20)	Aerobic Thiosulfate oxidizing/room temp	2	Acid production

4205	Sulfide (4205-2)	Aerobic Thiosulfate oxidizing/28ºC	1	Base production
4206	Diffuse flow (major 04)	Nitrate reducing/65ºC	3	EPS production

Headspace gas composition for nitrate reducing and anaerobic thiosulfate oxidizing media was H2/CO2 (80:20).

Future Work

Sulfides and Fluid samples (Rutgers laboratory)
-Extraction of DNA and RNA from samples stored, respectively, under -80ºC and RNAlater. DNA: Survey of functional genes, nitrate reducers and for methanogens/methanotrophs. RNA: Look for RNA transcripts of functional genes (nitrate reduction).
-Inoculation of sulfide and fluid samples at Rutgers lab for isolation, identification, and characterization of organisms from cultures positive for growth and for MPN work.

Inoculations (Rutgers laboratory)
-Isolation, identification, and characterization of organisms from cultures positive for growth.

Deployments (R/V Atalntis/Rutgers laboratory)
-Retrieval of stainless steel mesh cultivators in Jan 2007. Collection, examination, and storage of biomass from cultivators for RNA and DNA work as well as for inoculation.

Sievert, Taylor, Summons, Molyneaux, Sylva (WHOI, MIT)

Work during this cruise was carried out under the auspices of the NSF grant "Collaborative Research: Microbiology and Biogeochemistry of Autotrophic Microbes in the Subsurface at Hydrothermal Vents: Filamentous Sulfur Producing Bacteria". The recent discovery of microbial populations beneath the deep ocean floor has far reaching implications in biology and has a potentially strong influence on a variety of biogeochemical processes. Presently, the subseafloor biosphere is a poorly defined component of hydrothermal systems; we need better constraints on the nature and extent of this ecosystem and its contribution to primary production at hydrothermal vents.
Our studies entail an integrated microbiological and geochemical study of the abundance, distribution, and diversity of filamentous-S producing microbes (Arcobacter), and an assessment of their ecological role at 9˚N EPR. These microbes have been identified to have contributed to the production of white flocculent material that was discharged in great amounts from so-called "blizzard" or "snowblower" vents in response to the eruption at 9°N on the East Pacific Rise in 1991. The recent eruptive event at 9°N EPR with possible output of subsurface biomass is perfectly suited to further our understanding of this peculiar process. Our studies are designed to test the following general hypotheses:

1) **The prime habitat of filamentous-S-forming microbes is the shallow subsurface, and snowblower vents represent a snapshot sample of that persistent biosphere.**
2) **A significant portion of CO_2-fixation in the subsurface is carried out by epsilon proteobacteria related to *Candidatus* Arcobacter sulfidicus by means of the reductive TCA cycle.**
3) **The organisms forming filamentous-S produce a distinctive geochemical signature (biomarker, isotope) that is deposited and may eventually become part of the geological record.**

During this cruise we were particularly interested in finding and sampling so-called snowblower vents, which were a characteristic feature subsequent to the eruption in 1991. However, although the water in the ASCT was milky and also contained flocculent material, we were not able to find any snowblower vent during the duration of the cruise. This could be either attributed to the possibility that the phase of intense snowblower activity has ceased or to the limited number of dives we had available to survey the area. In lieu of a snowblower vent, we identified a diffuse vent site for more detailed studies. This site lies within the former Marker 82 area and was marked with a new marker #8 (x:4608, y: 77581, Hdg 310, Depth 2503). Extensive diffuse flow was observed at this site with temperatures ranging between 10 and 30˚C. New lava flow covered the area and in areas of diffuse flow the new basalt was covered with white staining, in particular the underside of collected basalt samples. In addition, tubeworms have already started colonizing the underside of these rocks. As a first step to address the above stated hypotheses, the following approaches were pursued:

- **Cultivation of microaerophilic, chemoautotrophic microorganisms from diffuse flow.** Fluid samples were obtained with majors. Different media were inoculated and dilution series performed. Enrichments were incubated at a variety of ranging between 20 and 70˚C.
- **Deployment of ArcoTrap colonization devices to initiate growth of filamentous sulfur forming microbes.** However, no extensive colonization observed at sited deployed, possibly due to short duration of deployment (4 days) and, more likely, relatively low temperature of the diffuse flow (10-17˚C). However, a very fine white film formed on the inside and outside of one of the colonization devices. Swabs of this material contained amplifiable DNA which should reveal which organisms are early colonizers of this diffuse flow. Small limpets were found on the colonizer that developed the biofilm and were provided to Tim Shank's group.
- **Incubation with ^{13}C bicarbonate to identify autotrophic microbes.** Water from diffuse flow sampled with two pairs of majors (~1.2 l; additional ~900 ml were filtered for further analyses in Vetriani's lab, ~130 ml from each bottle was used for chemical analyses by vonDamm's group, 50 ml each were used for cultivation for Vetriani's and Sievert's group, and 50 ml was used for chemical analyses by Luther's group) was incubated at two different temperatures (31˚C and 50˚C) in the presence of ^{13}C-labeled bicarbonate for a total duration of seven days. A variety of electron acceptor additions and head space gas phases were added to

stimulate growth of autotrophic microbes. Subsamples were taken for lipid biomarker and nucleic acid analyses.

- **Filtering of water with large volume pump in situ to obtain large amounts of biomass for lipid biomarker analyses and molecular biological work.** We had one successful deployment and operation of large volume McLane pump. The device was transported to and from the bottom via elevator and transported to the site of sampling by Alvin. The pump intake nozzle was placed directly into the fairly vigorous diffuse flow emanating from the vent. A small temperature logger at the tip of the intake nozzle recorded temperature before, during and after sampling. The 1 min interval temperature record revealed a high frequency variability of ~5°C with a mean temperature that ranged between 13 and 16°C. The slowly varying average temperature appeared to be a tidal variation in the temperature record, though correlation with tides at 9˚N will be necessary to confirm this. During filter sampling there was no indication of significant seawater intrusion (as would be evidenced by an abrupt lowering of the temperature recorded during filtration by the sensor at the tip of the intake). During deployment the pump filtered ~1400 l of vent fluid, resulting in enough biomass for detailed molecular biological and organic geochemical analyses. A quarter of the filter was fixed in RNA-Later and given to Vetriani to look at gene expression; the remainder was frozen at -80°C for subsequent molecular analysis. Initially we had planned for at least two deployments of the pump, but because of time and logistical constraints this was not possible. In the future, it is planned to obtain more large volume samples at different vents to further our understanding of the microbial communities living in the subseafloor.

In addition to these primary objectives, we were also interested in studying the colonization of newly exposed surfaces at vents by microbes and the interactions between microbes and the colonization by invertebrates, the latter in collaboration with Tim Shank (WHOI). For this we sampled basalt that had signs of microbial colonization (samples 4203-5, 4203-6, 4205-3, 4207-3). Subsamples were taken to study the composition and diversity of microbes potentially colonizing the basalt at diffuse flow areas. We observed extensive white staining, possibly of microbial origin. Samples were prepared for subsequent nucleic acid extraction as well as fluorescence in situ hybridization (FISH).

Furthermore, we sampled chimneys in collaboration with Rachel Haymon (UCSB) to correlate distribution and diversity of microbes in chimneys with mineralogy. For this we obtained chimneys which were first subsampled for microbiology (cultivation, DNA/RNA extraction, FISH) and subsequently dried for further mineralogical analyses. The samples obtained for later analyses are: 4202-3, 4202-5, 4203-3, 4203-7, 4205-2, 4205-4, and 4207-4.

Preliminary results

Cultivation

In total 160 tubes were inoculated and incubated at 4 different temperatures: 2 @ 20°, 43 @ 30°C, 47 @ 50°, 17 @ 65°C, and 51 @ 70°C

So far the following enrichements were successful (as of 7/2/06, 10:00 am)

Dive	Sulfur Source	Headspace	Sample	Incub T (°C)
4202	S_2O_3	N/C/O/H	sulfide	70
4202	S_2O_3	N/C/O/H	*Alvinella* tube	70
4203	S_2O_3	N/C/O	Majors water	30
4205	none	H/C/O	sulfide	50
4205	S_2O_3	N/C/O/H	sulfide	70
4205	S_2O_3	N/C/O/H	*Alvinella* tube	70
4206	S_2O_3	N/C/O	water from majors	30

Headspace key:
N/C/O/H = 80% N_2/20% + CO_2 + 20% air in headspace + H_2 overpressure
N/C/O = 80% N_2/20% CO_2 + 20% air in headspace + 80% N_2/20% CO_2 overpressure
H/C/O = 80% H/20% CO_2 + 20% air in headspace + H_2 overpressure
N/C = 80% N_2/20% CO_2

DNA extraction/PCR

DNA was successfully extracted on the ship from chips of glass possessing the "white stain" indicating possible microbial origin. Subsequent PCR further confirmed that biofilm is composed of bacteria, and that archaea are absent. Furthermore, DNA was successfully extracted from swabs of the inner side of one of the ArcoTrap colonization device put out for the collection of filamentous-sulfur forming microbes. Based on subsequent PCR, the thin white film appears to be of bacterial origin. It will be interesting to see how similar or different this biofilm is to the one observed on new basalt.

Future Work in the Laboratory

Future analyses will include the extraction of nucleic acids and lipids from the various samples and subsequent analyses to characterize the microbial communities. We will complement 16 rRNA based surveys for general diversity assessments with the analyses of specific functional genes, e.g. for autotrophic carbon fixation. Determining which organisms have taken up ^{13}C labeled bicarbonate in our incubations will provide important information on which organisms are responsible for autotrophic carbon fixation in situ. In addition, attempts will be made to isolate and subsequently characterize microorganisms from enrichments, also providing information on autotrophic microorganisms inhabiting this system. Rachel Haymon will perform mineralogical analyses on the sampled and dried chimneys. These data will then be correlated with data obtained by our and Vetriani's group.

RESET06 (AT15-6) June-July 2006

Hydrothermal Fluid Chemistry

K.L. Von Damm, M.J. Bates, S.K. Carmichael, F. Meana-Prado, J.M. McDermott
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Objectives:

- sample as many of the previously sampled high temperature hydrothermal vents as we could find
- sample any new high temperature hydrothermal vents
- recover the Hobos deployed in March 2004 in 15 high temperature vents
- re-deploy Hobos in the current high temperature vents
- although we did not have a manifold sampler, sample areas of diffuse flow
    - that had been our previous sampling sites for coupled chemical/ biological sampling
    - that were particularly intense
    - that were potential future coupled chemical/biological study sites
- obtain good point temperature measurements on all of the above
- assess whether the abundance &/or location of hydrothermal venting had been significantly changed by the recent eruptive activity
- assess how this eruption compared to the 1991-2 eruptions in terms of the effects on the hydrothermal system.

Accomplishments:

1. Hydrothermal fluids were collected from the following high temperature vents: Q, P, Io, V, L, A and of diffuse (low temperature) flow from the area formerly known as BM82, which is adjacent to Io vent. A total of 32 water samples were collected, in addition to a sample of local ambient seawater, and 16 gas samples from which we will analyze the water (total 49).

2. All of the sampled fluids had chlorinities (significantly) below the value for local ambient seawater.

3. The quality of the samples was poorer than we had hoped and typically obtain. Sample quality was compromised by the high temperature probe, used as a guide to sampling, having a ground and therefore being unusable on most dives. The loss of dive time due to a variety of reasons and the large number of tasks assigned to each dive also meant we often had severe time constraints related to sample collection. In 1991 poor sample quality was a result of no chimney structures being present, this was not the case for most of the high temperature vents in 2006.

4. In many cases the fluids were exiting from the same sulfide structures present before the 2006 eruption(s), although the composition of the fluids is distinctly different than when these structures were last sampled in November 2004.

5. The maximum measured fluid temperature was 387°C, measured in the P vent fluids. This is close to the two phase curve for seawater which is 389°C at this depth.

6. Shipboard measurements suggest the fluids are a bit more acid (lower pH) than is typically observed, in agreement with the 1991 observations.

7. Although the H_2S concentrations are not as high as was measured in many of the vent fluids in 1991, they are unusually high with likely end member concentrations of several tens of millimoles/kg.

8. SiO_2 concentrations are also unusually low, although again not as low as observed in some fluids in 1991.

9. Only three Hobo recording temperature probes were recovered (M, Q, Ty) all recorded during the January seismic events, but all had ceased recording sometime prior to the cruise during spring 2006. We did not visit all the vent sites where probes had been deployed in March 2004, and did not have sufficient time to search for the probes at other vents we did visit (L, V). We therefor remain hopeful that additional probes will be recovered during our Fall 2006 cruise.

10. Our general impression is that as of June 2006 there was more diffuse flow in more locations than prior to the 2006 eruption(s), but less than at the time of the 1991 sampling.

Overall, our results are consistent with one or more eruptions having occurred a number of months prior to June 2006. Of the areas visited, our results also suggest the Hole-to-Hell area, and perhaps the area immediately south of it (i.e., the previous BM 8-82 area) are the most hydrothermally active, although the area immediately surrounding V vent (9°47.x'N) also has a large amount of hydrothermal activity, not fully explored during this cruise.

Frustrations:

1. Because of time constraints we did not visit, or even 'fly be' previously long term study sites, that the New Horizon work also suggested were very hydrothermally active, such as Biomarker 141/2 and Tube Worm Pillar. We never got south of BM 82, and the 1992 transect had markers up to 212.

2. The New Horizon and Knorr work also suggested the area south of Tube Worm Pillar and north of V vent was also very hydrothermally active, and we were unable because of time constraints to get into this area with either the sub or camera tows.

3. We did not get north of M vent, which is now extinct, hence we do not know if the hydrothermal vent further to the north of it, Biovent, has also potentially lost its heat supply and is also extinct.

4. We did not have time to visit the Tica site, which had the lowest chlorinity fluids in November 2004, and looked to be a site of increasing hydrothermal importance.

5. The Bio9 area had really been the loci of the highest temperature venting fluids and an increasing number of black smokers. No fluids were sampled in this area, although an area of venting was found. This was a critical site for us to have sampled, but we did not have the dive time needed to actually sample this challenging locale.

Prior to the cruise K.L. Von Damm had put together a set of specific questions related to the hydrothermal system. They are included below, as well as the answers to them as of the end of the cruise.

Hydrothermal Questions for AT15-6

1. Brine ***must*** have been stored within the oceanic crust over the last 15 years. The 1991 new eruptive fluids were clearly fluids that had ***not*** been stored in the oceanic crust (*i.e., they were* ***not*** *derived from stored brines*). Are the 2006 new eruptive fluids derived from stored brines? Are there any signs of these stored brines venting?

Analyses to determine whether or not the 2006 hydrothermal fluids were derived from stored brines in the shore-based lab. As all of the fluids sampled had chlorinities significantly less than seawater, there was no evidence for venting of these stored brines.

2. In 1991 within ~1 month after the eruption there were clear signals for the dissolution of halite (low Br/Cl and elevated Na/Cl wrt seawater), but by 11 months later this signal was gone. Are there chemical signatures for halite dissolution in these perhaps 3-6 month old fluids?

This question also awaits analyses to be completed in the shore-based lab.

3. We had extremely high H_2S levels in the 1991 vent fluids. Is this 'typical'? (i.e., is it true in 2006 too)

While the H_2S concentrations measured in 2006 were significantly below those measured in some vent fluids in 1991 (i.e., ≤40 mmoles/kg vs ≤110 mmoles/kg), they are still unusually elevated by a factor of 3-4 above more "typical" values. It also appears that as in 1991, the 9°46'N area is higher in H_2S than the area around 9°50'N. This was also true in late 2004, the last time these fluids were sampled prior to the eruptive event. Whether or not the lower concentrations compared to 1991 are a fundamental difference between these two eruptions, or a result of the difference in timing of the sample collection relative to the eruptions is not yet clear.

4. In 1991 we sampled 'days-to-weeks' and 1 year old fluids. We have no constraints on their evolution between these two time points, although we do know the compositions were changing at least weekly when first sampled.
   - did the T continue to increase?
   - did the H_2S continue to increase?

- did the Cl continue to decrease?
- did the Si continue to decrease?

What do these changes tell us about the reaction zone's location, temperature, etc.?

To address this requires better constraints on the timing of the 2006 (& 2005?) eruptions. Our measured temperatures and H_2S concentrations are lower, and the Cl and Si higher than in 1991, suggesting these parameters did not continue to increase/decrease respectively in the interim.

5. In the 1991 sampling minimal water-rock reaction was observed. Is this still true 6 months out?

This will require shore-based analyses.

6. Are the more volatile transition metals preferentially mobilized during this early eruptive period?

This will require shore-based analyses.

7. Is there a signal for buried organic matter at sites where we know communities existed? (i.e., Tica, Biovent, BM 82, BM141/2)

This will require shore-based analyses. Of these sites, only BM82 was visited/sampled on this cruise.

8. Has TWP been re-activated? Do we see any evidence that the 'plugging' deposits are present in the 'new' fluids?

The Tube Worm Pillar (TWP) site was not visited on this cruise, so the answer to this must await the Fall 2006 cruises.

9. Is there a signal for buried sulfide deposits at places like Bio9? also for anhydrite at diffuse flow sites like BM82 or BM141/2?

No samples were collected from the Bio9 or BM141/2 sites. Both high and low temperature fluids were collected from the BM82 (Io) site. To address this will require shore-based analyses.

10. Do the foci of high T venting remain in roughly the same locations (as observed form 1989-1991)?

Yes. In fact in many cases the high T fluids are venting from chimneys that pre-date the 2006 eruption(s) (Q, P, V, L, and A vents). Of the vent sites visited, only M vent was found to have gone extinct after the eruption.

11. Is BM141/2 still a diffuse flow area or is it now high T?

The BM141/2 site was not visited on this cruise, so the answer to this must await the Fall 2006 cruises.

12. Do fluids from M vent look like eruption (dike) derived superimposed on deep venting?

M vent is no longer venting fluids.

13. After the 1991 eruption the northern vents (M, Q, etc.) exhibited very high CO_2 and He

concentrations and He/heat ratios. Is this still the case?

M vent is now extinct, and shipboard data suggest that the amount of total gas (which is primarily CO_2) I fluids from Q vent has dropped significantly. He concentrations and He/heat ratios await shore-based analyses.

14. Are these fluids as reducing as in 1991?

This will require shore-based analyses.

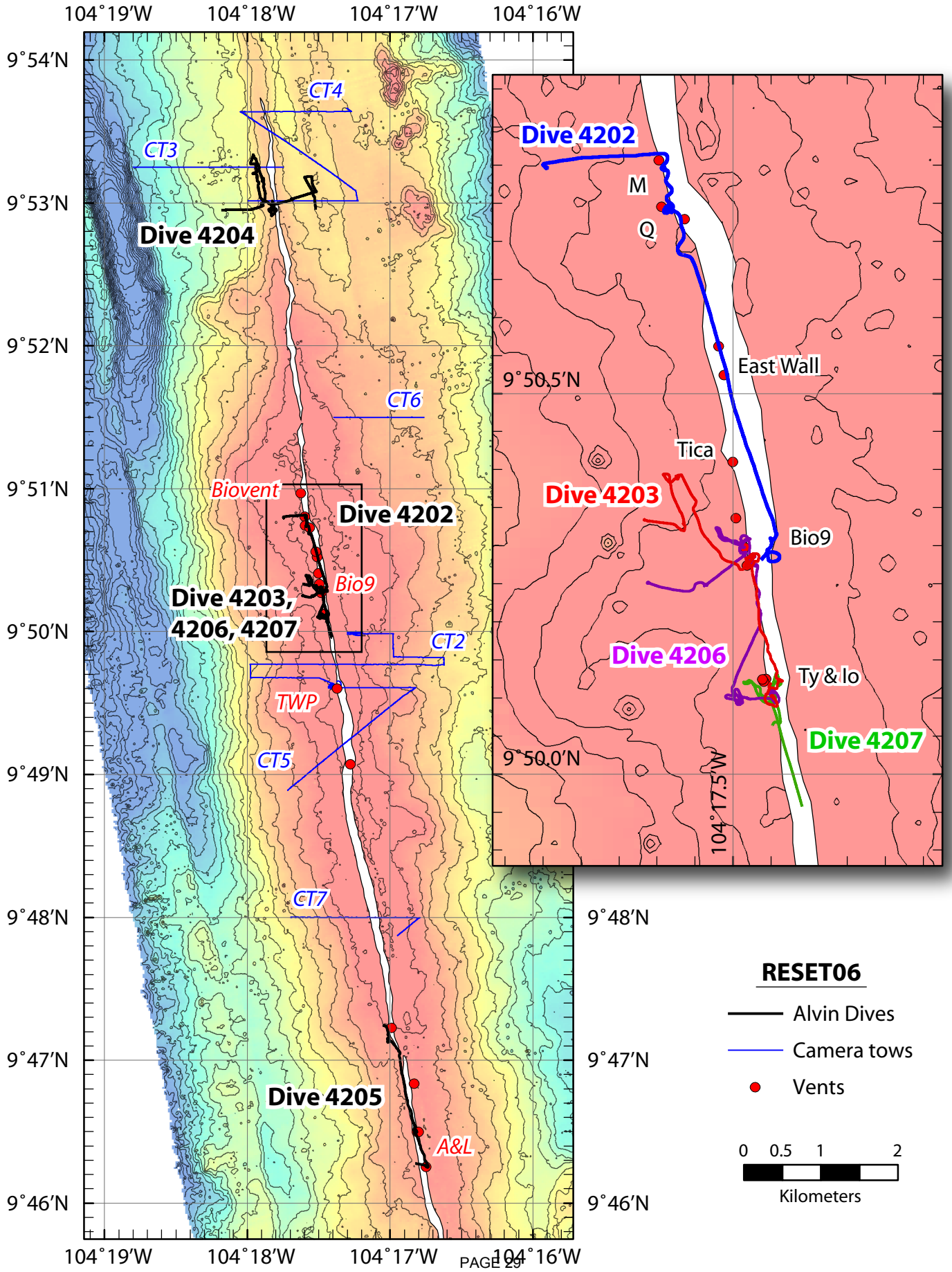
APPENDIX 1

Alvin Dive Plan, Observer Summaries, Video Log, arranged by dive

Dive Summary

	Dive #	Day	Date	Pilot	Port Observer	Stbd Observer	Location
1	4201	Su	25-June-06	Bruce Strickrott	Marv Lilley	Rich Lutz	Ground problems, no science accomplished.
2	4202	Mo	26-June-06	Mark Spear	Karen Von Damm	George Luther	M vent and Q vent, down to Bio9.
3	4203	Tu	27-June-06	Bruce Strickrott	Tim Shank	Stefan Sievert	P south through BM82.
4	4204	Wed	28-June-06	Mark Spear	Dan Fornari	Ken Rubin	9°53'N and off axis to scarp (east).
5	4205	Th	29-June-06	Bruce Strickrott	Karen Von Damm	Mike Perfit	L vent and north to V vent - southern extent of 2006 flow.
6	4206	Fr	30-June-06	Mark Spear	Marv Lilley	Rich Lutz	Tica, Bio9 and south to TWP.
7	4207	Sa	1-July-06	Bruce Strickrott	Tim Shank	PIT	Deployments at BM82, finish up in transect.

AT15-6 Alvin Dives



Dive Plan 4201 - 25 June 2006

Port: M. Lilley ***Starboard:*** R. Lutz ***Pilot:*** B. Strickrott

On Bottom Target: x = 4251 y = 78954 9˚50.83392N 104˚17.67956W

Objectives: Find M, recover Hobo, sample, deploy markers and settling experiments, transit via Q, and Tica to Bio9 vent area.

1. Turn on ECHEM at 200m, leave on as descend to bottom, positioned in its holster.
2. Turn on magnetometer at 1000m and do a 3 min spin clockwise and then counterclockwise, note time of spin.
3. Land on bottom ~100m west of the ASCT and 50m north of M vent.
   - turn on cameras including downlooking with booms (fly 4-5m up)
   - pick up a piece of 2006 flow at the landing site (or as soon as you encounter it)
   - deploy a marker at the sample site.
4. Transit ~100m E to the ASCT, cross as slowly as possible to the east wall with IMAGENIX on to get ASCT crossing profile.
5. Transit 50m south along top of east wall to M vent.
6. **At M vent:** **x=4401** **y=78904**
   - collect sulfide and place in grey biobox Hdg=300 Depth=2505m
   - measure T with hi T probe
   - 2 majors pairs
   - 2 gas tights
   - pick up basalt (if covered with bio-material place in grey biobox)
   - recover Hobo (#6)
   - deploy Hobo
   - deploy marker.

In Nov. 2004 M Vent was 366˚C.

7. Look around M vent area for snowblower &/or other areas of intense diffuse flow.
8. If there is 'appropriate' (vigorous, post-eruptive, white stuff - if a snowblower is found that is the 1st priority) diffuse flow at M Vent:
   - measure its T with hi or lo T probe to find the 'hottest' place
   - ECHEM to determine placement of following
   - collect 1 majors pair
   - collect 1 gas tight
   - deploy setting experiments as follows:
     - [3 'babytraps' and 3 'sandwiches'] [4 'TAMS' and 2 'rounds'] in >20°C flow
     - ECHEM on center of each TAM and round
     - 4 TAMS in ambient (non-venting) spot (move slightly?)
     - ECHEM on center mesh of each ambient TAM
   - filter slurp snowblower material
     (watch meter voltage carefully)
   - slurp early settlers off rock surface (amphipods too if present)
     - pick-up basalt with early settlers and place in grey biobox
   - deploy marker(s) as appropriate.

(If there wasn't an appropriate diffuse flow site at M, look for one while heading south.)

9. Transit south along top of E wall to Q vent.
10. **At Q vent:** **x=4408** **y=78791**
    - collect sulfide and place in grey biobox Hdg=54 Depth=2504m
    - measure T with hi T probe
    - 1 majors pair
    - 1 gas tight
    - recover Hobo (Green - old style)
    - deploy Hobo
    - sample basalt
    - deploy marker(s).

In Nov. 2004 Q vent was 332˚C.

11. Get down into ASCT.
12. *Transit to Mussel Bed/East Wall* *x=4541* *y=78502* *d=2501*
    - *evaluate as possible diffuse site* *x=4557* *y=78430* *d=2503*

13. **Transit south to Tica Vent.** **x=4580** **y=78181**
14. At Tica vent: Hdg=209 Depth=2511m
    - collect sulfide and place in grey biobox
    - measure T
    - 1 majors pair
    - 1 gas tight
    - recover Hobo (Red-old)
    - deploy Hobo if appropriate
    - sample basalt
    - deploy marker(s).

In Nov. 2004 Tica vent was 353˚C.

15. If diffuse flow/settlement experiment was not done at M, do it here if there is an appropriate site.
16. Look for *Riftia*.
17. If any *Riftia* remain, place in clear biobox.
18. *Drive back and forth across ASCT at wall height with IMAGENIX.*

19. **Transit south to Bio9 Vent Area:** **x=4618** **y=77974**
20. At Bio9 Vent Area: Hdg=108 Depth=2511
    - recover Hobos (#3=Bio9, #1=Bio9', #4=Bio9")
    - measure current T with hi T probe
    - deploy marker(s)
    - evaluate for resprobe deployment
    - if slurps not done, or settling experiments not deployed yet, do that here.

In Nov. 2004 Bio9 was 386°C, Bio9' was 384°C, Bio9" was 376°C.

21. Drive back and forth across ASCT at wall height with IMAGENIX.

Continue south as time permits.

BE SURE TO IMAGE AND DOCUMENT EVERYTHING AND LOOK FOR FUTURE SAMPLING SITES. DROP ADDITIONAL MARKERS AS NEEDED and to test launchers.

Basket load:

2 marker launchers with 14 markers
downlooking camera
ECHEM probe and can
Alvin hi T probe
Alvin lo T probe
slurp-filter
slurp-carboy
3 grey bioboxes
1 clear square biobox
2 scoops
5 majors pairs
5 gas tights
8 TAMS
2 rounds
3 baby traps
3 sandwiches
2 hobos

ECHEM laptop and power cord/charger in ball.

Origin is 9˚08'N and 104˚20'W.

Dive Transcript
Starboard Observer
R. Lutz

Dive 4201 June 25, 2006

Pilot- Bruce Stickrott; port observer- Marv Lilley; starboard observer: Rich Lutz

Took scans with ECHEM during Alvin's descent to bottom. ...started scans at approximately 700 m below the surface and ran scans 1-161...(File Body Name was 4201 and I may have changed it during course of scans to 420 lA) alternating between electrodes 1 and 2 scans showed peaks in sulfide peaks less pronounced as proceeded through dive (see below)

1605:42 on bottom at edge of collapse (X: 4285; Y: 78857) flow had dusting of sediment

1607 No ground detector Bruce will try and trouble shoot problem

1634.37 Finished running scans 162-171 with ECHEM while sitting on the bottom

We remained on the bottom, unsuccessfully trouble shooting the ground detector problem until surfacing at about 1750 GMT (1 :30 was the time on the ECHEM computer)

At 1752 GMT after leaving the bottom, I started running a series of ECHEM scans as we ascended the following represents a summary of the scans run (used time on the computer 1752 GMT = 1:52 time on computer, which is given below

Computer Time	Depth	Scan #' s	Electrode
1:52	2187m	1-5	2
1:56	2055	6-10	1
1:57	2035	11-15	1
1:59	2000	16-21	2
2:00	1970	22-27	2
2:02	1918	28-32	2
2:04	1852	33-37	2
2:08	1763	38-42	2
2:10	1712	43-47	2
2:12	1665	48-52	2
2:14	1615	53-37	1
2:16	1563	58	bad scan???
2:17	1540	59-64	2
2:19	1478	65-69	2
2:22	1396	70-74	2
2:28	1257	75-79	2
2:37	1000	80-84	2

2:41	952	85-89	2
2:46	843	90-94	2
2:51	752	95-98	2
2:52	719	99-103	1
2:54	678	105	bad scan???
2:56	642	106-110	2
3:02	524	111-115	2
3:11	360	116-119	2
3:15	220	120-125	2

VIDEO LOG

Dive 4201 June 25, 2006

Pilot- Bruce Stickrott; port observer- Marv Lilley; starboard observer: Rich Lutz

Port Cam 1 of 1

NO GOOD VIDEO CLIPS ANYWHERE ON TAPE
GROUND DETECTOR BROKEN: ENTIRE DIVE SPENT AT LANDING SITE: X: 4285; Y: 78857 (TOP LAB COORDINATES)

Stbd Cam 1 of 1

NO GOOD VIDEO CLIPS ANYWHERE ON TAPE
GROUND DETECTOR BROKEN: ENTIRE DIVE SPENT AT LANDING SITE: X: 4285; Y: 78857 (TOP LAB COORDINATES)

Dive Plan 4202 - 26 June 2006

Port: K. Von Damm ***Starboard:*** G. Luther ***Pilot:*** M. Spear

On Bottom Target: x = 4251 y = 78954 9˚50.83392N 104˚17.67956W

Objectives: Find M, recover Hobo, sample, deploy markers and settling experiments, transit via Q, and Tica to Bio9 vent area.

1. Turn on ECHEM at 200m, leave on as descend to bottom, positioned in its holster.
2. Turn on magnetometer at 1000m and do a 3 min spin clockwise and then counterclockwise, note time of spin.
3. Land on bottom ~100m west of the ASCT and 50m north of M vent.
   - turn on cameras including downlooking with booms (fly 4-5m up)
   - pick up a piece of 2006 flow at the landing site (or as soon as you encounter it)
   - deploy a marker at the sample site.
4. Transit ~100m E to the ASCT, cross as slowly as possible to the east wall with IMAGENIX on to get ASCT crossing profile.
5. Transit 50m south along top of east wall to M vent.
6. **At M vent:** **x=4401** **y=78904**
   - collect sulfide and place in grey biobox Hdg=300 Depth=2505m
   - measure T with hi T probe
   - 2 majors pairs
   - 2 gas tights
   - pick up basalt (if covered with bio-material place in grey biobox)
   - recover Hobo (#6)
   - deploy Hobo
   - deploy marker.

In Nov. 2004 M Vent was 366˚C.

7. Look around M vent area for snowblower &/or other areas of intense diffuse flow.
8. If there is 'appropriate' (vigorous, post-eruptive, white stuff - if a snowblower is found that is the 1st priority) diffuse flow at M Vent:
   - measure its T with hi or lo T probe to find the 'hottest' place
   - ECHEM to determine placement of following
   - collect 1 majors pair
   - collect 1 gas tight
   - deploy setting experiments as follows:
     - [3 'babytraps' and 3 'sandwiches'] [4 'TAMS' and 2 'rounds'] in >20°C flow
     - ECHEM on center of each TAM and round
     - 4 TAMS in ambient (non-venting) spot (move slightly?)
     - ECHEM on center mesh of each ambient TAM
   - filter slurp snowblower material
     (watch meter voltage carefully)
   - slurp early settlers off rock surface (amphipods too if present)
     - pick-up basalt with early settlers and place in grey biobox
   - deploy marker(s) as appropriate.

(If there wasn't an appropriate diffuse flow site at M, look for one while heading south.)

9. Transit south along top of E wall to Q vent.
10. **At Q vent:** **x=4408** **y=78791**
    - collect sulfide and place in grey biobox Hdg=54 Depth=2504m
    - measure T with hi T probe
    - 1 majors pair
    - 1 gas tight
    - recover Hobo (Green - old style)
    - deploy Hobo
    - sample basalt
    - deploy marker(s).

In Nov. 2004 Q vent was 332˚C.

11. Get down into ASCT.
12. *Transit to Mussel Bed/East Wall* *x=4541* *y=78502* *d=2501*
    - *evaluate as possible diffuse site* *x=4557* *y=78430* *d=2503*

13. **Transit south to Tica Vent.** **x=4580** **y=78181**
14. At Tica vent: Hdg=209 Depth=2511m
    - collect sulfide and place in grey biobox
    - measure T
    - 1 majors pair
    - 1 gas tight
    - recover Hobo (Red-old)
    - deploy Hobo if appropriate
    - sample basalt
    - deploy marker(s).

In Nov. 2004 Tica vent was 353˚C.

15. If diffuse flow/settlement experiment was not done at M, do it here if there is an appropriate site.
16. Look for *Riftia*.
17. If any *Riftia* remain, place in clear biobox.
18. *Drive back and forth across ASCT at wall height with IMAGENIX.*

19. **Transit south to Bio9 Vent Area:** **x=4618** **y=77974**
20. At Bio9 Vent Area: Hdg=108 Depth=2511
    - recover Hobos (#3=Bio9, #1=Bio9', #4=Bio9")
    - measure current T with hi T probe
    - deploy marker(s)
    - evaluate for resprobe deployment
    - if slurps not done, or settling experiments not deployed yet, do that here.

In Nov. 2004 Bio9 was 386°C, Bio9' was 384°C, Bio9" was 376°C.

21. Drive back and forth across ASCT at wall height with IMAGENIX.

Continue south as time permits.

BE SURE TO IMAGE AND DOCUMENT EVERYTHING AND LOOK FOR FUTURE SAMPLING SITES. DROP ADDITIONAL MARKERS AS NEEDED and to test launchers.

Basket load:

2 marker launchers with 14 markers
downlooking camera
ECHEM probe and can
Alvin hi T probe
Alvin lo T probe
slurp-filter
slurp-carboy
3 grey bioboxes
1 clear square biobox
2 scoops
5 majors pairs
5 gas tights
8 TAMS
2 rounds
3 baby traps
3 sandwiches
2 hobos

ECHEM laptop and power cord/charger in ball.

Origin is 9˚08'N and 104˚20'W.

Dive Summary 4202 - 26 June 2006 - **Port Observer: K. Von Damm**

Port: K. Von Damm ***Starboard:*** G. Luther ***Pilot:*** M. Spear

Objectives: Find M; recover Hobos, sample, deploy markers and settling experiments, transit via Q, and Tica to Bio9 vent area.

For reference: Local time = 0800; GMT = 1400; Local = GMT-6

Dive 4202 ended up being the first of this series to get to the seafloor and do science. Due to severe ground fault issues on 4201, while it got to the seafloor, the ~1.5 hours of bottom time was spent trying to fix ground issues at their landing site. When these could not be resolved that dive then returned to the seafloor without achieving any of its objectives. Therefore 4202 basically had the same dive plan as 4201.

As 4202 was essentially the first dive , and the first dive within a newly deployed transponder net, one of the inital goals for this first dive into a changed landscape was to establish our location and tie our navigation to the earlier work at this site. With this objective in mind, out first goal was to find M vent which had been imaged in the New Horizon camera tows and unequivocally identified by the Hobo imaged in that vent that we (KVD) had deployed in March 2004.

The sub departed the surface at ~1411. At ~1417 we turned on the ECHEM system at a depth of 200m. At ~1443 at a depth of 1014m we turned on the magnetometer and started our first spin which was counterclockwise and began at a heading of ~360. We finished our spins at ~1512 at a depth of 1821m.

When we landed on the seafloor the surface position had us at x=4140 y=78897, which would place us about 100m further west than our intended landing site, which was to be 100m west of the axis. At our landing site, ~150-200m west of the ASCT we appeared to be mostly on old (1991) flow with some (estimated) 1 year old flow. There was no clear pattern of which was on top or underneath, just some small tongues of 2006 flow, covering maybe 20% (?) of the surface. While sitting at our landing site at 1538 (0948) we noted grounds on the downlooking (Dan) camera, the high temperature probe, and the basket light. Before leaving our landing site we collected **Rock Sample # 1** (time = 1610, x=4135 y=78897 d=2504 hdg=145). This sample of basalt, of what appeared to be the 2006 flow, was stowed in the port aft milk crate. We attempted to deploy **Marker #1** at this site (time=1617, x=4135 y=78897 d=2504 hdg=145), but the marker launcher did not appear to be working. [N.B. When we got to the surface Marker 1 was no longer in the launcher, so it is not clear if it was indeed deployed at this site, or fell out some time later during this dive.]

We then began to transit east towards the ASCT and M vent. We had the IMAGENIX running as we crossed the axis, over to the top of the east wall. As our landing site was slightly north of the y-coordinate for M vent, once we got to the top of the east wall, we turned to head slightly south. We then arrived quickly at M vent.

Our coordinates at M vent were x=4418 y=78878, compared to the previous values of x=4401 y=78904. We observed three sulfide structures at the M vent site, all lined up along the top of the east wall - all were extinct, the Hobo was in the middle one (ID ing that unequivocally as M vent), and the white cap (alvinellids?) located on the northernmost structure and seen in the New Horizon tow cam photos was no longer present. There were several striking changes at the M vent site. First, the vents were extinct (M vent had been imaged in the 1989 ARGO work so it had pre-dated and survived the 1991 eruption). Second, where M had been on the top of the east wall of the ASCT, there was now collapse behind it, stranding M and the other sulfide structures on more of a remnant, separated by an at least several meter wide channel from the wall, i.e., the top of the ASCT wall had collapsed behind , i.e., to the east of the location of M vent and the other sulfides. On the top of the remnant on which M now stands, 2006 flow had clearly swirled around the base of the sulfide, and there was a rim of new flow standing up, showing where it had flowed up to, and then clearly drained out and collapsed, leaving a several cm thick rind of new flow in an almost vertical position (side of a collapsed lobate perhaps?).

We excavated the M vent structure, partly to retrieve the Hobo and also partly to see if we could get fluid flow started. We observed a small amount of diffusely flowing fluids exiting in one area of the chimney. A crab was crawling around in it which suggested it was very low temperature. As the high T probe was not working, we used one of the majors pairs with an ICL on it to measure the temperature. As it recorded only 2.7°C, barely above ambient, we did not collect a sample. In working around M, we had a volunteer basalt sample (**Rock Sample #2**) land in the front of the mesh basket at time=1711 hdg= 117 depth=2504. We retrieved **Hobo #6** from M vent. We also retrieved the sulfide that the Hobo had been in (**Rock Sample #3** x=4416 y=78879 d=2504 hdg=109) and placed it in the aft stbd milk crate (it was too large to place into the small grey bioboxes that were available and the clear biobox was full of deployment experiments). We then collected a sample of the new basalt that had flowed around the base of M vent (which was a mere oxidized sulfide stump at this point), **Rock Sample #4** (x=4419 y=78878 hdg=16) and placed it in the stbd aft milk crate, the same place as the sulfide from this same site. There was no orifice or flow into which to place a new Hobo. To unequivocally mark this as M vent, we deployed Marker #13 (time=1755 x=4418 y=78878 hdg=17) by using the manipulator (i.e., we did not try to launch it from the marker launcher). It should be noted that the depth when sampling at M was previously 2505m, and was now 2504m, unchanged within the precision of the measurement.

As there was no diffuse flow at M we did not deploy the colonization experiments as there was no appropriate setting for them.

We started the 2nd set of video tapes at 1800.

We departed M vent at ~1803 to transit the ~100m south to Q vent, which also sits atop the east wall.

We quickly found Q vent (x=4420 y=78791 in new nav, x=4408 y=78791previously) and observed 3 sulfide structures coated with white. In the area immediately surrounding Q we also observed some diffuse flow. In at least one of these diffuse flow areas an amphipod swarm was noted. There was one white covered sulfide structure on the wall leading down into the ASCT that we perused looking for the Hobo deployed at this site. There was a second sulfide structure relatively close to this one essentially on the ASCT rim, and then a third (and larger - 8-10m(?)

high) structure further back from the rim. These 3 structures have been observed previously at this site, the one furthest from the rim being sometimes referred to as X5'. All three were at least oozing fluid (partly indicated by the white material covering all of them), if not outright venting black smoke. (We did not go and closely examine all of them.) The Hobo was located in the sulfide located right on the top of the east wall rim, marking it unequivocally as Q vent and we set-up to sample it and retrieve the Hobo from it. As there was a strong current, in order to fluid sample we had to set-up on the side away from the Hobo. The first thing we did was collect the sulfide orifice **Rock Sample #5** which broke into several small pieces (time=1854 x=4426 y=78775 hdg=218 d=2501m stowed in grey biobox #1). We then proceeded to collect water samples. A we had no hi T probe, all of the temperatures were measured with the ICLs on the majors bottles. We fist collected the **Blue Majors Pair** (time=1908 x=4426 y=78776 hdg=206 d=2501). The ICL read a max of about 300°C, but I have a question as to the validity of this measurement as the ICL was reading negative numbers at first. We next collected the **White Majors Pair** (x=4426 y=78775 hdg=216 d=2502). The maximum temperature recorded with either ICL was 318°C. We then collected the Yellow Gas Tight (time=1936 x=4426 y=78775 hdg=220 d=2502), we weren t sure if we heard it fire and the ram was not retracted until the bottle was back in the basket which may compromise its sample quality. We then collected the **Black Gas Tight** (time=1944) which we heard fire and should be a good sample. We finally collected the **Orange Gas Tight** at 1946. We then deployed **Hobo #20** in this orifice (time=1954 x=4426 y=78775 hdg=223 d=2502).

We had tried to use the ECHEM probe earlier in the dive, but there was a problem with the Hg on the electrodes (or lack therefore). We did hold the probe ~0.5-1m above the Q orifice (time =2001) when we finished sampling the water in an attempt to poison the electrodes and therefore regenerate them, but this was unsuccessful and hence the probe was not used for the remainder of the dive.

We then set-up to recover the **Green Hobo**, which took a while as it was cemented into the structure, below the level at which we had been sampling. We were able to retrieve this (old style) Hobo, although not without breaking off the tip. Finally we picked up a basalt sample of the new flow **Rock Sample # 6** (time=2026 x=4429 y=78776) from near the base of Q. We then departed the Q vent area to head south (170) towards Tica, Bio9, etc. Because of the problems with the marker launcher (i.e., it wasn t working) we did not deploy a specific marker here, but the placement of Hobo #20 in the sampled orifice unequivocally marks Q vent. As Q is on the edge of the wall, depths can vary when sampling it depending on how the sub is positioned. Once again the old depths (2504) and new depths (2502) are not significantly different within their attendant errors.

While M was dead, my general impression was that Q was at least as hydrothermally active as before, if not perhaps even more so in terms of the amount of (diffuse) fluid flow.

We were starting to run short of time and power, so we decided to head south in a relatively quick manner. We were in sight of the bottom at all times, but did not stop to investigate particular things/places observed. Hence the next part of my transcript will just indicate where/when places of particular interest (usually more robust diffuse flow marked by

white material) was observed. As to our navigation during this drive south, it should also be noted that we crossed the baseline the surface was using to track us. The surface called down to tell us they thought we were going north when we were actually going south. We had ***NO*** confusion in the sub as to where we actually were. It is the DVLNAV x-y s that appear on the overlays and they incremented as expected. Hence the x-y s mentioned below are the ones from the overlay and are correct.

At ~2050 (x=4519 y=78345) **lots** of white stuff, and some dead Riftia tubes. This is a place worth investigating further.

At, and just prior to 2051, (x=45xx y=78325) we passed through an area of robust fluid flow and lots of white stuff.

At 2059 (x=4561 y=78140) we observed lots of dead ***Riftia*** tubes.

For other areas of interest during the transit south, it would be best to view the frame grabber or watch the video tapes directly. Some of the transit was done in the ASCT, some up on the top of the east wall. It was mostly (if not entirely) 2006 flow that was observed (i.e., lots of new lava including out of the ASCT as they were lobates). Also I repeatedly checked the co-ordinates versus the historical one for places like East Wall, Mussel Bed, etc., and it was my impression that many of the areas of more intense diffuse flow and white stuff were close to these previous areas of fluid flow and animal communities.

It was a high priority for this dive to reach the Bio9 area, if not to sample ourselves, at least to obtain the information needed for subsequent dives. As we came into this area there was decidedly more murk in the water - almost like being in dilute and somewhat greyish milk. Visibility was reduced. As we came into the Hole-to-Hell area my impression was that it was a very confusing place. Our approach was not down the ASCT, and of course there was not the track of Biomarkers starting with number 1 to follow. It would be best to examine the dive track for our exact position. Eventually I realized we were likely too far south and too far to the west so I asked Mark to drive east to the top of the east wall. We did this over what seemed to me a deeper and likely broader ASCT. We were fast running out of time. We got to the top of the east wall and turned to go north. I could see some white structures so I asked Mark to turn west, into the ASCT. One of the large white structures turned out to be a large basalt remnant (~10-15m high, 5-7m across?) covered in white. I knew it was basalt because of both the bathtub rings on it, as well as its general shape and morphology. This was some distance out my port view port. We really had to leave the bottom. As I turned to look aft out my viewport, I noted just in front of the remnant (i.e., just a bit further west) was a large spire covered in white. Based on its morphology I think this was a large sulfide structure likely at least oozing fluids. These observations were made at 2116 (x=4550 y=77909). At the time I noted I thought this might be Bio9, but thinking about the location in the ASCT and near a remnant, and the y-co-ordinate, during the ascent I realized this was most likely P vent.

Weights away at 2117.

Dive 4202 June 26, 2006
Pilot- Mark Spear; port observer- Karen von Damm
report by starboard observer: George Luther

GMT	**comments**
1410	start dive
1416	at 200 meters – began echem checks but echem did not provide data (due to wiring problem); T and pH probes working on echem wand magnetometer turned on and Alvin rotated
1453	tapes installed
1529-1548	noticed ground at 2360 meters; grounds at Dan Cam, hi T probe, upper basket light – all secured
1531	100 meters from bottom
1537	location south and west of M vent as bottom was reached; noticed shrimp and crabs
1608	noticed new flow and collapsed features; picked up rock sample #1 – basalt x=4135 y=78897 hdg= 144 depth 2504 placed basalt in port aft milk crate; tried to deploy port marker #1 twice but could not tell if it deployed – on return marker #1 was not on Alvin. Still photos 2006_06_26_16_14_01 and 2006_06_26_16_14_05 of std camera.
1631	moving to M vent; noticed new flow and collapsed features, white floc also prevalent
1644	**arrive at M vent** T = 2.7 ^{o}C with some flow; crabs in area
1654	recover HOBO # 6 at M vent x=4417 y=78881 hdg= 49 depth 2504
1711	after some excavating at middle structure which was knocked over, we recovered rock sample #2 – basalt from M vent which fell into front of Alvin's basket (Fe^{3+} yellow-orange solid covered the basalt) x=4415 y=78879 hdg= 111 depth 2503
1716	rock sample #3 – sulfide from M vent with part of HOBO attached x=4416 y=78879 hdg= 109 depth 2503 placed in std aft milk crate; rudder problems noticed
1751	rock sample #4 – basalt from M vent x=4418 y=78879 hdg= 16 depth 2504 placed in std aft milk crate; marker did not release from std system Still photos 2006_06_26_17_51_24 and 2006_06_26_17_51_29 of std camera.
1756	placed marker #13 manually; changed tapes x=4418 y=78878 hdg= 17 depth 2503
1759	tapes changed
1803	**leave M vent; heading for Q vent** noticed new flow and collapsed features, white floc also prevalent

815	**arrive at Q vent** which is active with 2 chimney structures from which black smoke emanated; one has a spindled spire. *Alvinella* were noticed on all structures. Amphipod swarm noted.
1819	noticed double tower structure (second structure); work proceeded on tower with spindle, which later fell during HOBO deployment/recovery.
1854	rock sample #5 – sulfide from Q vent x=4426 y=78775 hdg= 218 depth 2501 put 4 pieces in forward grey biobox; *alvinella* tubes also present on sulfide
1905	Water sampled from new orifice created after spire fell blue major pair fired; ICl 300 ^{o}C x=4426 y=78776 hdg= 206 depth 2501
1926	Water sampled – White major pair fired; ICl 318 ^{o}C x=4426 y=78776 hdg= 210 depth 2502
1939	yellow gas tight fired x=4426 y=78775 hdg= 219 depth 2502
1944	black gas tight fired x=4426 y=78775 hdg= 211 depth 2502
1947	orange gas tight fired x=4426 y=78775 hdg= 214 depth 2502
1954	HOBO #20 deployed in Q vent x=4426 y=78775 hdg= 223 depth 2502 2 photos from std camera 2006_06_26_ 19_56_12 and 2006_06_26_19_56_16
2000	deployed echem wand about 0.5 to 1 meter above vent. T max was 90 ^{o}C and was let to rest at location with 60 ^{o}C. On return Hg was on electrodes and sulfide was deposited and detected on the electrodes. Wiring problem likely for electrode problems. 6 photos from std camera 2006_06_26_20_01_41 through 2006_06_26_20_01_52a
2023	recovered old HOBO from Q vent – decision made to break it x=4424 y=78774 hdg= 119 depth 2502
2029	rock sample #6 – basalt from Q vent x=4429 y=78776 hdg= 92 depth 2504 Still photos 2006_06_26_20_27_17, 2006_06_26_20_27_31 and 2006_06_26_20_27_38 of std camera. placed between second and third grey bioboxes
2035	**left Q vent for Bio9**; many empty *Riftia* tubeworm tubes observed near TICA; noticed white floc material especially North of TICA and possible diffuse flow; rudder came back about half way through transit.
2105	**arrive near Bio9** (or P vent); Karen reported possible vent in distance but we were recalled to the surface
2117	dropped weights to return to surface
2250	surface

starboard pan and tilt camera recorded collection and placement of all samples.
Still external photos taken of 3 rock samples.
No *Tevnia* noticed on dive.

VIDEO LOG

Dive 4202 June 26, 2006
VCR #1
Pilot- Mark Spear; port observer- Karen von Damm; starboard observer: George Luther

Port Cam 1 of 3

GMT	X,Y	comments
15:37:05*	4215;78923	down-looking sit has great shot of collapse
15:57:45	4140;78897	sitting at young lava flow - lobate
16:10:20	4135;78897	collecting rock sample 1 from fresh lobate
16:24	4143;78909	small collapses in new lobate; light sediment dusting, upper lobes might be somewhat less sedimented
16:40	4426;78898	AST collapse is visible
16:41	4424;78892	small brachyuran crabs
16:44*	4413;78882	M-vent surrounded by new lava
16:49*	4418;78881	HOBO in M vent

Port Cam 2 of 3

1759	4418;78878	Marker 13 on bottom at M vent….marker deployed
1809	4434;78827	Following south along east wall of AST
1814	4431;78777	Arriving at Q
1823*	4414,78767	captured video of Q
1835*	4422;78769	alvinellid on Q chimney
1836*	4424;78770	hobo at Q
1846*	4426;78776	another view of hobo at Q
1854		4436,78775sulfide sample into grey biobox then majors sample, then other water samples as per diver logs

Port Cam 3 of 3

2000	deployed echem wand about 0.5 to 1 meter above vent. T max was 90 ^{o}C and was let to rest at location with 60 ^{o}C. On return Hg was on electrodes and sulfide was deposited and detected on the electrodes. Wiring problem likely for electrodes. 6 photos from std camera 2006_06_26_20_01_41 through 2006_06_26_20_01_52a
2023	recovered old HOBO from Q vent – decision made to break it x=4424 y=78774 hdg= 119 depth 2502
2029	rock sample #6 – basalt from M vent x=4429 y=78776 hdg= 92 depth 2504

	Still photos 2006_06_26_20_27_17, 2006_06_26_20_27_31 and 2006_06_26_20_27_38 of std camera.
	placed between second and third grey biobox
2035	**left Q vent for Bio9**; many empty tubeworm tubes observed near TICA
2105	**arrive near Bio9** but did not observe active vent; Karen reported possible vent in distance but we were recalled to the surface
2117	dropped weights to return to surface
2250	surface

starboard pan and tilt camera recorded collection and placement of all samples.
Still external photos taken of 3 rock samples.

VIDEO LOG

Dive 4202 June 26, 2006
VCR #2
Pilot- Mark Spear; port observer- Karen von Damm; starboard observer: George Luther

Stbd Cam 1 of 3
No best hits clips

Stbd Cam 2 of 3
4202s_1.dv* lava lapped around base of M vent
4202s_2.dv*……Q vent
4202s_3.dv*,,,,,,,Lava at base of Q vent and HOBO probe in top of Q vent
4202s_4.dv*…..bythitid fish at the base of Q vent
4202s_5.dv*…..hot water at Q vent and HOBO probe in top of Q vent
4202s_6.dv*……black smoke at top of Q vent and HOBO probe in Q vent

Stdb Cam 3 of 3

Dive Plan 4203 - 27 June 2006

Port: T. Shank ***Starboard:*** S. Sievert ***Pilot:*** **B. Strickrott**

On Bottom Target: x = 4418 y = 78121 9 50.382N 104 17.588W

Objectives: Release sediment trap near Tica: Bio9, south through former Biogeotransect to assess and sample venting and associated fauna and substrates. Recover/deploy Hobos, markers and various experiments.

1. Turn on ECHEM at 200m, leave on as descend to bottom, positioned in its holster.
2. Turn on magnetometer at 1000m and do a 3 min spin clockwise and then counterclockwise, note time of spin.
3. On way to bottom turn on CTFM to find sediment trap wire and follow to bottom
4. Land on bottom
   release sediment trap
   turn on cameras including downlooking with booms (fly 4-5m up)
   pick up a piece of 2006 flow at the landing site (or as soon as you encounter it)
   deploy a marker at the sample site.
5. Transit E to the ASCT, cross as slowly as possible to the east wall with IMAGENIX on to get ASCT crossing profile.
6. Transit south along top of east wall to Bio9 area **x=4618** **y=77974**
7. At Bio9 Vent Area: Hdg=108 Depth=2511
   recover Hobos (#3=Bio9, #1=Bio9', #4=Bio9")
   collect sulfide and place in grey biobox
   measure current T with hi T probe
   2 majors pairs
   2 gas tights
   deploy Hobo
   pick up basalt (if covered with bio-material place in grey biobox)
   deploy marker(s)
   evaluate for resprobe deployment.

In Nov. 2004 Bio9 was 386°C, Bio9' was 384°C, Bio9" was 376°C.

8. Look around Bio9 vent area for snowblower &/or other areas of intense diffuse flow.
9. If there is appropriate (vigorous, post-eruptive, white stuff - if a snowblower is found that is the 1st priority) diffuse flow at Bio9 vent area:
   measure its T with hi or lo T probe to find the hottest place
   ECHEM to determine placement of following
   collect 1-2 majors pair
   collect 1-2 gas tights
   deploy setting experiments as follows:
      [3 babytraps and 3 sandwiches] [4 TAMS and 2 rounds] in >20°C flow
      ECHEM on center of each TAM and round
      4 TAMS in ambient (non-venting) spot (move slightly?)
      ECHEM on center mesh of each ambient TAM
   deploy arco trap
   filter slurp snowblower material
   (watch meter voltage carefully)

pick-up basalt with early settlers and place in grey biobox
deploy marker(s) as appropriate.

(If there wasn t an appropriate diffuse flow site at Bio9, look for one while heading south.)

10. Drive south through the former transect, retrieving Hobos and evaluating future sampling objectives that meet future and continue (past) time series sampling sites, including:

P area
recovery Hobo (#10)
measure current T with high temperature probe
if bottle not filled or Hobo not deployed , leave it here

Alvinellid Pillar
recover Hobo (#14 - old style)
measure current T with hi T probe

BM82
recover Hobo (#12 - old style)
measure current T with hi T probe

Io
recover Hobo (#8)
measure current T with hi T probe

BM119

BM141/2

TWP & Y

deploy mini-transects here?

set imaging baseline?

Drive back and forth across ASCT at wall height with IMAGENIX.

Continue south as time permits - to Tevnia hole?

BE SURE TO IMAGE AND DOCUMENT EVERYTHING AND LOOK FOR FUTURE SAMPLING SITES. DROP ADDITIONAL MARKERS AS NEEDED and to test launchers.

NOTE: On Dive 4202:

M	old x:	4401	new:	4418	17m further east
	old y:	78904	new:	78878	26m further south

Basket load:

2 marker launchers with xx markers
downlooking camera
ECHEM probe and can
Alvin hi T probe
Alvin lo T probe
slurp-filter
slurp-filter
3 grey bioboxes
1 clear square biobox
2 scoops
4 majors pairs
4 gas tights
8 TAMS
2 rounds
3 baby traps
3 sandwiches
2 ARCO traps
2 hobos
1 crab trap

ECHEM laptop and power cord/charger in ball.

Origin is 9 08'N and 104 20'W.

Alvin Dive 4203
Dive Report
June 27th, 2006

Pilot: Bruce Strickrott
Port Obs: Tim Shank
Stbd Obs: Stefan Sievert

Time	Description
1609	250m DLK on.
1612	363m Stefan scanning the water column
1614	Maggie on and turning to port; Electrode 1 looks good, #2 not so good
1620	Hi-T grounded 800m
1629	**x4334 y77941** 950m 8 ground 26 to hull
1630	1000m – spinning to port til 1638
1638	1225m – spinning to stbd til 1643
1645	**x4339 y77967** 073 127m to Sediment Trap
1647	x1500m scans 66&67 electrode #2 and then back to #1
1657	1823m scans 68 to 77 on electrode #1- little oxygen
1700	1900m scans 79-85 oxygen there and then gone **x4341 y78009** 2020m turning east 200meters away
1706	2050m scans 85-90 strange 500m off bottom
1714	2280m DanCam downlooking camera ground 8
1717	250m from mooring- framegrabber on- (puffy smoke visible in water column-100m off)
1720	Cameras on, lasers on- floc in water column
1720	**x4380 y78026** very murky with billows of material passing by in the water column. Sheet flow out to port- this is fresh- newly erupted lava with a contact here with older lobate flow. Framegrabber on. Nice contact here. Lobates. One shrimp and a lone tubeworm tube. Wow, really fresh glass coming up over these lobates and little fingers coming out of the end of the lobates- one brittle star- lava less than 2 feet in thickness.
1723	**x4385 y78030** 097 100m to sediment trap to be released.
1736	**x4378 78025** hdg 097 the trap is 100m away. Moving to the east over fresh lavas with a few contacts.
1738	fresh flow with a glassy sheen to it- also “fallout sediment” on top. Some staining between the lobates- looks like iron staining. Lobate field with elongate lobates running along the axis on the submarine.
1739	2499m seeing *Riftia* tubes without dwellers- tubes look a bit scorched actually- they do NOT look like they were capture in the flow, rather perhaps pushed out here. Might have been 4 *Riftia* tubes in a swail between two lobates. **x4440 y78017** more Riftia tubes and small collapses- cool collapse the whole thing just dropped down- none of the plates turned over when it collapsed- still have not seen a crab yet- okay bruce has seen a couple.
1741	**x4450 y78007** at mooring #1drop weight- ~100m south of mooring #2- circular weight.
1751	x4456 y78072 Hdg324 2500m Deployed Marker #12 next to Basalt sample #1 and #2.

1755 **x4456 y78022** just took a **basalt sample (#1**) hdg324 fresh basalt, and deployed Marker 12- the piece is the size of a baseball. Took another **basalt sample (#2)** in the same location but of the lip of the collapse- placed in bottle basket with sample #1. Lots of great lava tunnels- we're crossing the blowout adjacent to bio9 area- big collapses with large and numerous lava tubes; chaotic terrain, and remnants. Rim of collapse here has 4 lava tunnels. Note: there were many *Riftia* tubes near the Marker 12 sampling site.

1756 Coming over large collapse area- might be the AST wall proper- placing DVL Target #56 here. More Riftia tubes here and the first one seen buried by lava. Long tubes. One by itself, 2 together, now 4 together- sheet flow with some folds, one galatheid crab on a Riftia tube- all fresh lava. One zoarcid and more dead Riftia tubes- big peninsula of a collapse remnant- fresh lobates on top of this peninsula.

1759 **x4422 y78100** Got a contact here between fresh and old lobates, stray Riftia tubes 2500m depth; hdg 339. Another Riftia tube.

1807 **x4423 y78129** 319 2498m at mooring #2

181750 pulled pin on mooring #2- heading to the surface- one Riftia tube near that mooring.

1819 x4435 y78138 Heading to Bio9 which is at **x4550 y77909**. Fresh lobates.

1819 **x4443 y78138** 2498m shallow collapses and first brachyuran- very small. Little fingers/buds coming off the lobates- lots of nematocarcinid shrimp- seeing a couple every few meters; more empty Riftia tubes and lots of little buds off these elongate lobates that are oriented at 158 hdg. Very glassy. Synaphobranchid fish and iron-oxide staining- just saw a Riftia down low with it's plume intact around the margin- the rest was blown out- whoa.

1822 x4480 y78096 On the edge of the AST hdg158 2499m- came over big collapse with big sheet flow below; altitude is 7m so total of 9 meters to the bottom. Just amazing- that Riftia with a frayed plume- like a cigar in a cartoon when it blows up. Nothing but sheet flow. This whole crossing was sheet flow. Just see one brachy and one *Riftia* tube; water column has been murky since we came into the AST. So much collapse and it's all new- one galatheid. Remnant that was once active- iron-oxide stainging with nematocarcinid shrimp on it. Baby brachy. 2504 is the full depth of the AST. Have not seen any venting yet. Remnant lip here- this may be the east wall at **x4468 y78038** so doing a nice crossing of the AST here. Fresh lobates on the other side here. This could be a false AST- need to stay on this heading. 4550 77909 is what we are heading for.

1825 **x4468 y78063** hdg228 coming over lava remnants

1828 **x4476 y78007** lots of little brachs and fresh glass and smokier here in the water column. We went through the breakout area known to be around Bio9 and it is still full of collapse with big sheet flows in the bottom of the collapses- amazing collapses. Port monitor is not working. Very shiny glass. Sheet flow below that swirls into a ropey flow. I've only seen one zoarcid so far…another galatheid. Nothing but sheet flow with folds and swirls, very little collapse…another galatheid. Hdg 162; **x4493 y77975**; 2499m, 2504m to the floor. These collapses now just go on and on. Couple of more galatheids. Lots of talus, very chaotic. Looks like a sheet flow overflowed the margin here. Have not seen Riftia tubes in a while. All the brachs are really small. More buds coming out of low-relief lobates.

1833 x4539 y77919 2499m 10meters from "P Vent" position. Seeing lots of small brachs; sheet flow covering the central AST floor. Hdg 160 as we cross the AST- large galatheid; Loads of brachs- really small one- less than two inches, I'd say. Smoky

outside coming from right to left across the sub. Coming up to a collapse wall in front of us- following the murk- some huge galatheids- bottom falls away to port big time- into the abyss- I can't believe- total depth is 2504 and the bottom just drops out to port – it's a smoky pit. Numbers of crabs picking up. It just goes down. Galatheids increasing.

1836 **x4564 y77897** we just turned almost to the east where it even gets deeper. 2504 right now but going down- high concentration of crabs- never seen it this high- can see nothing out front- the bottom just drops. 2510m to the floor- murky water.

1838 **x4580 y70711** 2513m depth and P Vent right in front of us. Black smoke coming from the base. This thing is enormous. Black smoke coming from a beehive structure- seeing "F1" marker- a quarter bucketlid sandwiched between the two western most spires- there are three chimneys here.

1839 **x4596 y77909** 2511 total depth

1840 **x4587 y77935** some alvinellid tubes on top- white almost covering the structure- shimmering water coming out of the structure. Flying by it now. Microbial staining on the seafloor around the base of these structures. There is a swail around the base- in the swail there is sheet flow in a north-south direction. There is a needle-like structure with lots of friable-looking spires on the top diffusing black smoke. The needle leans over at a 45° angle. Patchwork of microbial staining around these vents- 9 meters tall (x4579 y77932) shimmering water coming out all over the largest structure.

1846 target 57 **x4345 y77922** hdg345

1852 **x4571 y77928** 9 meter tall structure; hdg150 looking at the needle we've got the big sulfide structure out in front of the basket- a lot of that "olive-colored microbial mat" material on the floor here. This is basalt on the floor- white scree and crabs- don't see a lot of diffuse flow on the seafloor- diffuse flow coming off the side. See some small brachs. Don't see any colonization except for one Riftia. Current is not so strong here.

1856 **x4576 y77922** hdg035 2509m 1.4m alt. **At P Vent**.

1859 **Overlays stopped working**!!!

1910 **x4577 y77921** Hdg9.8 2509m Taking a sulfide from the P Vent orifice and placed in outboard biobox. Sample #3.

1916 **x4577 y77921** hdg010 2510m Sampling Yellow Pair at the base of P Vent (proper)- just like in the old days- ICL temp is 386C- there are three vents here on an orientation that runs a little more north south than before. P Vent has a large base with a shear basalt wall- basalt all around, and the eastern most chimney abuts up again a wall of tallus. I see a Marker…F1? There is also one long (less than a meter) *Riftia* tube here at the altitude of the P Vent orifice. (**Audio tape stopped working**).

1922 Blue major pair now- 387C on the draw.

1929 Red white and blue gastight now.- heard fire.

1932 White gastight now- heard fire.

1939 **x4575 y77921** hdg010 2509m at P Vent deploying HOBO probe #21, in 387C orifice-

1939 same xy, deploying **Marker 10**

2026 Noticed extinct sulfide on fresh basalt with a rusty HOBO probe still stuck in the orifice- recovered the probe (depth 2503) –this sulfide must be Ty Vent (made it Target 62).

2043 **x4608 y77580** (I think this is a bad Doppler fix- check dive 4207 for Marker 8 position- LBL fix is **x4677 y77599- good fix**) hdg310 2503m Black major pair sampling at Marker 8 vent in diffuse flow orifice (where echem scans were taken starting with scan 213).

2046 Now taking Green Gastight, same as above
2049 Now taking Red major pair, 12°C on the ICL.
2052 Deployed crab trap next to Marker 8 at this position. Time was running low on this dive so we had to deploy the colonization substrates as quickly as possible.
2053 Deployed Marker 8 Hdg310 2504m to be placed next to colonization experiments.
2058 Deployed "Round" stainless steel meshes CV1 and CV2 in 9°C fluids.
2059 Deployed two Baby traps in same area.
2102 Deployed Baby trap #38 in same area.
2106 Deployed 3 Sandwich colonization substrates together near CV2, but higher up.
2109 Deployed TAM #8 in diffuse flow
2110 Deployed TAM #9 in diffuse flow
2111 Deployed TAM #7 in diffuse flow
2112 Deployed TAM #6, #1, and #2 in diffuse flow
2115 Deployed TAM #3 in diffuse flow
2116 Deployed TAM #4 in diffuse flow
2119 Deployed ARCO trap1 in center of diffuse flow area
2122 **x4677 y77599** Taking the yellow slurp sample until 2128.
2126 Deployed ARCO Trap 2 in diffuse flow while slurp gun was running.

2132 **x4677 y77599** hdg182 2504m Taking rock sample at Marker 8 (old Biomarker 82 area)-basalt with biology, rock broke apart, so we will call these sample #5 and #6; placed in white biobox.
2135 **x4677 y77599** hdg 182 2503m Deploying Marker 11 where we collected basalt sample #6 with colonists. Moved off and dropped weights.

Report for ALVIN Dive 4203

Date; June, 27 2006

Pilot: Bruce Strickrott
Port Observer: Tim Shank
Starboard Observer: Stefan Sievert
Dive logged by: Stefan Sievert

- Descend at around 15:45 GMT
- Turn on ECHEM at 16:05 GMT, Depth 363 m, running frequent scans on the way down
- Turn on Magnetometer at 16:15, Depth 400 m
- Arrive on ocean floor at around 17:15 GMT in area of new flow
- Take Sample #1
    - Rock sample, new basalt, baseball size, put in big milk grate on basket, time 17:48 GTM, X: 4456, Y:78022, Heading 324. Depth 2500 m
- Take Sample #2
    - Rock sample, new basalt, bigger piece, put in big milk grate on basket, time 17:51 GTM, x: 4456, Y:78022, Heading 324. Depth 2500 m
- Deploy marker #12 at site of rock sampling, Time 17:51
- Search for sediment trap, find weight, not sure whether 1 or 2, communication with top lab, identification as trap 1, were given coordinates of trap one rather trap 2
- Search for trap 2, found after ~20 min, communicate with top lab to suggest that it should be tried to release trap 1 acoustically from Atlantis, unsuccessful, Alvin pulls pin and releases sediment trap manually at 18:15 GTM
- Writing down coordinates and time for starboard observer complicated by the fact that overlay does not work, has to get data for coordinates at time from port side observer
- Dive continues towards ASCT, fly over extensive areas of new flow, occasionally see dead Riftia (tubes only), and crabs, big collapses and drop offs, site has changed dramatically compared to pre eruption (according to port observer and pilot)
- Detect black smoker, which is tentatively identified as Pvent, decide to sample black smoker and to take sulfide, x: 4580, y:77910, Heading 57, Depth 2509 m

    - Sample #3 Sulfide is sampled and put in grey biobox on starboard side
    - 2 Pairs of majors successfully fired:
        - Yellow, Time: 19:16 GMT, temperature held at 3880-3885 during filling
        - Blue, Time: 19:20 GMT, temperature during filling ~385C
    - 2 gastights are successfully fired: Red/White/Blue and White, Time: ~19:25
    - Marker #10 deployed, 19:34 GMT
    - HOBO #21 deployed, 19:39 GMT

- See one lonely Riftia close by at Pvent
- Continue our way south along axis
- Come to an area of extensive diffuse flow, pilot and port observer identify it as the Ty and Io vent area, We survey the area for an appropriate diffuse flow to deploy colonization devices, do ECHEM, and use the slurpgun, while surveying we come across an HOBO, HOBO picked up at 20:26 GMT, Location: Target 62, Depth 2504 m
- Pilot and port observer also observe high temperature venting at what they think is Io vent
- Identify suitable site of diffuse venting, x:4608, y: 77581, Hdg 310, Depth 2503 m, sampling and measurements start:
    - 2 pair of Majors:
        - Black, Time: 22:43 GMT, temperature during filling ~10C
        - Red, Time: 22:49 GMT, temperature during filling ~10C
    - 2 Gastights: Green and Blue, Time 22:45 and 22:46
    - ECHEM run, deployed at diffuse flow, multiple scans, switch ranges multiple times because sulfide signal appears to be out of scale
    - Deploy crab-trap and Marker #8 at diffuse flow site, Time: 20:53 GMT
    - Start deploying colonization devices:
        - Round traps (Costatino Vetriani)
        - Babytraps (Monika Bright)
        - Sandwiches (Lauren Mullineaux)
        - TAMS (Tim Shank)
        - ArcoTraps (AT) 1 and 2 (Stefan Sievert, Craig Taylor)
    - Sample #4: Yellow slurp gun to filter diffuse flow at Marker 8, filtering for 6 min
- Sample #5 and 6: basalt from fresh flow covered with white “biofilm”, put in grey/white biobox,
- Marker deployed at rock sampling site: #11, 21:35, x:4603, y:77591, Hdg 192, Depth 2503
- Ascend to surface, continue runs with ECHEM

VIDEO LOG

Dive 4203 June 27, 2006
VCR #1
Pilot- Bruce Stickrott; port observer- Tim Shank; starboard observer: Stefan Sievert

Port Cam 1 of 2
NO GOOD VIDEO CLIPS ANYWHERE ON TAPE
OVERLAYS DISAPPEARED NEAR END OF TAPE
MONITOR IN SUB WAS NOT WORKING

Port Cam 2 of 2
4203p_1.dv slurp sample of microbial mat in diffuse flow near Marker 82 region

NO OVERLAYS ON THIS TAPE
NO OTHER GOOD VIDEO CLIPS ANYWHERE ON TAPE
MONITOR IN SUB WAS NOT WORKING

VIDEO LOG

Dive 4203 June 27, 2006
VCR #2
Pilot- Bruce Stickrott; port observer- Tim Shank; starboard observer: Stefan Sievert

Stbd Cam 1 of 2
4203s_1.dv* New basalt on top of wall (outside the ASC) near Tica
4203s_2.dv* P vent….black smoker

Stbd Cam 2 of 2
4203s_3,dv* loan tubeworm on side of P vent
4203s_4.dv* white mat-like coating in Marker 82 region….diffuse flow
4203s_5.dv* diffuse flow near Marker 82 region, major pair sampling water
4203s_6.dv* major pair sampling diffuse flow near Marker 82 region
4203s_7.dv* taking ECHEM measurements in diffuse flow near Marker 82 region

Dive Plan 4204 - 28 June 2006

Port: D. Fornari ***Starboard:*** K. Rubin ***Pilot:*** M. Spear

On Bottom Target: x = 3664 y = 82977 9˚53.0162N 104˚18.000W
d = 2540m

Objectives: Characterize 9°53'N on axis 'hot spot' observed in NH camera and CTD tows; transit to east to fissure eruption and then north along it, and over to ponded area against scarp.

1. Turn on ECHEM at 200m, leave on as descend to bottom, positioned in its holster.
2. Turn on magnetometer at 1000m and do a 3 min spin clockwise and then counterclockwise, note time of spin.
3. Land on bottom to west of ASCT.
   - have the surface survey you in at your position
   - turn on cameras including downlooking with booms (fly 4-5m up)
   - pick up a piece of 2006 flow at the landing site (or as soon as you encounter it)
   - deploy a marker at the sample site.
4. Transit ~200 m E to the ASCT, cross as slowly as possible to the east wall with IMAGENIX on to get ASCT crossing profile, then drive N in ASCT until you find the area of 'white' venting observed in the New Horizon photos.
5. If you find an area of high temperature flow (i.e., black smoker)
   - collect sulfide and place in biobox
   - measure T with hi T probe
   - 1 majors pair
   - 2 gas tights
   - pick up basalt (if covered with bio-material place in biobox
   - deploy marker (VERY IMPORTANT).
6. If there is an area of vigorous diffuse flow:
   - measure its T with hi or lo T probe to find the 'hottest' place
   - ECHEM to determine placement of following
   - collect 1 majors pair
   - collect 1 gas tight
   - deploy setting experiments as follows:
     - [4 'TAMS' and 2 'rounds'] in >20°C flow
     - ECHEM on center of each TAM and round
     - 4 TAMS in ambient (non-venting) spot (move slightly?)
     - ECHEM on center mesh of each ambient TAM
   - slurp early settlers off rock surface (amphipods too if present, but lower priority than other fauna)
   - pick-up basalt with early settlers and place in grey biobox
   - deploy marker(s)
7. If a snowblower is found, this is also an option for the diffuse flow sampling site.
8. If a snowblower is found:
   - filter slurp snowblower material

   (watch meter voltage carefully - on 4203 filter was nowhere near full after 6min).
9. An additional majors pair and gas tight can be tripped at a second black smoker or site of diffuse flow. Follow protocol in #5 or # 6 above as appropriate.

10. Transit east out of the ASCT for ~700m to the location of the fissure eruption
    - pick up basalt samples as appropriate along the transect.
11. Once you reach the location of the fissure eruption
    - collect basalt
    - photodocument
    - if white material or shimmering water is present use T probe and ECHEM
    - deploy marker(s).
12. Travel north along the fissure eruption sampling as needed, following protocol in #11.

13. Travel east to inward facing scarp along which the flow has ponded at x-y of camera tow crossing.

14. If you have a pair left, collect it at the end in an area away from all venting for a background seawater sample. ***(Just a majors, NOT a gas tight.)***

Basket load:

2 marker launchers with 14 markers
downlooking camera
ECHEM probe and can
Alvin hi T probe
Alvin lo T probe
slurp-filter
slurp-carboy
2 grey bioboxes
1 white square biobox
1 clear square biobox
2 rounds
8 TAMS
2 scoops
3 majors pairs
4 gas tights
1 gas tight

ECHEM laptop and power cord/charger in ball.

Origin is 9˚08'N and 104˚20'W.

Alvin Dive 4204 -June 28, 2006

Objective is to investigate the EPR axis near 9° 53'N for possible hydrothermal vent activity seen on New Horizon TowCam#3 survey and to characterize and sample the new lava flows at the axis and on the off-axis (to the east) fissure ridge seeing in both the NH06 TC#3 survey at 9° 54.5'N and on the AT15-6 TowCam #3 survey at 9° 53'N.

Dan Fornari - Port Observer, Ken Rubin - Stbd. Observer, Mark Spear - Pilot

Time (GMT)	**Observations**
1426	In ball at 400 m depth, descending
1436	716m depth, EChem has been on since ~ 200 m depth, no xponder navigation for this dive, Atlantis top lab will survey us in when we land on bottom and then we will key in the x/y into the DVLnav system.
1446	at 1000 m, getting ready to do spins for magnetometer calibration
1448	1072m turning to stbd for Maggie spin
1455	finished 1sts spin to stbd, the depth is 1300 m, but the depth on the DVNnav screen is not getting the correct depth, mark is resetting DVLnav
1501	finished 2nd Maggie spin, depth 1490 m, target depth is 2530 m to axis
1523	at 2101 depth, put underlay on the DVNnav screen, may be a bit south of intended target, Echem is on and Maggie is on.
1538	2525 m depth ~10 m above bottom, making bottom approach
1540	2540 m depth, 14 m altitude
1542	2554 m depth, 9 m altitude, seeing sed. Covered lobates making bottom approach
1542	2560 m depth, landing on sed. Covered lobates west of EPR axis at 9 53'N
1546	sitting on bottom, turned off lights, waiting for surveyed position from Atlantis top lab
1552	Took a few photos with handheld.
1554	maggie turned off momentarily to check for ground, now back on
1558	top lab surveyed position for Alvin on bottom X=3343 Y=82855
1608	2564 m depth, position keyed into DVLnav and will now head east towards axis to look for new lava contact, downlooking camera is grounded and observer strobes have small ground too
1611	underway o/c 090
1613	2562 m did not go more than 50 m and we have new lava contact. Sitting on bottom taking sample #1
1616	at contact with new flow west of the axis, panning around with port camera to give view of outcrop, mark preparing to sample
1620	**Sample #1 X= 3416 Y=82861 , 2563 m, in situ sample broken off new flow where it contacts sedimented lobates**
1630	2559m, recording 3-chip on port recorder, going east, flow more hackly 3 m altitude, saw nice lava whorl
1633	new flow going over old, large bolster shaped pillows, underlying surface has ~ 2 m relief over large bolsters. New flow has abundant decorations, buds.

Time (GMT)	Observations
1635	2555 m depth, now mostly in new flow w/decorations, only very few older pillows sticking through
1636	2551m depth, alt 2 m, seeing some areas where there is clear sheet flow coming from the north, now looks like we are going over a channel with sheet flow, unclear if new or old, but think it is new lava.
1637	seeing other side of channel, o/c 091, flow coming from the axis, channel probably a few 10s of meters high
1638	I have the north margin of the channel, definitely new lava, ken seeing into the channel on port side.
1639	2548 m depth, moving a bit south into main body of channel, continuing upslope to axis, all curtain folded sheet flow on margin, with more lineated sheet flow within the channel.
1640	seeing crabs, mark sees some cloudiness in the water, looks like we're going over the margin of the channel.
1642	2545 m going over new flow but with occasional outcrops of older lava
1645	2537m, 3 m altitude, occasional crabs, mostly new lava, likely only 1 m thick, seeing into older surface on occasion. New flow mostly lobates and sheets/folded sheets in channel area
1647	going over collapse, perhaps some diffuse flow, looks like axis, new lava flow in the collapse, 2533 m depth
1649	crossed the axis, using Imagenex, about 10 m wide (sub length)
1650	turning north to go back across the collapse trough, ken sees new lava on the walls, abundant crabs on the walls
1651	seeing some bacterial mat on walls of collapse, no shimmering water, decided to keep looking to the north, many baby brachyurid crabs, on west side of axis, looking for place to sample new flow at trough rim, in collapse area
1702	**Sample #2 X=3939 Y=82969, 2534 m depth at west rim of trough from new lava flow, piece of lava pillar? Or next to one?**
1707	turned to 310 to try to intersect narrow trough, made several crossings trying to get back to it to follow it north
1710	seeing nested collapse along trace of axis w/orange hyx staining in walls of collapse, seems like a trace over an eruptive fissure, seeing enechelon collapse pits along 350 trend.
1718	headed off to 030, now coming back to 310 course to find trace of axis
1722	passed over a primary fissure, very deep, with collapse along it, seeing also old pillows/lobates with sediment cover, fissures cutting through it, new lava did not spill out very far or much from fissure here.
1723	fissure with new lava in it under my viewport, we are following it, ken sees older pillows out stbd side. Trying to figure out if we are E or W of the axis,
1724	2531 m, now seeing older lava, turning west to 260 to angle off to see if we pick up young lavas and clearer indication of the axial zone
1725	in older pillows/lobates now w/sediment cover, heading 260

Time (GMT)	Observations
1729	still in older pillows/lobates, ken sees fissure with new lava in bottom, turning to go 350, seeing several fissures right here, definitely has new lava in the floor of the fissure, about 2-3 m wide, with new lava in it. Fissure cuts
1732-33	excellent photos of following the fissure with the new lava in the bottom of the fissure, some spilled out of the crack. Fissure cuts through older pillowed terrain
1734	now all new lava, lobates under sub
1735	just passed contact of new flow with older sed. Covered sheet flow, still lots of baby brachy. Crabs even on older flow, turning to 260
1742	in older lobates and pillows with sed. cover, called up to ask tim to get post of southern vent area from NH06 surveys
1746	tape 1 ends
1752	tape 2 starts,
1754	2532 m depth, heading south (158), got target to the south about 700 m, near where we first intersected the axis, from toplab, passing over older pillows/lobates now, there were 3 targets, from vents seen on NH06 TowCam#3 survey.
1756	passing over deep fissure, following fissure to the south, I'm seeing new lava flow on east side of fissure as we are flying south, seeing patches of new flow and older sed. covered pillows.
1758	some new lava, at first target but no seeing any significant or any hyx venting or diffuse flow. New lava is present with some staining and occasional whitish patches, but not very continuous or thick.
1800	2534 m depth, heading for 2nd target, seeing lots of baby brachy. Crabs. Some orange hyx staining in interstices of lobate forms. All new flow here.
1803	passing over 3-4 m wide fissure with cloudy water and crabs abundant, but no extensive area of microbial staining, but does look like there is a little activity. Following it to the south, new flow in bottom of fissure, shelly lobates
1804	crack/fissure narrows now, roofed over, not seeing the crack anymore
1805	2531 m depth, lots of crabs on older pillows, crossing over fissure now
1806	flying down west margin, new flow is flowing down the wall of the fissure
1806:57	great shot of new lava draping down into the fissure
1811	seeing new flow here, but with older lobates too
1816	2536 m depth, headed south, have about 350 m to go to get to the southern vent location on the NH06 TC#3 survey and where we first approached the axis on this dive. We are cutting across fissure with new lava in it and spilling out slightly, new lava lobate morphology, thin flow, <1 m thick in most places
1820	250 m to go to get to the target, seeing mostly new lava flow, lobate morphology, seeing it flow into older collapse pits. Some hyx staining but no focused flow. Still have many small brachy. Crabs.

1825 2535 m depth, near vent target, going over new lobate lava flow as thin veneer over older sed. covered lobates and pillows

1840 2539 m depth, zigging back and forth over area of vent target, seeing new flow but no sign of hyx activity. Fissure is very discontinuous and new flow at times issues from it, at other times is within it, and then other times you see it cascading into the fissure.

1852 going to head east from here to get to old pillow ridge, then suspected new fissure ridge before intersecting scarp.

1853 heading east now, 2540 m depth, crossing new flow mostly lobates with occasional pillows, some decorations on the forms. Axis is dominated by fissures mostly with new flow in it and sometimes spilling out. Fissure is cracking older lobate and pillow terrain. No focused venting observed, but there is a high concentration of small brachyr. Crabs.

1855 continuing over new flow, lobate morphology with older pillows sticking through it.

1856 2548 m, about 100 m east of axis, about 14 m deeper than crestal depth, seeing now curtain folded sheet flow as we proceed to the east.

1900 at margin of new lava flow where lobate/curtain folded sheets abut the pillows at the base of the off axis pillow ridge. Will set up to take samples of the new flow at the east margin of it.

1903 2550 m depth, maneuvering to take samples of old and new lava X=4235 Y=83000

1904 good video of contact and location of samples #3 and #4, going to sample older pillowed flow - from pillow ridge- first then the new lava coming from the axis.

1909 Sample #3, X=4235 Y=83001, 2550 m depth, from older lobate flow at contact with new lava ~ 100 m east of axis.

1916 Sample #4A/B, X=4234 Y=82998, 2550 meters, new lava at contact with older sediment covered lobates ~100 m east of the EPR axis

1921 good videdo of sample #4 site, heading east to get to new fissure ridge lava flow.

1925 2548 m depth, heading east from contact between new axial flow and older pillow ridge flows.

1927 going over sed covered lobate and pillows on pillow ridge, ascending west facing slope

1929 at crest of the older pillow ridge, 2540m depth is summit of it and a small fissure at summit

1930 at new flow on EAST side of older pillow ridge, this is the new flow coming from the off axis fissure ridge. Setting up to sample

1931 X=4421 Y=83058, 2546 m depth, at west margin of new fissure ridge, location is about 400 m east of the axis.

1935 **Sample #5 of west margin of new fissure ridge flow, 2546 m depth, X=4422, Y= 83058.**

1937 Heading east now from new fissure ridge sampled at #5 sample location.

1938 heading 080, mostly pillows and lobates with some decorations on the new flow

1939 2542 m depth, new fissure ridge flow morphology more lobate here

1941 at 2541 m depth, now new flow is curtain folded sheet flow, this is likely the axis of the fissure ridge, dropping target so we can know the trend of the fissure ridge axis. There is prominent hyx staining, flock in the lows in the lava folds.

1944 2541 m depth, at scarp where fissure ridge new flow abuts it. Scarp face is scalloped, shows some possible original collapse morphology but considerable talus chutes and exposures of lobate flow sequences. Top of scarp has older sed. covered lobates. Scarp height is ~2-3 m.

1946 good video of scarp morphology, now backing away from scarp to land at the base of it

1950 back at base of scarp on new fissure ridge flow

1951 end tape 2

1954 start tape 3

1955 2545 m depth, looking for sampling spot to collect new lava against scarp, will be sample #6

2008 Sample #6, X=4579 Y=83092, 2545 m depth - sample of new fissure ridge flow where it abuts the west facing scarp ~500 m east of axis, <u>also sampled orange sea star next to the new lava - that is sample#6 too, put in biobox</u>

2013 good video of new lava against scarp base, new flow is lobate

2016 proceeding north along scarp face w/new flow contacting it, now flow is curtain folded sheet flow in places, also some hyx/oxide staining in interstices between lava forms

2019 2541m depth, flow trend seems to be trending away from scarp, lobate lobes contacting the older lobates

2022 running north along contact between new flow and older lobates

2023 now turning 260 to head to trace of axis of new fissure ridge, we ran about 200 m along the new fissure ridge flow, parallel to the west facing scarp

2026 2545 m depth, running along 260 just crossed new fissure ridge lava /old lobate lava contact, seems like this contact may be the northern limit of this fissure ridge as ken sees older lava out the stbd side and I have new lava of port side.

2027 good video of new/old lava contact while running west along northern margin of the fissure ridge, going to turn to head 170 down axis of fissure ridge.

2030 2543 m depth, turned to 170 and heading back into new fissure ridge flow, along suspected axis of it, just crossed over contact between old sed. covered lobates and new lobate lavas

2032 seeing more hyx staining on new flow surface and now surface is curtain folded sheet flow

2036 2542 m depth, still on curtain folded flow, occasionally more flat sheets, but generally curtain folded and also seems like we are driving up the center of a channel, trending SE-NW that may be over the eruptive fissure

beneath the sheet flow that marks the axis of the new fissure ridge. Also extensive collapse within the curtain folded flow.

2040 getting set up to slurp hyx oxide fluff, 2545 m depth at summit of fissure ridge in curtain folded lavas w/abundant staining/fluff. Good video of sample site.

2045 Sample#7, macro slurp, X=4527 Y=83092, 2545 m depth, of hyx oxide fluff on summit of new fissure ridge

2100 Sample#8, X=4526 Y-83092, 2545 m depth, curtain folded sheet flow at axis of the new fissure ridge flow where hyx oxide staining was slurped in sample #7

2103 sample 8 in video

2106 good video of sample site for samples 7 and 8

2108 2542 m depth, leaving sampling site headed 170 to traverse along axis of new fissure ridge to the south, traversing sheet flows w/occasional hackly or curtain folded areas, still seeing channel levee

2113 following sheet flow in channel to south along axis of new fissure ridge, staining continues

2115 more hackly flow, or broken up curtain folded flow surfaced in new lava

2119 curtain folded new lava continues

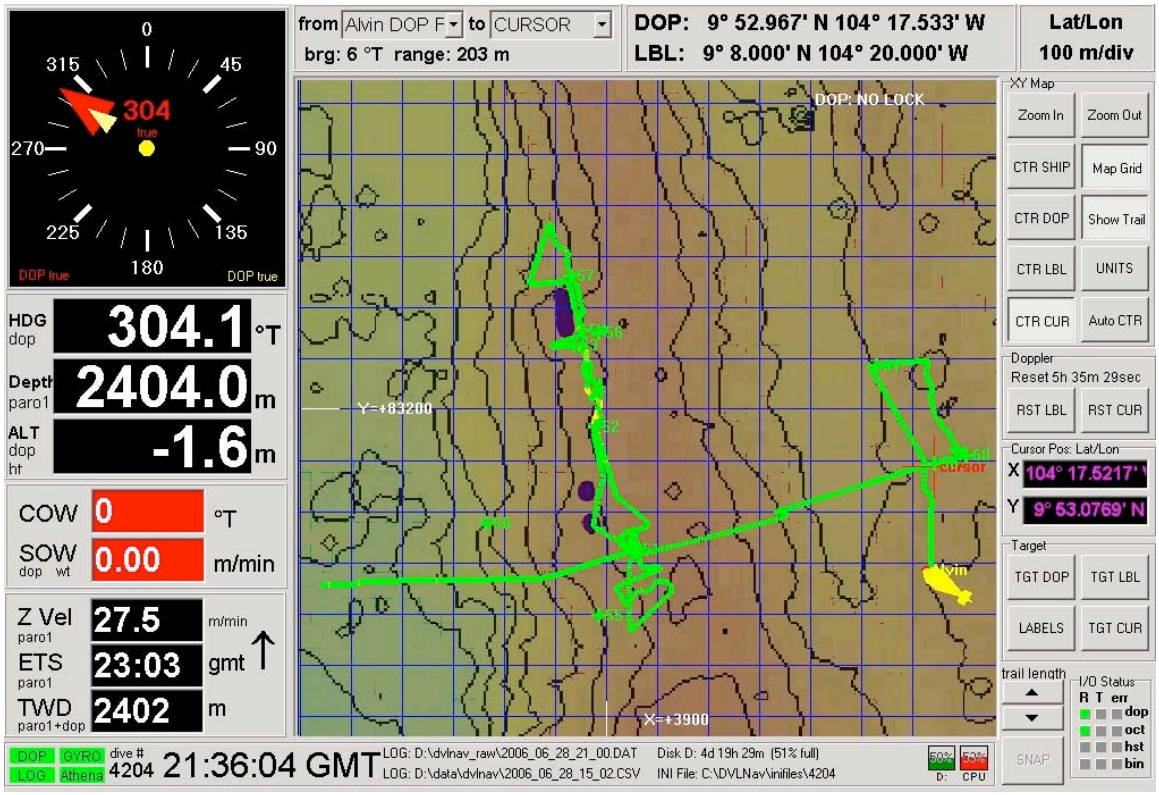
2120 stopped to collect last sample of hackly new fissure ridge flow at this spot before ending dive and also taking water sample in major pair for bottom water

2121 White major pair sampled for bottom water, 2545 m depth, X=4535 Y=82862

2127 Sample #9, X=4535 Y= 82862, 2545 m depth, new fissure ridge flow, at axis, hackly sheet flow

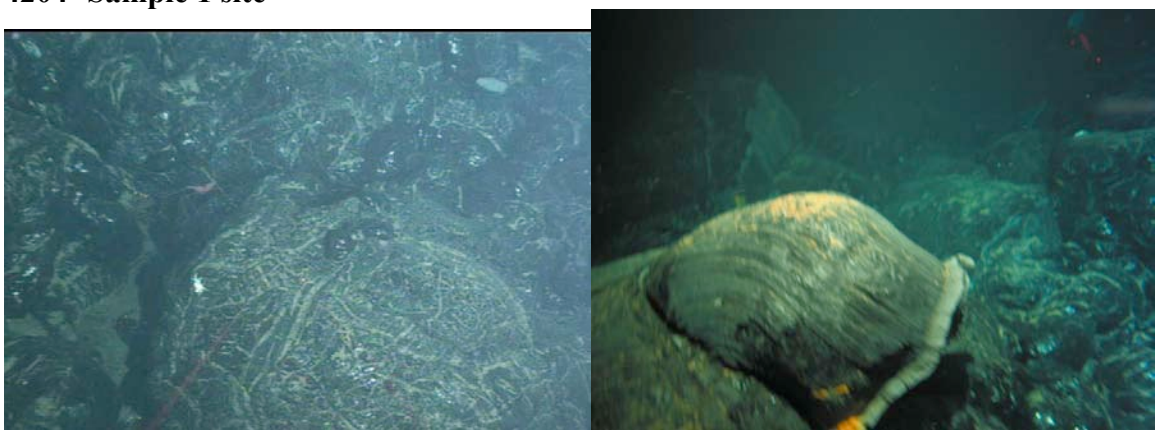
2130 weighs away, end of dive

DVLnav snapshot of 4204 dive track

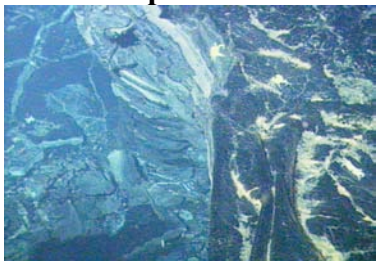


Photos of Sampling Sites- Dive 4204

4204- Sample 1 site

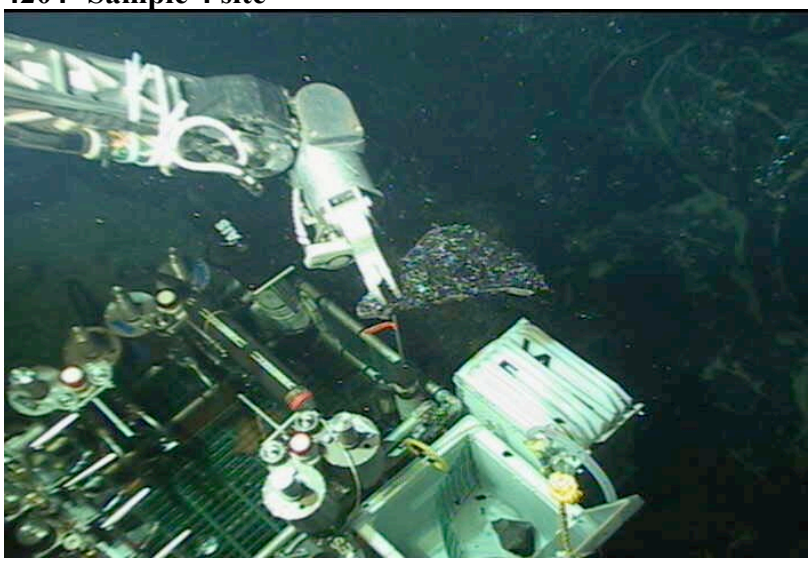


4204- Sample 2 site



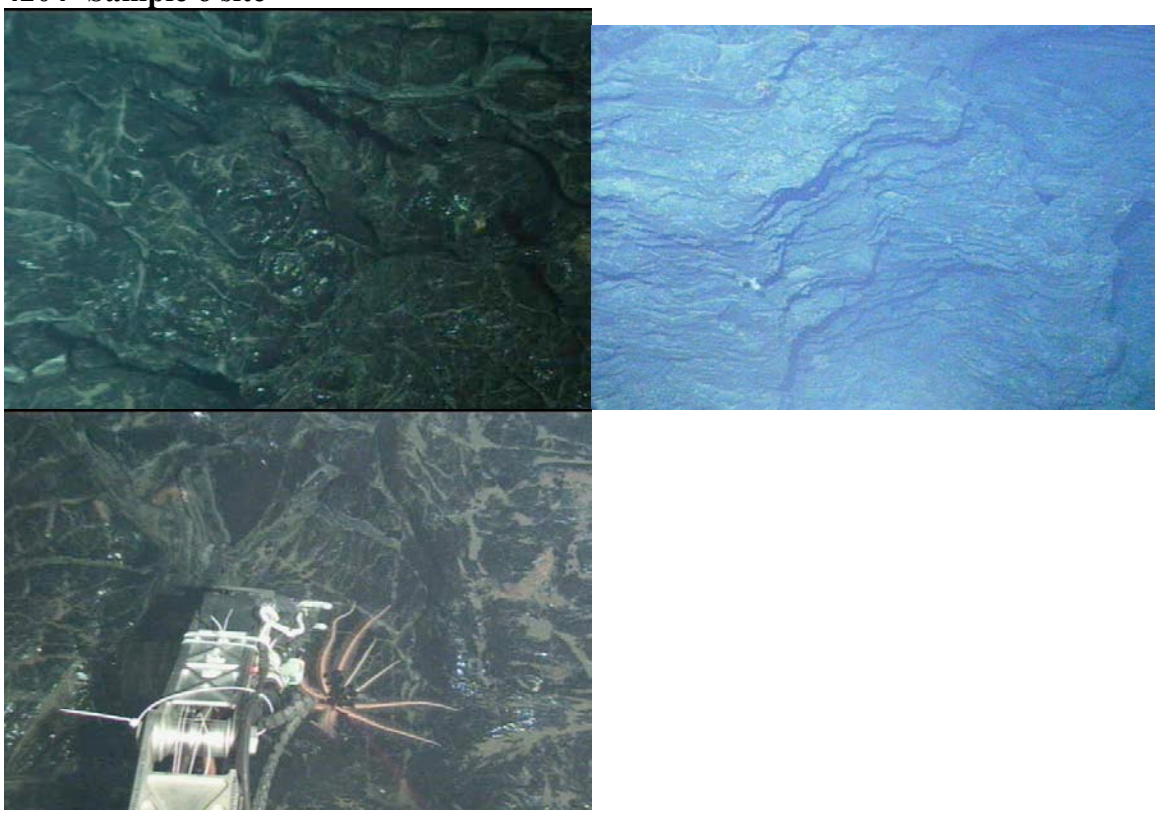
4204- Sample 3 site

4204- Sample 4 site



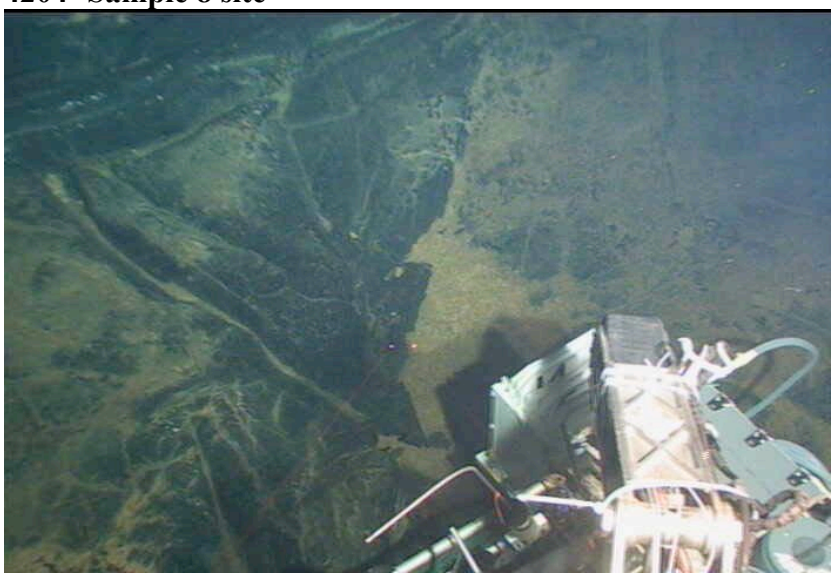
4204- Sample 5 site

4204- Sample 6 site



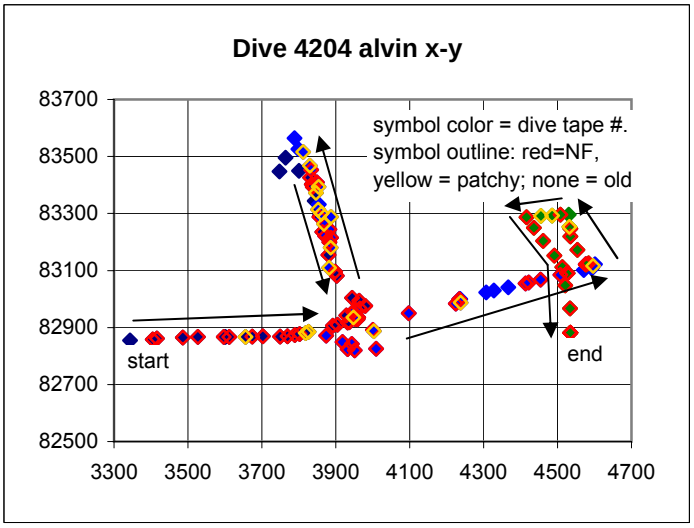
4204- Sample 7 site

4204- Sample 8 site



4204- Sample 9 site

Dive 4204, 28-Jun-06; Stbd observer: Ken Rubin
summary: landed off axis to west in old flow, transited east to new flow contact, followed sheet channel to axis, saw collapses and diffuse flow smoking pit with abundant crabs, searched along axis for more focussed and/or active H-therm site, followed discontinuous collapse trough and fissures in new and old flow; New flow was patchy at axis and varried a great deal along strike. Headed south again to sites identified by NH towcams to no avail. Transited ENE out of new flow over old pillow ridge with a collapsed lobate fissure on top, and then onto new flow from an off-axis fissure ridge. Flow continued east to the fault scarp. Fissure ridge is characterized by mostly high effusion rate morphologies and significant h-therm sediment and staining on its axis. No macrofauna or active venting were observed there. Sampled 8 rocks, 1 starfish, and 1 "background" major pair.



GMT	X	Y	depth (m)	comment	video P or S
1543	*3418*	*82015*	2564	on bottom, sedimented lobates, PRE-SURVEY X-Y	P + S
1546		same	same	lights off, video is black	P + S
1603	3343	82855	2564	new X-Y from ship survey	
1610		same	same	underway from west of axis heading 090	
					no stbd microphone
				CONTACT: old ornamented pillows covered in sediment	audio on video, port
1613	3405	82858		with new flow ornamented pillows	on both
1615	3416	82861		sample 1 - New Flow; brachyuran crab + shrimp	S
1626	3486	82865	2559	New Flow (NF) lobates	P + S
1628	3527	82867	2559	jumbly/hackly NF sheets	P
1631	3597	82867	2559	transition back to lobate	
1632	3601	82867		back into old pillows	P + S
1632.5	3612	82867		back into NF	P + S
1634	3656	82867		some old pillows poking through NF	S
				NF lobates, perhaps less sedimented on smaller lobes	
1635	3674	82868		overlying main lobes	S
1636	3703	82869		sheet flow channel heading 091	P + S
1639	3749	82868		sub veering away from channel	
1640	3769	82869		channel still visibile out port window	P: bracyuran
				curtain folded sheet on channel margin; pilot sees smoke	
1641	3789	82874		in the water	
1641	3802	82877		crabs visible	S: bracyurans
1642	3819	82880		patches of old lava; Dan sees collapses out window	P
1643	3826	82885		patches of old pillows in NF lobates	S
1646	3892	82906		brachyuran crabs	P + S
1647	3904	82910		colllapsed NF lobates	P + S
1648	3932	82918		whiteish coating on NF lobates	P + S
1648.5	3936	82919		diffuse flow smoke from collapse pit	S
1649	3954	82929		ON AXIS:, big collapse	P + S
1650	3959	82929		over axis collapse	
1651				collapse w/new lava on wall visible out stbd window	
1652	3961	82935		crabs, bacterial mat on wall	P + S
1653	3956	82936		small axial collapse ~1 sub length wide	
1655	3929	82942		lots of brachyuran crabs	P + S
				SAMPLE 2: rim of collapse - lobate crust although sample	
1659	3939	829091		looks like sheet flow	P + S
1706	3965	82967		moving NNE along rift, some old obates poke through NF	S
1707	3980	82976		lost rift, change heading to 210	

1708	3963	82994	moving to NW	
1709	3944	83004	pilot sees smoke in the water	
1710			pillars in rift collapse, lots of microbial staining in lobate joins/cracks	P + S
1712	3903	83081	narrow axis collapse sometrimes roofed over	S
1713	3898	83096	very narrow collapse; NF on top and floor	S
1715	3880	83155	riding the narrow crack	P + S
1717	3883	83199	lost the axis going 330	
1718	3887	83215	zig-zag back to 210	
1718.5	3864	83235	found axial fissure again	
1722	3856	83288	eruptive fissure is roofed over	P + S
1722.5	3858	83295	CONTACT: old ornamented pillows covered in sediment with new flow lobates at eruptive fissure	P + S
1723	3852	83314	NF to port; old to stbd; over narrow fissure	
1724			turning west to 260	
1730	3843	83344	found fissure again in old pillows	
1732	3846	83372	lava flooring collapse trough; can see high "water mark" of NF before collapse stuck to fissure walls	P + S
1733	3838	83393	NF lobate filled the trough here; walls look old	
1734	3835	83402	NF overflows trough	P + S
1735	3831	83426	entirely within NF; contact w/old visible to stbd	P + S
1736			east of axis	
1737	3800	83450	old flow	
1740	3748	83447	old flow - come about to 347	
1743	3764	83496	at coordinates of NH towcam vent site - nothing here	
1746			old pillows and lobates at axis; come about	end tape 1
1753	3788	83564	old lobates; sub at rest, getting targets from top lab	tape 2
1754			underway to targets at 158	
1755	3799	83526	collapse in old lobate	P + S
1756	3812	83516	port: deep fissure; stbd collapses; patchy NF; crabs	P: patchy; S old
1758	3830	83468	some NF, patchy to stbd	P + S
1759	3833	83453	brachyurans on NF	P
1802	3849	83409	fissure in NF on axis; white stuff on rocks in collapse to stbd	S (and P has crabs)
1803	3853	83393	old fissure walls with NF at bottom, toms of crabs	P
1805	3854	83332	old pillows to lobates at fissure walls	
1806	3861	83300	NF at walls (Port sees NF pouring into fissure)	not on video
1806.5	3887	83288	stbd & pilot see crack w/NF down in crack Plus old/young pillows and lobates above wall; NF lobe poring down into fissure	P
1807	3866	83279	CONTACT: all old again	P + S
1808	3868	83263	Stbd : NF at fissure bottom	S
1808.5			stbd: NF CONTACT at top of fissure	S
1810	3871	83221	stbd: collapse with lots of white stuff on walls; come about but couldn't find the spot	S
1812	3883	83244	small fissure w/NF down in it; lotrs of crabs	P + S
1814	3883	83221	head for next target, 180	
1815	3886	83180	back into mostly NF on top of collapse	
1818	3882	83110	some collapse w/whitish walls, NF patchy on top	
1821			NF low patchy	
1823	3874	82872	CONTACT: ols lavas then NF both cameras	P + S
1829	4000	82892	heading 240	
1830	4003	82887	stbd: NF pillows; port: patchy lobates	
1833	3918	82849	heading 130 in NF lobates	
1834	3932	82824	heading 70 in NF lobates	
1840	4009	82825	NF lobates; no fissure to be seen; heading 220	P + S
1845	3943	82842	return original axis crossing spot heading 006	
1849	3953	82963	NF lobates w/small collapse	

1850	3947	82955		head south to original crossing; some staining	
1851	3948	82936		patchy NF	P + S
1852	3951	82820		on axis, no luck finding spot so heat east at 080	
1856	4097	82950	2548	hackly and curtain folded NF sheet	P + S
1859	4225	82984	2547	(same)	
1900	4238	82987	2547	CONTACT: old ornamented pillows at contact	
1903	4235	83001		sample 3 = old	
1909	4234	82998		sample 4a = NF	
1915	4234	82998		sample 4b = NF	
1925	4237	83000	2548	underway to fissure ridge (FR); sedimented pillows + lobates; going up hill	
1927	4307	83023	2542	collapse in lobate on axis of old pillow ridge, then N-S fissure	
1928	4328	83030	2542	going down hilll	
1929	4367	83041		lineated fissure to port	
1930	4413	83055	2544	CONTACT: NF lobates	
1935	4422	83058	2546	sample 5, then underway at 080	
1938	4454	83068	2544	NF lobate, no windows to old flow here	
1941	4508	83085	2543	NF lobates, some h-therm staining in cracks	
1941.5	4527	83090	2542	hackly NF sheet, much more staining here; may be FR	
1943	4571	83102	2541	v ery flat NF sheet w.lots of h-therm sed on it then back to lobates	
1944	4593	83107	2542	CONTACT: back into old pillows then scarp.	
1947	4596	83116	2537	leaving scarp, NF is below	
1948	4601	83122	2540	scarp looks like ~ 7m high	
1951	4576	83122	2544	NF at scarp base	end tape 2 start tape 3
1954	4577	83121	2545	sample 6 site: starfish locale	S
2013	4584	83125	2542	closeup of NF on stbd cam; angular rock 6	S
2016	4554	83172	2543	underway heading 348; NF curtain folded sheet w/ h-therm staining	
2019	4535	83220	2544	NF lobate	
2020	4535	83246	2540	Port: NF; stbd see scarp but not flow	
2021	4532	83253	2539	NF not making it to scarp here; heading 338	
2023	4530	83296	2541	old lobates, had gone 200m along flow, head 260 to intersect NFagain	
2024	4508	83296	2543	CONTACT: NF ornamented lobates	
2026	4485	83293	2544	stbd: CONTACT (mostly old pilows but some NF lobates); port NF	
2027	4455	83291	2543	contact still visible to stbd on video	S
2029	4416	83287	2543	come about to follow trend of FR axis from contact of NF lobate w/old pillows; heading 133	P + S
2031	4436	83250	2542	NF lobates	P + S
2033	4461	83204	2543	NF hackly sheet heavily coated in places	P + S
2035	4491	83152	2542	curtain folded NF sheet w/h-therm sed on top	P + S
2036	4513	83112	2542	v ery flat NF sheet w/h-therm coatings on FR axis with hackly levees?	P + S
2039	4527	83090	2545	macro slurp site (and rock)	P + S
2100	4526	83090	2545	rock sample 8	P + S
2104				rock sample 8	P + S
2108				underway	P + S
2110	4521	83048	2543	lineated/flat NF sheet w/h-therm coatings on FR axis; no crabs out here; maybe that's why coating survived?	P + S
2115	4534	82967	2543	hackly NF sheet	P + S
2120	4535	82882	2545	hackly NF sheetl Karen's water sample; rock sample 9	P + S
2127	4535	82882		more microbial stuff on NF hackly sheet	P + S
2138	4535	82882		lites out; OFF BOTTOM	

VIDEO LOG

Dive 4204 28-Jun-06

VCRs #1 and #2 (P and S)

Pilot- Mark Spear; port observer- Dan Fornari; starboard observer- Ken Rubin

Port and Stbd Cams, tape 1 of 3

GMT	X	Y	comment	video P or S
1610	3343	82855	underway from west of axis heading 090	
1613	3405	82858	CONTACT: old ornamented pillows covered in sediment with new flow ornamented pillows	audio on video, port on both
1615	3416	82861	sample 1 - New Flow; brachyuran crab + shrimp	S
1626	3486	82865	New Flow (NF) lobates	P + S
1628	3527	82867	jumbly/hackly NF sheets	P
1631	3597	82867	transition back to lobate	
1632	3601	82867	back into old pillows	P + S
1632.5	3612	82867	back into NF	P + S
1634	3656	82867	some old pillows poking through NF	S
1635	3674	82868	NF lobates, perhaps less sedimented on smaller lobes overlying main lobes	S
1636	3703	82869	sheet flow channel heading 091	P + S
1639	3749	82868	sub veering away from channel	P + S
1640	3769	82869	channel still visibile out port window	P: bracyuran
1641	3789	82874	curtain folded sheet on channel margin; pilot sees smoke in the water	P + S
1641	3802	82877	crabs visible	S: bracyurans
1642	3819	82880	patches of old lava; Dan sees collapses out window	P
1643	3826	82885	patches of old pillows in NF lobates	S
1646	3892	82906	brachyuran crabs	P + S
1647	3904	82910	colllapsed NF lobates	P + S
1648	3932	82918	whiteish coating on NF lobates	P + S
1648.5	3936	82919	diffuse flow smoke from collapse pit	S
1649	3954	82929	ON AXIS:, big collapse	P + S
1650	3959	82929	over axis collapse	P + S
1651			collapse w/new lava on wall visible out stbd window	P + S
1652	3961	82935	crabs, bacterial mat on wall	P + S
1653	3956	82936	small axial collapse ~1 sub length wide	
1655	3929	82942	lots of brachyuran crabs	P + S
1659	3939	829091	looks like sheet flow	P + S
1706	3965	82967	moving NNE along rift, some old obates poke through NF	S
1707	3980	82976	lost rift, change heading to 210	
1709	3944	83004	pilot sees smoke in the water	
1710			joins/cracks	P + S
1712	3903	83081	narrow axis collapse sometrimes roofed over	S
1713	3898	83096	very narrow collapse; NF on top and floor	S
1715	3880	83155	riding the narrow crack	P + S
1722	3856	83288	eruptive fissure is roofed over	P + S

1722.5	3858	83295	CONTACT: old ornamented pillows covered in sediment with new flow lobates at eruptive fissure	P + S
1732	3846	83372	of NF before collapse stuck to fissure walls	P + S
1733	3838	83393	NF lobate filled the trough here; walls look old	
1734	3835	83402	NF overflows trough	P + S
1735	3831	83426	entirely within NF; contact w/old visible to stbd	P + S
1736			east of axis	
1737	3800	83450	old flow	
1746			old pillows and lobates at axis; come about	

Port and Stbd Cams, tape 2 of 3

1753	3788	83564	old lobates; sub at rest, getting targets from top lab	tape 2
1755	3799	83526	collapse in old lobate	P + S
1756	3812	83516	port: deep fissure; stbd collapses; patchy NF; crabs	P: patchy; S old
1758	3830	83468	some NF, patchy to stbd	P + S
1759	3833	83453	brachyurans on NF	P
1802	3849	83409	fissure in NF on axis; white stuff on rocks in collapse to stbd	S (and P has crabs)
1803	3853	83393	old fissure walls with NF at bottom, toms of crabs	P
1806.5	3887	83288	pillows and lobates above wall; NF lobe poring down into fissure	P
1807	3866	83279	CONTACT: all old again	P + S
1808	3868	83263	Stbd : NF at fissure bottom	S
1808.5			stbd: NF CONTACT at top of fissure	S
1810	3871	83221	stbd: collapse with lots of white stuff on walls; come about but couldn't find the spot	S
1812	3883	83244	small fissure w/NF down in it; lotrs of crabs	P + S
1815	3886	83180	back into mostly NF on top of collapse	P + S
1818	3882	83110	some collapse w/whitish walls, NF patchy on top	P + S
1823	3874	82872	CONTACT: ols lavas then NF both cameras	P + S
1829	4000	82892	heading 240	
1840	4009	82825	NF lobates; no fissure to be seen; heading 220	P + S
1845	3943	82842	return original axis crossing spot heading 006	
1849	3953	82963	NF lobates w/small collapse	
1851	3948	82936	patchy NF	P + S
1852	3951	82820	on axis, no luck finding spot so heat east at 080	
1856	4097	82950	hackly and curtain folded NF sheet	P + S
1900	4238	82987	CONTACT: old ornamented pillows at contact	P + S
1903	4235	83001	sample 3 = old	S
1909	4234	82998	sample 4a = NF	S
1915	4234	82998	sample 4b = NF	S
1925	4237	83000	underway to fissure ridge (FR); sedimented pillows + lobates; going up hill	
1927	4307	83023	collapse in lobate on axis of old pillow ridge, then N-S fissure	
1928	4328	83030	going down hilll	
1929	4367	83041	lineated fissure to port	
1930	4413	83055	CONTACT: NF lobates	
1935	4422	83058	sample 5, then underway at 080	

1938	4454	83068	NF lobate, no windows to old flow here	
1941	4508	83085	NF lobates, some h-therm staining in cracks	
1941.5	4527	83090	axis	
1943	4571	83102	v ery flat NF sheet w.lots of h-therm sed on it then back to lobates	
1944	4593	83107	CONTACT: back into old pillows then scarp.	
1947	4596	83116	leaving scarp, NF is below	
1948	4601	83122	scarp looks like ~ 7m high	
1951	4576	83122	NF at scarp base	

Port and Stbd Cams, tape 2 of 3

1954	4577	83121	sample 6 site: starfish locale	S
2013	4584	83125	closeup of NF on stbd cam; angular rock 6	S
2016	4554	83172	underway heading 348; NF curtain folded sheet w/ h-therm staining	
2019	4535	83220	NF lobate	
2020	4535	83246	Port: NF; stbd see scarp but not flow	
2021	4532	83253	NF not making it to scarp here; heading 338	
2023	4530	83296	old lobates, had gone 200m along flow, head 260 to intersect NFagain	
2024	4508	83296	CONTACT: NF ornamented lobates	
2026	4485	83293	stbd: CONTACT (mostly old pilows but some NF lobates); port NF	
2027	4455	83291	contact still visible to stbd on video	S
2029	4416	83287	come about to follow trend of FR axis from contact of NF lobate w/old pillows; heading 133	P + S
2031	4436	83250	NF lobates	P + S
2033	4461	83204	NF hackly sheet heavily coated in places	P + S
2035	4491	83152	curtain folded NF sheet w/h-therm sed on top	P + S
2036	4513	83112	v ery flat NF sheet w/h-therm coatings on FR axis with hackly levees?	P + S
2039	4527	83090	macro slurp site land rock)	P + S
2100	4526	83090	rock sample 8	P + S
2104			rock sample 8	P + S
2110	4521	83048	lineated/flat NF sheet w/h-therm coatings on FR axis; no crabs out here; maybe that's why coating survived?	P + S
2115	4534	82967	hackly NF sheet	P + S
2120	4535	82882	hackly NF sheetl Karen's water sample; rock sample 9	P + S
2127	4535	82882	more microbial stuff on NF hackly sheet	P + S
2138	4535	82882	lites out; OFF BOTTOM	

Dive Plan 4205 - 29 June 2006

Port: K. Von Damm ***Starboard:*** M. Perfit ***Pilot:*** B. Strickrott

On Bottom Target: x = 5879 y = 70469 9˚46.23066N 104˚16.79090W

Objectives: Find L, A, U and V; recover Hobos in L and V; sample, deploy markers, Hobos and settling experiments; sample fauna near V; reach southernmost extension of new flow and collect appropriate lava samples.

1. Turn on ECHEM at 200m, leave on as descend to bottom, positioned in its holster.
2. Turn on magnetometer at 1000m and do a 3 min spin clockwise and then counterclockwise, note time of spin.
3. Land on bottom ~100m west of the ASCT and 50m south of L vent
   - have surface survey you in at your position
   - turn on cameras including downlooking with booms (fly 4-5m up)
   - pick up a piece of 2006 flow at the landing site (or as soon as you encounter it)
   - deploy a marker at the sample site.
4. Transit ~100m E to the ASCT.
5. Transit 50m north to L vent.
6. At L vent: x=5969 y=70522
   - collect sulfide and place in grey biobox Hdg=038 d=2512+17m
   - measure T with hi T probe
   - 1-2 majors pairs
   - 1-2 gas tights
   - recover Hobo (#3)
   - deploy Hobo
   - pick up basalt if surrounded by new flow (if covered with bio-material place in grey biobox)
   - deploy marker.

In Nov. 2004 L Vent was 352˚C.

7. Other vents around L include:
   - Hot-8(brine) x=5954 y=70553 d=2528 hdg=147 296°C
   - Mkr 22 x=5990 y=70553 d=2526 hdg=169 350°C
8. Transit north (350) along W wall to A vent.
9. **At A vent: x=5859 y=70977**
   - collect sulfide and place in grey biobox Hdg=261 d=2522m
   - measure T with hi T probe
   - 1 majors pair
   - 1 gas tight
   - deploy Hobo
   - sample basalt
   - deploy marker(s).

A vent has two syntactic foam markers (but *not* the A bucket lid marker)

In Nov. 2004 A vent was 235˚C.

10. Fly if necessary up to Mkr 18 (U Vent) x=5517 y=72163
11. At Marker 18 (or U Vent) Hdg=065 d=2507+3

    U vent is a lava pillar in the center of the ASCT with a sulfide on top of it that has an animal community on top of it and was venting brines in 2004.

- collect a sulfide with animals on it and place in the biobox
- measure the temperature of the fluids
- 1 majors pair
- 1 gas tight
- sample basalt (if new flow)
- deploy Hobo?
- deploy marker.

In 2004 U Vent was 257°C.

12. Transit north to the V vent area.
    In the NH camera tows, this area appears to be the southernmost area of 2006 flow.
    - Mkr 19 (at base of W wall) x=5499 y=72342 d=2514 Hdg=283
      - recover Hobo (#11)
      - recover sulfide orifice
      - measure temperature
      - 1-2 majors pair
      - 1-2 gas tights
      - deploy Hobo
      - sample basalt if new flow
      - deploy marker.

In Nov. 2004 V vent (marked by both the Mkr 19 and V Vent bucket lids) was 348°C. (This is the glass chimney vent of 1991.)

- Mkr 21 (top of west wall) x=5494 y=72358 d=2510+6.8 Hdg=?
  - recover sulfide orifice
  - measure temperature
  - 1 majors pair
  - 1 gas tight
  - deploy Hobo?
  - collect extant animal community - *Tevnia* & *Riftia* were here in 2004
  - sample basalt if new flow
  - deploy marker.
- Mkr 20 (diffuse flow area with animal community just south of Mkr 21 vent on top of wall)
  - collect extant animal community
  - measure its T with hi or lo T probe to find the 'hottest' place
  - ECHEM to determine placement of following
  - 1 majors pair in diffuse flow
  - 1 gas tight in diffuse flow
  - deploy setting experiments as follows:
    - [4 'TAMS' and 2 'rounds'] in >20°C flow
    - ECHEM on center of each TAM and round
    - 4 TAMS in ambient (non-venting) spot (move slightly?)
    - ECHEM on center mesh of each ambient TAM
  - filter slurp snowblower material (>6 minutes)
    (watch meter voltage carefully)
  - slurp early settlers off rock surface (amphipods too if present)
    - pick-up basalt with early settlers and place in grey biobox
  - deploy marker(s) as appropriate.

Continue transiting north and sampling new flow.
BE SURE TO IMAGE AND DOCUMENT EVERYTHING AND LOOK FOR FUTURE SAMPLING SITES. DROP ADDITIONAL MARKERS AS NEEDED.

Basket load:

2 marker launchers with 14 markers
downlooking camera
ECHEM probe and can
Alvin hi T probe
Alvin lo T probe
slurp-filter
slurp-carboy
3 grey bioboxes
1 clear square biobox
2 scoops
5 majors pairs
6? gas tights
8 TAMS
2 rounds
3 hobos

ECHEM laptop and power cord/charger in ball.

Origin is 9˚08'N and 104˚20'W.

Dive Summary 4205 - 29 June 2006 - Port Observer: K. Von Damm

Port: K. Von Damm ***Starboard:*** M. Perfit ***Pilot:*** B. Strickrott

Objectives: Find L, A, U and V; recover Hobos in L and V; sample, deploy markers, Hobos and settling experiments; sample fauna near V; reach southernmost extension of new flow and collect appropriate lava samples.

This dive had several important goals. L vent, which we have been sampling since 1991 is the most southerly vent at which an eruption in 1991 was observed (vents further to the south did appear to have been influenced by diking, but likely not eruption at the seafloor). It is also the most southerly vent on the segment influenced by the 1991 eruption. In 2004 we deployed a Hobo probe at this vent, making it also our most southerly instrumented vent. The New Horizon cruise towcams had not observed young lavas as far south as L, but it was also likely these tows were not directly over the ASCT in this area. Therefore one of the goals was to establish the most southerly extent of the 2006 eruption, as the dive would traverse north past the site where the New Horizon tows first observed new basalt. L vent is also relatively easily identifiable, as a tall (17m high) sulfide structure, with two additional active smokers nearby. Thus L vent would also aid in unequivocally tying our navigation together at a known point. This dive was done with only DVLNAV, as the 3 transponders deployed did not provide coverage this far south.

The ECHeM system was turned on at ~1419 at a depth of 312m.

The Dan (bottom looking) cam was also turned on at ~300m to check for ground as the pressure increased. It had a ground at ~1000m and was not used during the dive.

We turned on the magnetometer at 1421 at a depth of 373 m and began spinning. counterclockise (to port). We stopped spinning counterclockwise at 1429 at 634m. At 1437 we began to spin to the right at a depth of ~900m. We stopped spinning at 1442.

At 15:27:58 we turned on the 1st set of video tapes.

This dive reached the seafloor at 1536 with the inhull navigation telling us we were at x=5890 y=70503 d=2519. The surface surveyed us in, and gave us our location as x=5816 y=70556. Our intended target was x=5879 y=70469, so our landing site was ~150m west of the ASCT and about 30m north of the location of L vent. At the landing site it was difficult to tell if we were on 1991 or 2006 flow. We collected a sample of what appeared to us to be the younger looking flow, although whether this was merely an artifact of non-sediment accumulation on the sides of the lobates will have to wait for the chemical results. This basalt from the landing site is **Rock Sample #1** (x=5889 y=70502 hdg=221 d=2519) and it was placed in the aft area between the grey bioboxes in the milk crate.

We then began to transit east to the L vent site. We found L relatively quickly, but instead of a 17m high chimney it was now 4.4 m high. Near the base of L vent we also observed a half-bucket lid Legacy 96' marker. The L vent bucket lid marker we had deployed in March 2004 was not observed. As Hobo #3 had been deployed at the top of L vent, it was no longer in the much shorter sulfide chimney. We did observe several pieces of fallen down sulfide around

the base of L vent, but did not see the Hobo. Part of the problem was that around the base of L there was diffuse flowing fluids with lots of white material, making a white Hobo more difficult to pick out. We spent some time trying to discern if the sulfide had fallen on ***top*** of the new lava flow, or if the new lava flow had flowed on ***top*** of the sulfide, which we eventually decided was the case.

At the top of L we broke off a small chimney in order to increase the fluid flow and to make a better orifice for water sampling and temperature measurement. This sulfide was **Rock Sample # 2** (t=1624 x=5975 y=70519 hdg=356 d=2523 alt=4.4m) and was placed in the forward grey biobox. This sample had Alvinellids and other biology on it. [N.B. Previously when sampling L x=5969 y=70522 hdg=038 d=2512+17m.] The maximum temperature we then measured with the Alvin high T probe was 346°C. The 1st water sample we collected was the **Black Gas Tight** (t=1650 x=5975 y=70519 hdg=345 d=2522 alt=4.5), and we heard it fire. We next collected the **Yellow Majors Pair** (t=1703 x=5975 y=70983 hdg=345 d=2522) and the maximum T on the ICL was ~130°C. We next attempted to deploy a Hobo into this orifice, and Hobo #22 was briefly in this orifice (t~1707) but it then fell out and to the seafloor. We then attempted to deploy Hobo #24 in it, in order to preserve the sub s set-up position. This too fell to the seafloor. This was a difficult orifice to work, and not really deep enough to place a Hobo probe into securely, so we abandoned our plan to deploy a Hobo in it. We then went down to the seafloor to retrieve both Hobos. The sulfide chimney we were working on pre-dates the 2006 eruption and we know from the previous chemistry at L, as well as the height of the sulfide (~17m), that it was very solid material - and it was, as evidenced by our difficulty in excavating a better orifice.

It should be noted that our set-up on L was complicated by the fact that there was warm water rising on some sides around the chimney, which made the sub want to be buoyant. While working around L, the bottom window temperature reached 4°C, again attesting to the flux of warm water around the main sulfide structure at this site. Mike was running the ECHEM unit and saw some signals while we were doing this, although the probe was not removed from the holster.

There are several things to note about the lavas around the base of L. L sits on the floor in the middle of the ASCT. When we first arrived at it, it was obvious it had been affected by the 2006 eruption as there was lots of warm water with white material in it. Initially I wondered if there was only diking, and not eruption at this site, as I saw only older (i.e., 1991) lavas. I soon realized that there ***was*** 2006 flow on the ASCT floor around L, but it did not cover the entire ASCT floor. Also, I remember L as sitting on a relatively flat ASCT floor, and now there were several collapses cut into the floor, almost channel-like in their nature. In some of this diffuse flow, in addition to the white material, there appeared to be early colonizers. We collected **Rock Sample #3** (t=1737 x=5977 y=70518 hdg=24 d=2527) which was a sample of basalt from around the base of L which was new flow with colonizers (*Tevnia*) on it and placed it in grey biobox #2.

We deployed **Marker #9** around the base of L (t=1747 x=5972 y=70518 hdg=210 d=2527). [NB this is within 2 m of our the previously measured depths at the base of L, so the same within the measurement error.]

L had been a difficult place to sample and we spent longer at the site than I had hoped. As we began to transit north (350) out of the L vent area we observed our bucket lid Marker #22 deployed on AdVenture 9 (January 2002). This (active) sulfide chimney was much taller than I

remembered (I remember it as only 1-2 m tall and in March 2004 it had a beehive we tried to sample, and I would estimate this structure as now ~4-5m), it was covered with white material, and was obviously still active. We did not have the time to stop and sample it.

Thus began our transit the ~450m north to the A vent site. We made this transit almost entirely in the ASCT, and close enough to see the bottom. Several observations demonstrate that this eruption is strikingly different than the one in 1991. First, the bottom of the ASCT floor had intermittent coverage with 2006 flow. In some cases a sheet flow of 1991 flow could be observed with a sheet flow of 2006 flow only partially covering it and running parallel to it. In all cases the walls were old talus from the 1991 flow, i.e., the 2006 neither rose up and covered the walls as a result of filling the ASCT, nor did it appear to have flowed into the ASCT from down the walls in any place that I observed. In several places at the tops of lava pillars/remnants there appeared to be blebs of 2006 flow, but whether this is indeed the case, or merely that the 1991 flow looked "fresher" in these places due to a lack of sediment cover cannot be assessed. My impression sitting on port and driving north, is that the flow was more likely to be on the eastern floor of the ASCT (when it was present and did not cover the whole thing), and that it flowed from north to south - based on the lava lobes. When two sheet flows of 1991 and 206 flow were side-by-side in the ASCT floor, the 2006 flow, in my observations, was always to the east. I never saw any evidence of new flow on the western wall, which is the wall I observed.

As we got close to the location of A vent, we observed more white stuff in the water. The main A vent is on a bench in the western wall (x=5855 y=70973 d=2522m), while there is a secondary vent up on the rim nearby (x=5842 y=70968 d=2517m). As we came into this area we were closer to the rim depth than the bench depth. We also observed a definite halo of white stuff on the rocks, and the ring of serpulids which has always marked the outlying edge of this hydrothermally active area was still present. We came upon the secondary A vent (on the top of the rim) with the bucket lid A marker that had been (erroneously) deployed at it on dive 3985. We looked around for the main A vent, which still had the two syntactic foam block markers initially deployed at it in 1991 when last visited in November 2004. We could find neither the vent nor the markers, but I am not convinced it is gone, just that we did not observe it. This will need to be resolved in November 2006. As the vent at the A bucket lid marker and main A had almost the same chemistry in the past, we eventually went back to it, and sampled it. This A vent structure was a relatively large white spire (~ 4m built partly over the edge of the ASCT wall. It was covered in white material and leaking fluids. Bruce's initial comment was that it looked like this structure was "done". We collected the orifice from A bucket lid marker **Rock Sample #4** (t= x= y= hdg= d=) and placed it in the port aft milk crate. Although it had "bio" on it, it was too large to place in a biobox, which was full anyway with biological traps to be deployed. We measured a maximum temperature of 269°C with the high T probe, and were able to get a good enough orifice with robust enough flow to sample fluids. We collected the **Black Majors Pair** (t=1904 x=5799 y=70983 hdg=241 d=2514). We next collected the **Orange Gas Tight** (t=1906 x=5799 y=70983 hdg=241 d=2514) which we heard fire. Finally we collected the **White Gas Tight** (t=1910) from the same orifice and heard it fire as well. We deployed **Marker #4** at this site (t=1920 x=5798 y=70987) adjacent to bucket lid A.

In order to collect a 2006 basalt from the ASCT at this latitude we moved down into the ASCT and collected the edge of a collapsed lobate as **Rock Sample #5** (t=1927 x=5816 y=71011 hdg=284) and placed it (actually 2 pieces) in the starboard aft milk crate. In fact as we set the sub down to collect this sample, we caused more collapse of the lobate as it was hollow

underneath the outer shell.

We then left the A vent area and continued north, mostly within the ASCT, but sometimes out of it - always in sight of the bottom.

The description given previously of the distribution of 1991 vs 2006 flow holds for the area north of A vent as well. We came into several areas where there was obviously more murk and "stuff" in the water, but did not observe any discrete venting sources. We did see the /5 syntactic block foam marker that we had deployed in 1991 (x=5681 y=71552), sitting on basalt in/on the ASCT wall. In 1991 this marked a site of diffuse flow, but no diffuse flow was visible (or even white material) at this time.

We started the third set of tapes at 1932.

Our next objective was U vent, which is located in the bottom of the ASCT. U is ~1.2 km north of A. It is worth noting that the New Horizon images suggested that the southernmost extension of the 2006 flow was slightly south of the location of U vent. Partway along our transit to U we decided to sample a basalt to examine the potential difference in age/chemistry along this distance. **Rock Sample #6** is a piece of the new flow where it forms a contact with the 1991 flow (t=2023 x=5475 y=72199 d=2510) somewhat south of the location of U vent. We dropped **Marker #14** at this site (t=2027 x=5476 y=72200 hdg=295 d=2510).

U vent is a basalt pillar with a sulfide diffuser on top which had an animal community (like a smaller version of Tube Worm Pillar) we first discovered in 2002 and sampled again in 2004. In 2002 on AdVenture 9 we had deployed the bucket lid marker 18 at this site, and once we realized it was not "V" vent, subsequently named it "U". We had been out of the ASCT up on the east wall on lobates, when we approached U. It is near the east wall, but although we clearly saw a lot more "stuff" in the water and spent some time looking for it, we never did find the structure. One of the interesting aspects of U is that it was observed to be venting in the ARGO photos in 1989, but seemed to be inactive in 1991 when we visited it. The next time we got back into this area in 2004 it was indeed active. Because of time and power constraints and the need to get to V vent, we abandoned looking for U and continued north. We therefore were unable to assess whether the pre-existing animal community on the top of this pillar was still present.

Again the previous descriptions of the floor of the ASCT hold. In general the proportion of 2006 to 1991 flow appeared to increase as we went further north.

By the time we arrived at the V vent area we were out of power and almost out of time. We did not have time to look for any of the markers that had been previously deployed at this site. We also did not have time to look for the Hobo probe that had been deployed in 2004 in V vent. The V vent area consists of several things: the main V vent at the base of the west wall, also identified by bucket lid Marker #19; a basalt remnant with a "diffuser" sulfide on top that has hosted an animal community (including *Riftia* and *Tevnia* when last observed in 2004) and marked by bucket lid Marker #21; and an area of diffuse flow that hosted a mussel, etc. community also on the top of the west wall, but located just south and marked by bucket lid Marker #20. We quickly set-up at a black smoker that we ***think*** was the Marker 19 V vent, but as noted above did not observe and did not have time to look for the Hobo or either of the two markers we had previously deployed here. The setting was correct, although the structure appeared to have grown: it was not tall but was comprised of many small (1m) spires. We collected the **Red Majors Pair** (t=2043 x=5415 y=72333 hdg=268 d=2511 alt=1.7m) and measured a maximum temperature of 263°C with the ICL. We then collected the **Blue Majors**

Pair (t=2046 x=5415 y=72333 hdg=268 d=2511) and measured a maximum of 319°C, followed by the **Red Gas Tight** (t=2050 x=5415 y=72333) which we heard fire, and finally the Yellow Gas Tight (t=2052 x=5415 y=72333) which we also heard fire. Smoke was in our eyes so to speak and Bruce could not see if the last gas tight was well into the orifice, hence this sample may not be as good as the others. [NB Previous coordinates for V vent are x=5499 y=72342 d=2514. Navigation is not always good for this vent as it is in a bit of a cul-de-sac at the base of the west wall. It is also an area where talus has appeared to be sloughing off of in the past, and the sulfide chimneys are likely growing up through the talus.] All of this sampling was done with the lights off to conserve power. Of the vent areas visited on this dive, V was the most active in terms of the apparent extent of diffuse flow and white material on the rocks. The last thing we did before leaving the V vent site was to collect a basalt covered in white material. Because it was covered in white it is impossible to assess if it was 1991 or 2006 flow. It was collected just a couple of meters from where we collected the fluid samples and is **Rock Sample #7** and was placed in the main wire mesh basket on the sub.

To leave the V vent area we moved up out of the ASCT and over the west wall to drop weights. I could not observe either of the markers or the specific sulfide or diffuse flow communities to verify that they still exist. However, there remained abundant white stuff with diffuse flow on the top of the wall as well.

We then left the seafloor - a bit early in time, but completely out of power.

Dive 4205 Transcript of audio tape with documentation from video tapes

Std. Obs. M. Perfit

1534 Starting to see bottom…lobates not collapsed. pretty young looking, glassy, seems to head down to W. Not much sediment cover. 2517m approaching bottom of nicely formed lobates. Light sed cover, good glassy reflections off of surfaces. 2518m on bottom.
1539 5891x 70503y.

1540 **Sample #1** 5892x 70503y Hdg. 193 2519m s Lobate flow that looks young but likey is not the "new flow" Looks like 91-92 flow….has too much sediment cover. Sample is round bud of lobate flow right at the contact. Light sediment coating but quite glassy. Put in area behind the bioboxes.
1557 finished sampling, 2519 m. heading to AST to the East. Likely we are about 150-160 m W at 100° to get to of ASC.

Good relief on lobated pillows…sort of gnarly lobates with not much sediment. about 1 m relief but collapse is starting to appear…1 m deep with shelves on inside of lobate collapse. all looks like the same flow we sampled.

1602 5866x 70547y 100° hdg. 2515 m deep…. looks the same with older stuff underneath. Saw an Alvin weight. Starting to drop into deeper collapse, with some lobates with 20-30 cm, but then drops down into a major collapse area. Bottom covered with talus of lobates. Getting cloudier, small many Brachyurans.
1604 2-3 m deep collapse, coming over a steeper messy wall of collapse (ASC?). No new flow in floor of trough. Looks to be sheet flow floor with not much sediment on it. Older pillar sticking up. Old collapse on SIT camera looking down.

1605 in ASC 2517 heading 165 more of a ropy flow in axis. Lot of talus and broken glass. Cloudy water. Nothing looks too new. Much glass debris. Flying high in murky water.

1608 2517 At L vent .5982 70518y A lot of staining on lavas. Sitting on some lobate flows with shimmering diffuse flow coming out of lobates. Could be the new flow around the chimney.
1610 Driving to the W and NW. Contact of new and old flow on port side. Also new flow over collapsed sulfide chimney pieces. Glassy lobate with some collapse transitions into one covered with white bacterial staining and venting as we circle from west to the North and then E around L.
1611 Facting 054. Bucket lid Legacy 2 on bucket lid (this was a 1996 marker- so why is it on top of new flow?). Lid might be on edge of a chimney remnant and survived. Shimmering water very extensive. Lots of crabs on lavas.
[moving around the chimney looking for HOBO].

1613 New flow surrounding part of a collapsed chimney [note that Karen stated the L chimney was much taller in the past]. Appears to lap up over it. New flow looks like it is coming in from higher up (confusing- unsure of this).

[At top of L vent setting up to sample fluids and place Hobo into it]. New flow is in contact with collapse talus of older ACT to the N of the chimney. Bottom window temp up to 2.5°C.
1618 Surveying around chimney to the east and then N over the Legacy marker again.
1623 **Sample #2** 70519y 5975x 2523m. Heading 356 Temp 1.9 Sulfide taken from top spire on L vent. Same place that Bruce excavated to get probes and major and gas samplers in. Most of pictures are facing to the N.
1627 2523m 70520 …built up on older lobates..but there is new flow that may have filled up part of ACT. It is in contact with older flows too. It appears that the new flow is around the chimney. Some Alvinellids alive on chimney.
1630 manuvering around for a while to get a better position to sample fluids
1641 excavating the chimney to get better flow.

~1700 taking Voltammetry Data 5975x 70519y Scans #20-58. Wand remained in its holster. Sub is up about 4 m. from diffuse flows that concentrate around the base of the chimney. Readings look good but vary greatly from run to run presumably due to the fact that we are not directly in the flow and it must be mixing with ambient seawater beneath us.

1705 yellow major pair in 344°C fluid.
1715 END OF TAPE 1

1720 2527 m on bottom at L vent. Base of trough. Contacts along collapse along walls. More venting toward the chimney. Very glassy hardly any sediment. Much venting in cracks, with white staining and crabs concentrated there. Fish in one of the venting whole. Depth 2527, sitting on bottom.

Some talus near the wall but it appears to abut the wall sharply. Very coated with bacteria. Many moderate sized Brachyurids…maybe a baby zoarcid fish?

Sampling in new lobates with good diffuse flow and immature tube worms
1731 5976 70517 hdg 231. Temp up to 3.3° Good video of sulfide chimney overrun by new flow
[Second side of audio tape]
1734 **Sample #3** New flow at base of L vent. In diffuse water. 5876x 70518y 2526m Facing 214 Sw. Lobate flow with Tevnia on it. Good pictures of this stop. Two pieces from the same location, from a site with vigorous diffuse venting, with lot of biology, Brachyuran crabs, bacterial mats. Along the west wall of the ACT. Panning camera to show area. Can see the really flat top on the lobate flow surface. Some diffuse venting in the lobates.

1753 Flat area of lobates with contact off in distance
Sample came apart – in two pieces .
1754 taking video of flow in contact with sulfide.
1800 5793x 70514y 2526m Heading to A vent. Confirmed that some of the chimney had fallen over and the new lava flowed around it. Collapse here in new flow, stills of this….depth of 1m or 1.5 of open space under the new lobate flows

Moved around to the S and E to see collapse in new flow very clear contact of the new lobate with older lavas that are mostly talus.
1802 MARKER #9 ???deployed.
1803 Fissure along the wall with a nice contact. Older flows are very clearly stained with Fe-Mn oxide coating on them and lobate comes right up to the base of older lavas but there is talus between. There is staining and some venting in new lobates. Lots of collapse along the edge. Some pillars and collapse at edge of AST. Traveling along the wall and see another sulfide with lava wrapped around it.
1804 Hdg 325, 5967 70559 Seeing Marker 22 near another chimney that appears to be active. with new flow lapped on to it.
Less collapse, can see marker 22. Fresh lobates on other side of chimney? Surpulids on the wall or stained old flow and much talus. Old folded sheets that look red and grungy looking. Not in sharp contact with the wall and still has glassy surface with some sediment on it. Now turn into folded sheets that can be seen on both sides of sub.

1806 2526m Folded sheet flow. y 70580 heading 318. Lots of collaped lobates some very glassy, can't see wall here. Contorted sheets or collapse. Some staining but lots of cloudy water..hard to see. More talus and collapse. Karen on west wall, so I don't see the E wall. Ropey sheets, distrupted still looks older.

1808 hdg. 331. 2523 m Low relief. Lots of broken talus, but might be 1991 flow because it is glassy and does not have much sediment accumulated. Folded flow with fair relief. No wall. Crabs common. Not as much collapse or talus. Folded flow looks pretty much the same. Has more of sheet on E with ropes heading N-S. All pretty ropey but varies to very jumbled.

1810 5918x 70816y Very glassy flow, folded but has fine sediment cover. Might be near the E wall because it looks shallower.
1811 5903x 70716y hdg 330 2522m all young flow in contact with older. Port camera shows us flying along the contact. Picture of lobates over sheets. Bruce sees contact on west but does not go to either wall. Big collapse on my side. meter or two of collapse. alt 1.4 drops to 3.8 suggesting 2.4 m of collapse. Flow Does not reach the wall. Lobates are very open under them with short pillars holding them up. Much collapse. Bruce sees all young flows in front. Contact on port side, but I am in all young flow and not near the wall. Two levels of collapse obvious. One up higher and another inside it. Looks like two periods of flow. Pillar with collapse.
Flat on bottom, not a lot of collapse….looks solid on bottom. Around edges of the collapsed lobates there is much talus on floor but away from the collapsed edges it appears to be more of a solid flow. 2-3 meter deep collapse here. Becomes shallow lobates with less collapse. alt 4.4 changes to 1.6…suggests nearly 3 m deep collapse.
1815 5860 70846y 2523 m Still in thick new flow with collapse…some pillars sticking up above it..but are they OLD? or young?
1817 2522m Get the sense that there were two periods of flow. Lobates but starting to see diffuse flow. Venting between the young lobates. Karen sees contact on west wall some of which is up on a bench. [maybe a fissure along the west wall?]]
1819 More white covering on lobates. Flying up about 6 m. 314 hdg. We came up a step and we are into older lavas with talus. Some ropey flow moving down to the SE but its up on the wall – up a step depth 2519. Deeper on Stb. Lots of bacterial coating. zone of white staining is very restricted to small areas. Shrimp.

1820 Surpulids on rocks, lots of white coatings
1822 Hdng 345. At "A" marker 2516 m….very pointy spire on chimney. Note A marker is a bucket lid that sits on the slope to the E of the vent. Fractured older basalt with diffuse flow. Going to move around to find the "true" A vent. Going down and further N looking for syntactic foam markers.

1825 heading 314…contact. 5827 70991 2.5 degrees. Coming up a wall where the A marker is. Coming around from facing w to the N. Staining on bottom and the wall. Heading 300 depth 2521.

1826 Shallow collapse in lobates…could be the new flow. Short pillars. Bruce sees the contact. M-sized collapse. 2522 heading 350. New right on the edge of collapse. Just on top of the collapsed area. Some of the collapse is on top of older collapse but can't see what is down in the collapse. Old collapse has 2-3 m of relief. Not clear why the new flow is not down there..but can see some pretty glassy flows in deeper part of collapse.
1829?-30 5819 71042 Collapsed area with a lot of crabs. Its an older area but its hard to tell if there is young flow in amoungst the collapse talus. Nice pillars. Turned around and flying south at some point
1831 heading 179 5822 71024 2522 m Flying hdging 233?..flying about 3 m high, that is about the depth of collapse here. Collapse remnants on the wall , talus, white staining. 2519m. Big collapse pieces, older and degraded, some bathtub rings on wall. Mostly old talus with white coating common on wall heading up on NW.
1833 Flying 172…so we have come around again and can see "A" marker again. Water is getting cloudy and now there is much diffuse venting. Diffuse flow all over in jumbled sheet flows with fine white coating. Heading mostly S SW 170- 229. T is 2.3°
1836 hdg 233 depth 2518 Can see surpulids on the wall. Took a still photo. Turned away from the wall again.
1837 flying south 2517m along the wall.
1838… mostly ropey flows below. Back into patchy fresh lavas with a bit of low relief collapse over jumbled sheet flow. Not very thick maybe 0.5 m
1839 5821 70945 2520m heading 051. turned around to N now -contact going north but back into talus as we come up a wall.
Wall was very coated with bacterial matter.
1840 at location where A should be 5840 70962 2516m. Looks like a dead collapsed sulfide chimney.
1844 moving to the west at 259 to look at wall which is stained white but is older collapsed lavas. 2520 m.
1846 Back at orginal spot with tall chimney. Lots of diffuse flow all around T 2.8 - 3.1 °. There is a vent here and did see what appeared to be a clump of Alvinelids. ON top of wall facing 277 on west wall. Trough is about 9 m. deep from this point.
1848 Chimney is about 9 m tall. Knocked top spire off. Many Brachyurans on it. Can see clearish fluids emanating from top. Starting to take fluids etc from chimney at "A". Depth 2514
1858 At chimney that was excavated. Started more focused venting. mostly clear fluids. T up to the 260°-270°C range. Sampling fluids. First with black major pair? white gas tight.
1915 finished water sampling.

1916 Large piece of sulfide **sample #4** in back port milk crate. 5799x 70983y 2514 m. Going to head N ..flying high to make ground. Need to drop down to get sample of new flow.
1919 heading 254 at 2516 m over serpulids on old lobates. Putting our marker near this vent ..Marker #4 5798 70986 on bench on west side of valley wall.
Audio TAPE ENDS, RECORDER OUT OF POWER [remainder of dive is based on video but my voice is not clearly head.]

1924 heading 040 at 2520m collapse on edge of new flow
1925-1928 5812 **71011 2523 m SAMPLE #5 landed on lobate top and collapsed the roof.**
1931 flying N at 340…new flow with older pillars sticking trough.
end of TAPE 2.

1934 5807x 71042y 2521m hdg 341 Heading N Older collapse
1937 Hdg 354 some pillars that are about 3 to 4 m high. Looks like some new lava on top of older collapse roof…or at least the same height.
1938 5770 71201 2521m might be young flow on floor here, some staining and venting in lobates with shallow collapse. LOOKs like younger flow is mostly on east side and has not flowed on top of remnants in center of axis
1939 Much more diffuse venting- many more crabs, lavas are highly broken up and then into lobates that look like YOUNG flow.
1940.. Many crabs and staining…more sheets here….contact with older here.
1941 Older? sheetflow, cloudier water, collapse on edges, sheet on east side, older sheets (1991?).
1943 5733x 71285y 2514m sheet is continuous for some time. Very coherent, Talus on West side where it drops down to flat floor from the wall. Running along the edge of a collapse- higher on west side. older area
1944 more of a collapse area. Hdg. 354 2.5 m deep collapse. Good drainback features, pillars common. 2514 m deep.
1945 edge of older collapse on East side now. lots of pillars in center.
1948 ropey sheets, 5688, 71484 2514m older collapse area with pillars
1950 5681x 71552y **old MARKER /5** a 1991 marker very collapsed area with many pillars that are up to 4 m high. Could be degraded sulfide there.
1952 ropey glassy flow on east side of trough 2514m depth 5666x 71634y heading 345… We have not come out of the ASCT, still at same depth and trend.
1956 Jumbled sheets with common pillars and collapsed remnant walls, 2512 m, Older collapse
1959 5630x 71817y 2513 hdg. 347 New flow, narrow tongue. Discussion about whether lobes on top of pillars are new flow. I suggest NOT, we agree to disagree. Does not extend far at all.
2001 2512m, might be some blebs of new flow amoungst the old collapse Water is getting murkier.
2003 5613x 71959y hdg 041 more coherent older lobates with more crabs and surpulids
2004 heading more W to find vent "V". Depth shallowing 2508m Mostly coherent lobates that could be 1991 flows. Pretty glassy only light sediment.
2007 5562x 72067y hdg 315 2507m Staying in lobates
2010 More collapse 5509 72127. 2506…still shallow.

2012 More crabs …looks like new lava. YEs young lava in the trough, very glassy very lobey, 5466x, 72176 y. Hdg. 208 now, depth 2508. Turned to west and could see young flow in the deeper part of the trough.
2015 Turned to the S 5461 72149 /steep wall with bacterial staining. Very cloudy water. Lots of staining on collapse.
2017 heading to V vent going N again. Young flow covering some talus in trough but it is very patchy.
5471 72118 2508m. Looking for chimney on top of pillar. Collapsed older area. Water has good deal of floc and is murky.
2020 hdg 349 contact with new flow in forward camera and on port side. Very narrow. 5483x 72184y 2507 m
Stopping for sample. Some handheld shots of this on Karens? camera
2025 **Sample #6 Young basalt** lobe in contact with older pillar. Lobe is upper crust on collapse. 5475x 72199y hdg 277 2510m depth. Placed in front main compartment. Three pieces of basalt.
2027 **Dropped Marker #14** 5476 72200 2509m
2028 Large collapse at contact in new flow. 5469 72212 2508m hdg 321
Quickly back into older 1991? flow as collapsed remnant walls and pillars.
2032 2506m hdg 341. New flow? Patchy in shallow collapse.
2034 Turning to west hdg 280
2034 New flow in old collapse. wrapped around a pillar. start to see lots of floc and biogook on collapse. Wall is not in sight. Much diffuse venting 5424x 72330y. 2510 m At V vent 5417x 72332y 2511 m deep.
V vent is smoking. Looks like a candelabra. Lots of dark smoke heading to the East. Sampling fluids…but difficult because of smoke. Red bottles? Blue one?
2045 5415x 72333y 2511 m heading 268° Window temp is 2.6. Hi T probe up to ~319°C.
Taking EChem readings in flow around V vent. Scans 59-120. Showing clear peaks.
2048 Gas tight. Bruce having a hard time seeing.
2051 other Gas tight.
2054 heading 299. Fallen sulfides on port side. Picking up lava from this area. Looks older.
2056 5414x 77336y 2512m **Lava sample #7** in older? flow just north of vent
Taking more EChem readings away from vent and on way up to surface scans 120-137. Driving around a bit.
2058 Weights away.

VIDEO LOG

Dive 4204 **28-Jun-06**

VCRs #1 and #2 (P and S)

Pilot- Bruce Strickrott; port observer- Karen Von Damm starboard observer- Mike Perfit

Port and Stbd Cams, tape 1 of 3

GMT	comment	video P or S
?	dive launch	P + S
1534	bottom on SIT camera; lightly sedimented old pillows	P
1543	not too old lobates	S
1600	underway; lightly sed. Old lobates	P + S
1601	collapse in old lobates	P
1602	2nd collapse in old lobates	P + S
1604	ASC-large collapse, murky water	P + S
1606-7	nothing on either video	P + S
1608	L-vent chimney, bracyuran	P + S
1610	new flow in AST floor + old sulfide chimney lying down	S
1611	microbial stain on new flow	P + S
1612*	L-vent and new flow	S
1615	Looking for Hobo; then L-chimney and new flow	S
1617	sulfide chimney burried in new flow	S
1619	found a bucket lid marker	P + S
1623*	removed top of L-chimney	P
1632	alvinillid on top of L-chminey; bracyrans too	P
1640	water sampling	P + S
1643*	alvinillid on top of excavated chimney	P + S
1655	water sampling (until end of tape 1)	P + S

Port and Stbd Cams, tape 2 of 3

1730	New lava over sulfides	P + S
1734	same, plus lmall NF lava collapsel sample 3 of NF at chimney base	P + S
1800	port recording stbd cam	P + S
1802	port cam switched back	P
1803	underway to A vent	
1806	curtain folded sheet in AST; port and stbd video is very dark; can't tell if it is new flow or not; Karen feels it it '91	P + S
1811	improved stbd video; looks like a contact of new lobate and '91 sheet; new flow is patchy here	P + S
1815	collapses in AST and new flow	P + S
1827	A-vent, collapses in old lava, driving around for 20 min	P + S
1847	sampling A-vent fluids; brachyurans on edifice	P + S
1925	sampling NF in AST beneath A vent	S
1930	Discussion of sepulid seen earlier in the div; getting underway at tape 2 end	P + S

Port and Stbd Cams, tape 3 of 3

1932	not much too see on either tape	P + S
1936	NF collapses at AST floor; Galitheids in collapses of NF and old flows	P + S
1939	more whitish stuff coating rocks; lots of diffuse flow	P + S
1942	sheet flow in AST; looks old but hard to tell	P + S
1946 -1950.5	very cloudy water and dark video; old marker 295 at 1950.5 gmt	P + S
1951	more dark video	P + S
1952	collapses (dark video)	P + S
1953	stbd video improves	S
1956	collapsed old lobates	P + S
2003	old lobates	P + S
2010 to 2012	collapse in old lobates; smoke + white floc in the water; more crabs	P + S
2022	NF lobates at AST bttom; take sample	P + S
2037	V-vent chimney isw smoking when Alvin arrived	P + S
2056	old lava sample	P + S
2058	lites out; OFF BOTTOM	

Dive Plan 4206 - 30 June 2006

Port: M. Lilley ***Starboard:*** R. Lutz ***Pilot:*** M. Spear

On Bottom Target: x = 4457 y = 77877 9˚50.24963N 104˚17.56711W

Objectives: Land near sediment trap, transit to Bio9, recover Hobo, sample, deploy resprobe, markers and settling experiments, transit via P; pump deployment at BM82 (Mkr 8); transit south to TWP.

1. Turn on ECHEM at 200m, leave on as descend to bottom, positioned in its holster.
2. Turn on magnetometer at 1000m and do a 3 min spin clockwise and then counterclockwise, note time of spin.
3. Land on bottom ~150m west of the ASCT at the latitude of the Bio9 vent area.
   - pick up a piece of 2006 flow at the landing site (or as soon as you encounter it)
   - deploy a marker at the sample site
   - locate sediment trap.
4. Transit E to the ASCT and get down into it to find Bio9.
5. **At the Bio9 vents: x=4618 y=77974 hdg=108 d=2511m**
   - determine number of vents; if there are multiple vents measure the temperature and determine which is hottest
   - collect sulfide from orifice
   - 2 majors pairs
   - 2 gas tights
   - use toaster
   - pick up basalt
   - recover Hobo (#3=Bio9, #1=Bio9', #4=Bio9")
   - deploy Hobo (s)
   - deploy resprobe
   - deploy marker(s).

In Nov. 2004 Bio9 was 386°C, Bio9' was 384°C, Bio9" was 376°C.

6. Look around the Bio9 vent area for areas of intense diffuse flow.
7. If there is 'appropriate' diffuse flow at the Bio9 vents:
   - measure its T with hi or lo T probe to find the 'hottest' place
   - ECHEM to determine placement of following
   - deploy setting experiments as follows:
     - [3 'sandwiches'] [4 'TAMS' and 2 'rounds'] in >20°C flow
     - ECHEM on center of each TAM and round
     - 4 TAMS in ambient (non-venting) spot (move slightly?)
     - ECHEM on center mesh of each ambient TAM
     - pick up rock with early colonists and place in grey biobox/RNA chamber
     - ECHEM where rock was obtained
   - filter slurp (snowblower) material
     (watch meter voltage carefully >6minutes)
   - sample *Riftia* (if observed) and place in clear biobox .
8. If no appropriate site for a resprobe deployment is found at the Bio9 vents, transit south through the ASCT to P vent.
9. **At P vent: x=4577 y=77921 Hdg=010 d=2510m Mkr10**

- measure T with hi T probe
- 1 majors pair
- 1 gas tight
- deploy resprobe
- sample basalt
- (there is already a Hobo in this orifice)
- look for old Hobos (#10 new style in P, #2 new style in P-middle)
- deploy marker(s).

On 4203 P vent was 387˚C.

10. Transit south to BM82 (Mkr 8) vent area.
11. Look for Alvinellid Pillar (**x=4688 y=77645** (-50-60m?) and recover Hobo #14 (old style)).
12. **At BM82/Mkr 8: x = 4608 y=77581 Hdg=310 d=2504m**
    - position pump snorkel in diffuse flow
    - position sediment trap as needed (?)
    - measure temperature of black smoker at Ty/Io
    - recover Hobo from Io (new style # 8)
    - 1 majors pair
    - 1 gas tight
    - deploy Hobo if appropriate
    - sample basalt with early colonizers and place in grey biobox/RNA chamber.

In Nov. 2004 Ty vent was 310˚C and Io was 355°C.

13. Transit south through BM141/2 area: **x = 4746** (-50-60m?) **y = 77144** (-20-40m?)
14. Transit south to TWP.
15. At TWP: **x = 4845** (-50-60?) **y = 76693** (-20-40?)
    - see if it has re-activated
    - measure temperature
    - collect remaining bottles
    - deploy Hobo if one remains
    - deploy marker.

Continue south as time permits.

BE SURE TO IMAGE AND DOCUMENT EVERYTHING AND LOOK FOR FUTURE SAMPLING SITES. DROP ADDITIONAL MARKERS AS NEEDED.

Basket load:

2 marker launchers with 8 markers
downlooking camera
ECHEM probe and can
Alvin hi T probe
Alvin lo T probe
slurp-filter
2 grey bioboxes/RNA chambers
1 clear square biobox
2 scoops
1 resprobe with ICL can
4 majors pairs
5 gas tights
1 toaster
8 TAMS
2 rounds
3 sandwiches
2 hobos

ECHEM laptop and power cord/charger in ball.

Origin is 9˚08'N and 104˚20'W.

GMT	
1455	We are at 1100 meters and starting clockwise magnetometer turns.
1458	Starting counterclockwise magnetometer spins.
1507	Finished with magnetometer spins.
1512	We are at 1650 m and the ground in the Dan cam just showed up.
1541:34	The bottom is in sight, looks pretty flat, black, shiny, ropey sheet flow with collapse features in sight
1602	On the bottom, 2504 m, x=4377, y=77876; We placed basalt sample #1 in the middle milk crate. Looks like new flow
1606	Headed for the sediment trap, ropey sheet flow out my window. Lightly sediment dusted with white stuff here and there.
1607	Still over ropey sheet flow, x=43982, y=77870, now starting to see some areas of collapse, maybe one m deep, occasional orange shrimp are the only biology so far
1609	Still ropey sheet flow, x=4423, y=77864, sheet flow has become very flat, hdg is 088 and the flow striations are aligned with the direction of the sub.
1609:35	x=4438, y=77860, very smooth flow
1610:46	x=4466, y=77859, still smooth sheet flow
1611:45	x=4483, y=77871, still over sheet flow with lineations perpendicular to the sub hdg 019, depth 2503, alt 1.2 m
1615	At the sediment trap. X=4507, y=77876, depth 2501, trap is on lobates that abut the sheet flow
1620:30	Pumping water to get light enough to lift the sediment trap.
1626	Still pumping water
1628	We have lifted the trap and are headed for Bio 9, flying too high to see the bottom well.
1640:31	x=4601, y=77958, about 30 m from Bio 9. Setting the trap down so we can drop down to see the bottom as we approach Bio 9. depth is 2505 m

1646	trap dropped and we are headed for bio 9.
1648	x=4607, y=77957, very murky here, we are still too far off bottom.
1649:36	x=4591, y=77995, see a riftia tube on the bottom, lots of small brachyurans, we are at the east wall, murky as hell
1651:30	Looks like old stuff from the east wall has collapsed down onto the younger flow
1658:41	x=4535, y=78014, in ASC, collapsed lobates
1701	x=4546, y=78003, we think we are north of bio9 and will drive south
1704:37	x=4566y=77986, mostly unbroken lobates with some collapse here and there
1705:24	x=4572, y=77981, intact lobate beneath the sub but all I see is collapse
1713:30	x=4599, y=77986, still looking for Bio9, water is not very murky here, broken sheet flow, lot of relief, lot of small crabs
1717	Small chimneys, x=4613, y=77991, hdg 355, depth 2509, diffuse flow around chimneys, beehives, not much smoke
1727:41	Used hi T probe and could only get 22 deg. Decide to bail.Will continue to look for othervents as we make our way south
1729	Leaving the area, bottom is very flat sheet flow.
1731:31	x=4595, y=77975, Jumbled stuff looks like collapse of old east wall, see sediment trap as we move down the ASC near the east wall.
1733:49	x=4597, y=77957, bottom is dropping away, we need to get lower
1744	At the P vent hobo, the orifice looks way too small to deploy the res probe, video alarm goes off.
1745	Still at P vent hobo, x=4627, y=77938, depth 2510, hdg 035
1746:30	Changing video
1751	Have been looking around the P structures to find a place to deploy the res probe but no luck
1820	Had a tape problem. We have deployed Lauren's settlement experiment near P vent in diffuse flow x=4631, y=77930, Rich did echem at the site and we deployed Marker 5. echem temp was 21.5
1834	Leaving the site of Lauren's experiment to collect the elevator with the pump for deployment at M82
1848	x=4648, y=77812, hdg 179, driving to elevator, sheet flow with pressure ridges

1952	Tape problem again. We searched quite a while for the elevator and found it We took rock sample #2 at the elevator site where a new flow overlapped an older flow, whether 91 or not, I'm not sure, depth was 2502. rock is in the port milk crate. We are now near biomarker 82
1956	Setting up to drop pump, x=4676, y=77587, hdg 082, depth 2504
2005	Rich is doing echem in a crack where we plan to deploy the pump hose. Echem temp is between 13 and 25 degrees
2026	The pump hose is deployed in the crack and we are headed north to find Io.
2033:54	Found a series of smokers a few meters north of the diffuse flow experimental site.x=4677, y=77601, hdg 355, depth 2504 m, we believe this is the old Io site
2049	Got 371 deg on hi T probe. Taking Black major pair, icl reads 350.
2101	Took blue major pair, icl did not work
2108	Took RWB gas tight
2111	Took green gas tight. All of these samples taken at x=4677, y=77601, hdg 371, depth 2504
2115	We try to setup to deploy the res probe. The north side is the only possibility but Mark says he can't get the sub into the needed position so we bail.
2124	We are taking white major pair in a diffuse flow crack a couple of meters east of Io, we are very late but Rich wants the sample for Costa. We try to deploy a marker at the Io sample site but Mark loses site of the vent and we are very late.so we drop weights. EOD.

Dive Transcript
Starboard Observer
R. Lutz

Dive 4206 June 30, 2006

Pilot- Mark Spear; port observer-Marv Lilley; starboard observer: Rich Lutz

Took scans with ECHEM during Alvin's descent to bottom…..started scans at 564 m below the surface (File Body name was 4206 initially during descent…..later changed to 4206A and later during dive to 4202B…..each time gave a new File Body name, I set the Index to 0, which would start over numbering scans in order)

GMT

	Scans	Depth
1434:53	1–6	564m
1436:57	7-13	640
1439:22	14-18	705
1441:14	17-23	762
1442:	Hit Manual DC Mode and continuous for temperature calibration	

	ECHEM temp	Depth	Alvin Window temp
1444:09	11.0	800m	5.3
1445:27	11.0	891	5.1

	Scans	Depth
1446:27	24-36	980
1450:23	37-41	1051

	ECHEM temp	Depth	Alvin Window temp	Low-T Probe
1451:45	10.0	1100m	4.2	
1452:43	10.0	1113	4.1	
1454:34	10.0	1164	3.9	4.17
1455:56	9.5-10.0)(alt)	1196	3.9	4.0

	Scans	Depth
1457:20	42-49	1232
1459:47	50-62	1292

	ECHEM temp	Depth	Alvin Window temp	Low-T Probe
1502:45	9.0	1232m	3.3	3.5

	Scans	Depth
1503:52	63-74	1474

	ECHEM temp	Depth	Alvin Window temp	Low-T Probe
1507:20	8.5-9.0(alt)		2.9	2.9

	Scans	Depth
1508:23	75-82	1560
1511:21	83-90	1667

	ECHEM temp	Depth	Alvin Window temp	Low-T Probe
1513:40	8.5		2.6	2.7

	Scans	Depth
1515:12	91-98	
1517	99-105	
1522	106-109	
1523	110-114	
1525	115-120	

	ECHEM temp	Depth	Alvin Window temp	Low-T Probe
1527	7.5-8.0(alt)		2.0	2.0

	Scans	Depth
1529	121-135	

	ECHEM temp	Depth	Alvin Window temp	Low-T Probe
1532	7.5-8.0(alt) (mostly 7.5)		1.9	1.9

	Scans	Depth
1534:36	136-145	

	ECHEM temp	Depth	Alvin Window temp	Low-T Probe
1537	7.5		1.8	1.8

	Scans	Depth
1538	146-150	

1542 approaching bottom…flat, ropey new sheet flow out starboard window: X 4376; Y 77879

1543:00 on bottom….X 4378; Y 77879

	Scans	Depth
1547	151-155	on bottom (first “good scan”)
15:50:54	X 4377; Y 77876	
	Scans	
1553:06	156-163	
1555	picking up rock at landing site (X 4378; Y 77855)	
	Scans	
1556	164-168	
1601:33	digital still of rock sample in claw (rock sampled at landing site) (X 4379; Y77876) – put into milk crate at center aft	
1606	driving to sediment trap	
	Scans	
1606:11	169-174	
1609:35	175-180	
1611:49	181-185	
1613:16	186-188	not good scans????
1614:56	189	
1615:23	190-194	
1617	at sediment trap (X 4511; Y 77875)	
1622:06	scans 195-199 (X 4511; Y 77876)	
1629:16	X 4508; Y 77875….picked up sediment trap….eading toward Bio 9	
	Scans	
1633:49	200-205	X 4575; Y 77933
1635:49	206-210	there was a slight sulfide peak in previous scans
1639:30	211-215	X4602; Y 77959
1640:21	deployed sediment trap (X 4600; Y 77959)(25 m from Bio 9)	

	Scans	
1646:39	216-223	X 4609; Y 77949
1649:49	224-229	X 4592; Y 77977
1651:30	230-234	X 4589; Y 77967
1653	235-241	
1655	242-250	X 4558; Y 77985
1705	251-256	X 4587; Y 77976
1708	257-262	X 4595; Y 77970
1713	263-267	X 4596: Y 77985

1715:15 at "chimlets" at a hydrothermal vent……near Bio 9????

	Scans	
1718:48	216-223	X 4613; Y 77001

1744 at P vent – at HOBO probe site (will deploy Marker #10 at this site)
X 4627; Y 77938

1753 computer shut down…..I turned it off

1754 computer turned back on…renamed File Body to 4206A and set index to 0

	Scans	
1802:15	1-5	

1806:51 X 4632; Y 77928 – at diffuse flow about 5 m from Marker 10 (later deployed 3 of Lauren's "sandwiches" in the diffuse flow here)

	Scans	
1816:45	6-16	- scans taken about 2 m above diffuse flow site

1822:20 18-26 X 4631; Y 77930 – scans taken in diffuse flow (ECHEM temp probe recorded temp of 21.5 C – scans were taken where sandwiches were deployed)

1825 starboard cam has shots of where deployed Lauren's sandwiches

1829:59 starboard cam has shot of Lauren's experiments

1830:36	2 hand-held digital camera shots of Lauren's experiments X 4631; Y 77930
1833:21	ECHEM back in holder – took scan 27 at 1 uA
1834	deployed Marker 8 at site with Lauren's sandwiches
	Scans
1835	28 - scans taken at 100 nA
1838	29-35 - sub moving toward old Marker 82 region
1840	36-40
1847	41-43
1921	X 4617; Y 77611 taking rock sample - put into port aft milkcrate
1923	starboard cam show rock in port aft milkcrate
1924	computer shut down again ....renamed File Body 4206B and set index to 0
1926	X 4618; Y 77611
	Scans
1929	3-7 (electrode #2)
1932	8-13 (taken with electrode #1 which was not as good as electrode #2)
1934	14-18 (electrode #2)
1958	X 4676; Y 77587 - scans taken at colonization area -scans taken while in holder - scans 20?? – 32
2000	at colonization area (markers 11 and 8) – setting up for ECHEM
	Scans
2001:40	32 - off scale
2002	33 - positioning sub
2003	34 - in colonization area
2004	36-47 - taken at 1 uA.....temp. on ECHEM temp probe = 25 C
2010	48-71 - taken at 10 uA - temp on ECHEM probe between 13 & 25 C

2020???	72-81 taken at 100uA - taken after ECHEM put in holder...out of area (note that offscale at 100nA)
2025???	82-93 in holder ....taken at 1 uA
2030???	94-96.....in holder, taken as leaving area
2035???	97-99.....taken at 1 uA in area near Io???
2040???	100-103.....taken at 100 nA in area near Io???
2045????	104-109.....taken in area near Io???
2051:18	X 4677; Y 77801 - taking major pair in hot water – black major pair
	Scans
2053???	110-114 - in holder....near vent where major pairs taken (see above)
2100:36	blue major pair in same orifice as black major pair taken above
2108	took gas tight (red, white and blue) in same orifice as major pairs above
2111:53	took gas tight (green) in same orifice as previous gas tight
2124	took white major pair in diffuse flow some distance from hot water above – about 10 m from the Marker 11 and Marker 8 site...X 4683; Y 77608

VIDEO LOG

Dive 4206 June 30, 2006
VCR #1
Pilot- Mark Spear; port observer: Marv Lilley; starboard observer: Rich Lutz

Port Cam 1 of 3

GMT	X,Y	comments
1717:17*	4613;77991	chimlets near former Bio 9 vent
1718:26*	4613;77991	chimlets near former Bio 9 vent
1721:50*	4613;77991	close up of beehive on top of chimlets near Bio 9
1744:50*	4627l77938	P vent with a HOBO in it

Port Cam 2 of 3

1753.35*	4625;77943	P vent
1807:05*	4632;77928	diffuse flow near P vent where Lauren's expts deployed
1815:45*	4631;77930	taking ECHEM measurements in diffuse flow where Lauren's experiments were deployed
1829:20*	4631;77930	deploying Lauren Mullineaux's "sandwiches"
1834:14*	4631;77930	Marker 5 deployed and Mullineaux's experiment

Port Cam 3 of 3

2022:34*	4676;77586	deploying slurp hose for pump on elevator at diffuse flow area near former Marker 82 area….now marked with Marker 11
2025:33*	4675;77584	slurp hose and elevator with pump at Marker 11
2032:49*	4677;77599	chimlets near Marker 11 area
2126:36*	4683;77608	major pair sample taken in diffuse flow about 25 m from Marker 11 area

VIDEO LOG

Dive 4206 June 30, 2006
VCR #2
Pilot- Mark Spear; port observer: Marv Lilley; starboard observer: Rich Lutz

Stbd Cam 1 of 3

GMT	X,Y	comments
1718*	4613;77991	chimlets near former Bio 9 vent
1723*	4613l77991	close up of chimlets and beehive near former Bio 9 vent

Stbd Cam 2 of 3

1829*	4631:77930	deploying Lauren Mullineaux's "sandwiches"
1834*	4631;77930	Marker 5 deployed and Mullineaux's experiment

Stbd Cam 3 of 3

2026*	4675;77584	slurp pump and elevator for microbiological studies

Dive Plan 4207 - 1 July 2006

Port: T. Shank ***Starboard:*** A. Zafereo (PIT) ***Pilot:*** B. Strickrott

On Bottom Target: x = 4640 y = 77586 9˚50.09176N 104˚17.46722W

Objectives: Land to the east of BM82/Mkr8; load ARCO traps on pump elevator and release it; position INSECT elevator; sample, deploy resprobe, markers; transit south to BM 141/2 sample, etc.; continue transit south down to TWP, sample and characterize; transit down to Tevnia Hole noting diffuse flow.

1. Turn on ECHEM at 200m, leave on as descend to bottom, positioned in its holster.
2. Turn on magnetometer at 1000m and do a 3 min spin clockwise and then counterclockwise, note time of spin.
3. Land on bottom ~35m west of the area formerly known as Prince (I mean BM82) now Mkr8
   - transit east to Mkr 8.
4. **At BM82/Mkr 8: x = 4676 y=77586 Hdg=310 d=2504m**
   - recover two Arco caps and place in bioboxes on elevator
   - stow snorkel and release pump with pull-pin
   - get INSECT elevator **x= y=**
   - position INSECT in flow
   - ECHEM as required
   - recover Hobo from Io (new style # 8)
   - sample 2nd black smoker ****NOT**** sampled on 4206
   - (**4206 sampled: x=4677 y=77601 Hdg=352 d=2504m T=371°C)**
   - 1 major pair
   - 2 gas tights
   - deploy resprobe
   - deploy Hobo if appropriate
   - sample basalt with early colonizers and place in grey biobox/RNA chamber.

In Nov. 2004 Ty vent was 310˚C and Io was 355°C.

5. Transit south through **BM141/2 area: x = 4746** (-50-60m?) **y = 77144** (-20-40m?)
   - if there are now smokers here measure their temperature and sample
   - if there is intense diffuse flow here now measure its temperature and sample
   - 1 major pair
   - 1 gas tight
   - sample basalt with early colonizers and place in grey biobox RNA chamber
   - ECHEM with this sample.
6. Transit south to TWP.
7. **At TWP: x = 4845** (-50-60?) **y = 76693** (-20-40?)
   - see if it has re-activated
   - measure temperature
   - collect orifice
   - collect remaining bottles
   - deploy Hobo if one remains
   - deploy marker.
8. Continue to transit south within the ASCT to Tevnia Hole.

BE SURE TO IMAGE AND DOCUMENT EVERYTHING, and TO DEPLOY MARKERS AT ALL SAMPLING SITES.

Basket load:

2 marker launchers with 8 markers
downlooking camera
ECHEM probe and can
Alvin hi T probe
Alvin lo T probe
slurp-filter
2 grey bioboxes/RNA chambers
1 clear square biobox
2 scoops
1 resprobe with ICL can
4 majors pairs
5 gas tights
8 TAMS
2 rounds
3 sandwiches
2 hobos

ECHEM laptop and power cord/charger in ball.

Origin is 9˚08'N and 104˚20'W.

Alvin Dive 4207
Dive Report
July 1st, 2006

Pilot: Bruce Strickrott
Port Obs: Tim Shank
Stbd Obs: Antoin Zafereo

Time Description

1350 In water
1440 400m
1406 Maggie on- 400m sub turning to port
1410 580m DLK on and scanning. Electrode #2 (of 2) not good. Electrode 1 better- lots of turbulence
1427 **x4939 y77681**(bad) 1100m Maggie spin to stbd
1436 **x4928 y77678**(bad) 1365m scan #77 on E1- bottom temp. 3.1 Echem wand 9°C pH0.208
1441 **x4713 y77962**(good) 1600m hdg270 to elevator
1448 1680m- seeing large oxygen signal (786m altitude)
1452 1800m Imagenix on.
1454 **x4715 y77682** 1861m. Target is 4676 77586- marker 8
1502 **x4736 y77589** 2130m
1507 **x4693 y77536** 2300m
1511 **x4672 y77534** dropped one weight at 76m alt. heading north- see balls of pump elevator
1514 **x4671 y77524** dropped second weight and looking for the bottom- should just be a few tens of meters from the pump elevator.
1515 17 meters off bottom; taking scan 194- noisy electrode- likely just turbulence of moving through the water
1516 **x4655 y77511** pan & tilt on, lasers on- 11m off bottom- small brachyuran crabs, broken up sheet flow, in the AST- bottom temp is 1.9C.- depth is 2498m and we're heading north- large galatheid and lots of small brachyurans. Our target position x4676 y77586 Mkr8 with elevator.
1521 fissure off to stbd **x4653 y77520** heading north- on the floor with sheet flow at base of collapses- loads of brachyurans- sheet flow just rolled in these collapses. Not much of a current but floc bits in the water column. Picking up diffuse flow out front. Lots of shimmering water right near where we landed- lots of small brachs, and a small octopus (dropping target). Bruce sees old sulfide- we're heading southeast and now turning to go north. Lots of staining, brachyurans, another small octopus. 2502m. A little bowl with diffuse flow- clear, shimmering fluids, couple of zoarcids, no apparent colonization. Large remnant and we're along strike with it at due north- small amphipod swarm on southern edge of that linear remnant- lots of small brachys- relatively few galatheids- pockets or patches of white covered diffuse flow areas- Bruce sees bright orange "jelly fish" on the left- I don't see it. Another amphipod swarm here. About two or three of these pockets per sub length. Big time chaotic hackely flow here- falls away out to port.

Lava remnant over to the right- fissure off to the left- about half a sub length away. Cannot see the bottom of the fissure.

1525 **x4679 y77571** depth total 2504m- more diffuse flow throughout this area- coming into the area and now at the pump elevator- lots of shimmering water out to port. Not seeing any apparent colonists- at TamTown- as we are heading north- TamTown is just east of the fissure that is off to the right- now running echem scan 207- lots of noise just sitting in the holster.

1534 **x4669 y77594** hdg010 2504m at marker 8- recovering Arco Trap from the "center" of TamTown, tried to close the trap, and placed in biobox on elevator- the biobox closest to the pump.

1550 **x4669 y77594** hdg010 2504m – recovered the more western Arco Trap (trap closest to the pump hose- "AJ1") and place in biobox more distal to the pump on the elevator

1601 scan 222-224 sulfide peak

1610 **x4664 77592** 2504 hdg333, both Arco traps in bioboxes on the elevator- the trap in the center of the TamTown activity was placed directly next to the pump and the trap a little further away, went into the more distal biobox- diagonally from the pump.

1612 releasing elevator

1617 elevator's away

1624 deploying/positioning control TAMS #3, #5, #22.

1639 **x4663 y77660** Hdg135 2504m Deployed Round stainsteel screen (Round) in TamTown near marker 11

1641 **x4663 y77660** Hdg135 2504m Deployed TAM 21 in TamTown near marker 11

1642 **x4663 y77660** Hdg135 2504m Deployed TAM 16 in TamTown near marker 11

1644 **x4663 y77660** Hdg135 2504m Deployed TAM 12 in TamTown near marker 11

1647 **x4663 y77660** Hdg135 2504m Deployed TAM 11 in TamTown near marker 11

1649 **x4663 y77660** Hdg135 2504m Deployed TAM 14 in TamTown near marker 11. So TAMS are grouped: 11, 12, 13, 14, 16, 21 and CV4; also 1, 7, 8, and 9 are together; in the control area is 3, 5, 22, and another one where the marker didn't float up (perhaps #4)

1705-1737 E-chemistry at TAMS locations and in crack with TAM13. Conducted scans on the mesh, below the mesh, and on the edge or lip of the basalt above where Tevnia was colonizing. The chemistry was remarkably different in these habitats. Poly-sulfides were observed as well as transient oxygen in lower temperatures. Saw up to 19°C in high sulfide scans- see attached table of scans performed.

1740 Heading to elevator leaving Mkr 8 "TamTown" site

1758 **x4597 y77639** Insect under tow

1828 Insect deployment- problem with bungee; placed white vemco with electrode immediately adjacent to Tevnia imaged in the 3-chip video – largest Tevnia observed during the dive. Then placed the Blue vemco with electrode deep in a crack where we measured in-situ chemistry with the E-chem wand. Immediately adjacent to the blue electrode, we place the red and the yellow- the red was sandwiched between meshes of the TAMS and the yellow was placed adjacent to the mesh of one of the TAMS. The number on the TAMS involved needs to be recovered from video. I'll construct a map when I get back.

1920 Insect deployed after some difficulty with both the length of the copper tubes- too long. Had to position the elevator further away.

1924 **x4651 y77591** hdg155 2504m Sample #3 one rock broke into two just above 19°C fluid orifice scanned using echem probe. Placed in clear biobox in two pieces. Sample was just above where we were scanning- had colonists on it. We then moved to the north to look at the blacks smokers and take water samples. We transited approx. 8 meters and there are multiple spires low to the seafloor just like Io Vent was- all appear to be beehives- perhaps 10 or more spires, none more than 1.5m in height. The chimneys have alvinllids on them, but not on where the true beehives are- to the southern end are 4 more spires with a circular base of sulfide adjacent to these is a carpet of alvinellids- there are several of these (have digital pics of this). Tape recorder not working…….

1935 **x4646 y77607** hdg090 2505m Tried to excavate an orifice but getting temperatures to be consistent is very difficult. The high-T probe is NOT working- not grounded…but not working. Some sulfide with worms on it fell next to the basket, so Bruce picket it up and place it in aft chambers. So, sample #4 grab of worms off sulfide that fell down when trying to sample active orifice on "Io Vent". Place this grab in aft gray biobox. Still could not get a high consistent temperature- so went and looked for another black smoker in the area- transited south about 30 to 40 meters and only found diffuse flow in patches, another amphipod swarm on the top of a remnant. Also saw a well-defined fissure 20 meters south of the Mkr 8 area- connects with a fissure running perpendicular to the north-south trend of the primary fissure.

2017 **x4639 y77606** hdg155 2504m. Looking at the northern side of vent. Hi-T probe not working…it's not grounded so don't know what the problem is. Taking **white** major-no Temp reading during the draw- the right hand bottle came all the way back- bottles fired separately and the port springs did not come back all the way.

2022 **x4639 y77606** hdg155 2504m. Firing **black** major pair- getting 322°C to 291°C and about 268 during the draw. Both springs back.

2028 **x4639 y77606** hdg155 2504m. Sampling with **blue** pair and seeing max ICL temp of 375°C about 374°C during the draw. Both springs back.

2030 **x4639 y77606** hdg155 2504m. Gastight white in 375°C orifice- heard fire.

2034 **x4639 y77606** hdg155 2504m. Gastight black in 375°C orifice- did NOT hear fire.

2037 **x4639 y77606** hdg155 2504m. Gastight red in 375°C orifice- heard fire.

2044 **x4639 y77606** Hdg155 2504m. At "Io" vent about 8 meters north of TamTown; ICL temp. 375°C. Deployed Res Probe in the orifice that was water sampled (used filename 4207- confirmed instrument was logging using the ICL loop- saw 4 lines of data.

2048 **x4639 y77606** Hdg155 2504m. Deployed HOBO probe #23 in vent orifice, andrecovered the empty crab trap that was ~6 meters south of the "Io" Vents. We then turned to tranist south until time reached 2110. We transited about 300m and saw all new flows, sheet in the bottom of the AST, scalloped east wall with numerous archways and lava tubes- fresh lobates on top- stunning. This morphology very different from that just south of P Vent where there are small steps down the wall with black sheet flow pouring down the steps. Diffuse activity was not spotted south of about 30 meters past the hi-T vent sampled. At the end of the dive, was coming into another active area as the water appeared murky with increasing amounts of floc.

2114 **x4702 y77269** 2476m Weights away.

Alvin Dive 4207

Dive Report

June 27th, 2006

Dive Number: 4207 **Date: July 1, 2006**

Pilot **Port observer** **Starboard Observer**
Bruce Strickrott **Tim Shank** **Antoin Zebakas**

SITE	GMT	X,Y	DLK Electrode #	Scan #	CV	Video internal*	Comments / Biosampling / BioDeployment
Water column	1409		1	1-4	1uA		Electrode looks great, noisy- temp is 5C higher on wand
Water column	1416		2	5-30	1uA		650m-810m- not good; electrode bad
Water column	1417		1	31-34	1uA		Decided to stay on electrode 1
Water column	1418		1	35-40	10uA		830m-930m
Water column	1421-1506		1	41-165	1uA		Some O2 in the 80s; peaks in the 160s
Water column	1507-1508	4700 77544	2	166-173	1uA		Trying electrode 2 again- better but not good
Water column	1508-1517		1	174-200	1uA		Trying electrode 2 again- better but not good
On bottom	1518	4664 77513	1	201-203	1uA		Landing site
On bottom	1520	4664 77513	2	204	1uA		Not good- electrode done for the day
On bottom	1521	4664 77513	1	205	1uA		noisy
At Mkr 8 station in holster	1530	4668 77593	1	215-220	1uA		noisy
At Mkr 8 station in holster	1602	4666 77596	1	222-231	1uA		High sulfidee w/mkr 11 out front and port of port of basket
Above TAM12	1645-1710	4666 77596	1	232-245	1uA		While deploying TAMS

At TAM14	**1710-1715**	**4666 77596**	**1**	**246-273**	**1uA**		**Poly-sulfides at 11°C?**
At TAM14	**1715-1720**	**4666 77596**	**1**	**274-282**	**1uA**		**Poly-sulfides? Split peaks may just mean a lot of sulfide; intermittent O2**
Above TAMS	**1720**	**4666 77596**	**1**	**283-345**	**1uA**		**Lost Poly-sulfides at 19°C? High sulfide; pH 0.129**
Above TAMS	**1736**	**4666 77596**	**1**	**346-365**	**1uA**		**Transient peaks at 14.5°C**
Edge of collapse lip above flow and TAMS	**1737**	**4666 77596**	**1**	**366-369**	**1uA**		**Polysulfides!!!???**
At Insect Elevator in holster	**1756**	**4666 77596**	**1**	**370-371**	**1uA**		**Background at Insect Landing site**
TamTown	**1806**	**4666 77596**	**1**	**372-385**	**1uA**		**Background at TamTown**
At elevator	**1851**	**4666 77596**	**1**	**386-**	**1uA**		**Sulfide peak; deploying Insect**

VIDEO LOG

Dive 4207 July 1, 2006
VCR #1
Pilot- Bruce Strickrott; port observer: Tim Shank; starboard observer : Anton Zebekas

Port Cam 1 of 3

GMT	X,Y	comments
1526.22*	4670;77590	elevator with slurp pump and colonization at Marker 11, the former Marker 82 site
1529*	4670;77590	ARCO microbiological experiment of Stefan at Marker 11 site, the former Marker 82 site
1530*	4670;77590	Second ARCO microbiological experiment of Stefan's at Marker 11 site, the former Marker 82 site
1532**	4670;77590	TEVNIA AT MARKER 11 SITE!!!!; very nice shots of newly settled Tevnia

Port Cam 2 of 3

1854	4653;77592	INSECT deployed at Marker 11 site, the former Marker 82 site
1856:21	4654;77583	INSECT deployed at Marker 11 site, the former Marker 82 site
1857:11	4655;77587	INSECT deployed at Marker 11 site, the former Marker 82 site
1927:58	4645;77606	chimlets near Marker 82 region….maybe former IO vent??

Port Cam 3 of 3

NO BEST HITS VIDEO CLIPS

VIDEO LOG

Dive 4207 July 1, 2006
VCR #2
Pilot- Bruce Strickrott; port observer: Tim Shank; starboard observer : Anton Zebekas

Stbd Cam 1 of 3

GMT	X,Y	comments

NO BEST HITS VIDEO CLIPS

Stbd Cam 2 of 3

1732	4670;77590	ECHEM measurements in colonization experiments at Marker 11 area, former Biomarker 82 area
1859	4670;77590	INSECT deployed at Marker 11 site, the former Marker 82 site
1901	4670;77590	1 electrode (white in diffuse flow near Tevnia???
1919	4670;77590	3 electrodes of INSECT in diffuse flow with TAMS

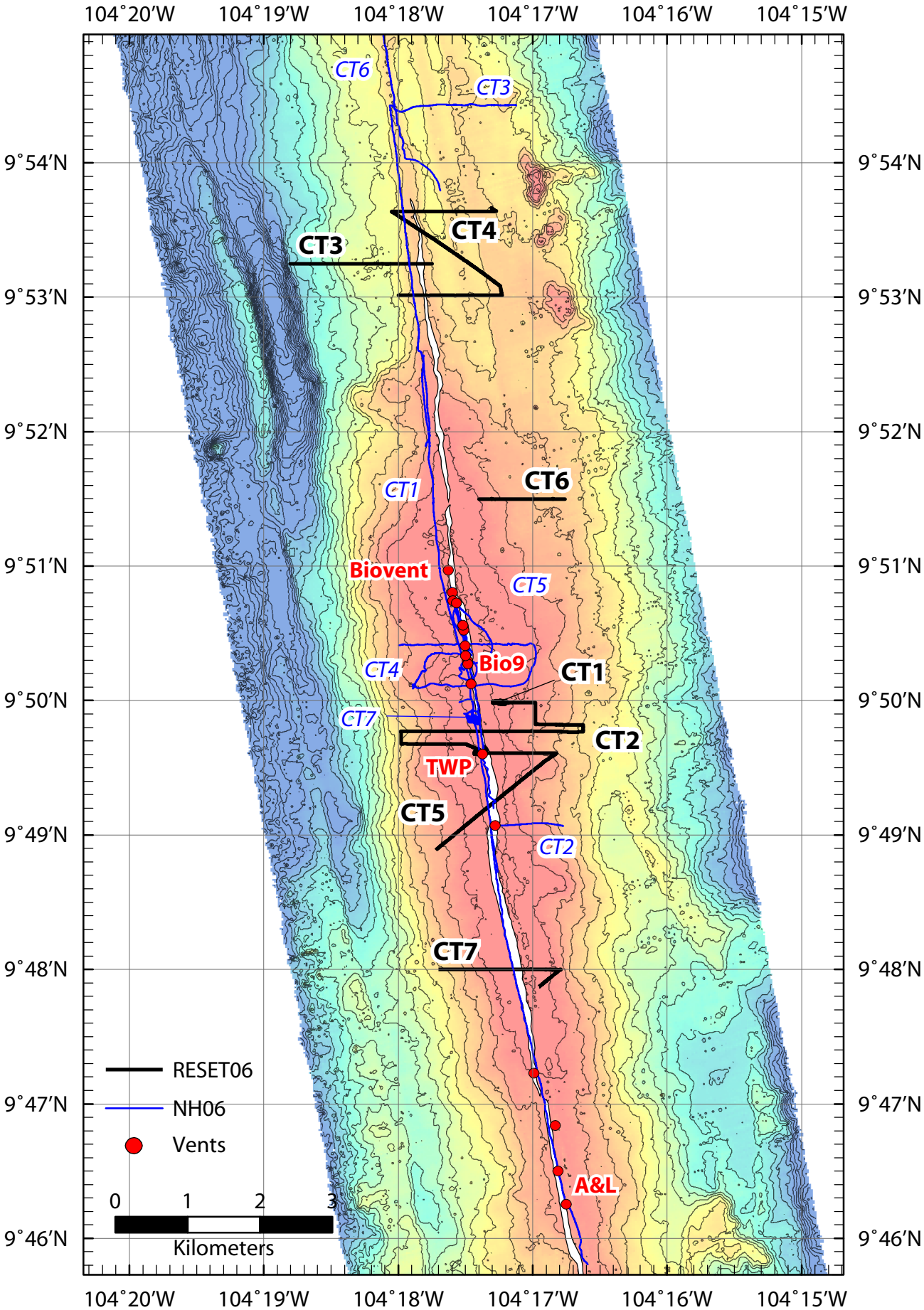
Stbd Cam 3 of 3

NO BEST HITS VIDEO CLIPS

APPENDIX 2

TowCam Summary

AT15-6 Camera Tows

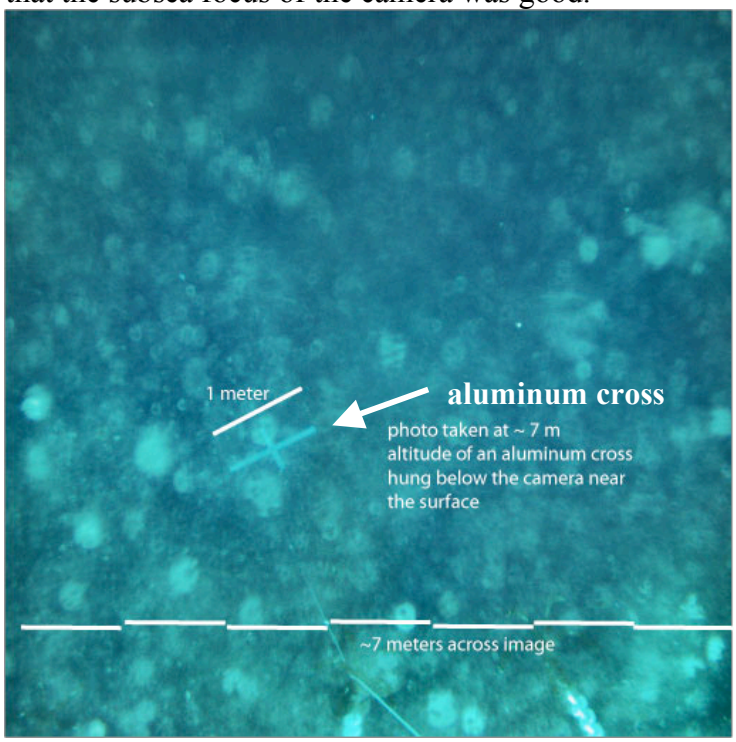


Operations Summary - WHOI-MISO TowCam (Fiber optic)

The WHOI-MISO TowCam was mobilized for the AT15-6 cruise to have capability for near-real time image acquisition (i.e., one image every 10 sec.) and storage using the capabilities of the UNOLS 0.680" fiber optic cable and traction winch system on board R/V Atlantis. This capability allowed for efficient search operations for 'stuck' ocean bottom seismometers (OBSs) as well as geological observations at night during Alvin battery charging time to further map the extent of the new lava flow(s). Engineers at WHOI's Deep Submergence Lab. (DSL) (J. Howland, A. Bowen et al.) and the NDSF participated in this effort and contributed to its success.

The system was mobilized during the Galveston, TX port stop and the various subsea and topside components tested on deck. The fiber optic cable was terminated to the TowCam system and the equipment installed on the frame. The basic operation of the system primarily relied on the standard CTD (SBE25) capabilities of the WHOI TowCam [Fornari, 2003]. This entailed the power system junction box/cabling interfaced to the new DSL digital still camera and fiber to serial hardware installed in two subsea housings that supplied the proper telemetry and power links for the camera and CTD to operate over the fiber optic cable.

At sea, the system was tested on CT#1 over the OBS206 site at the EPR axis. The camera was also calibrated in water at the surface using an aluminum cross hung below the camera with 1 meter and crossing ½ meter legs imaged at ~7 m altitude. The results show that the subsea image area is approximately scaled to the altitude (which is supplied by the SBE25 CTD) and that the subsea focus of the camera was good.



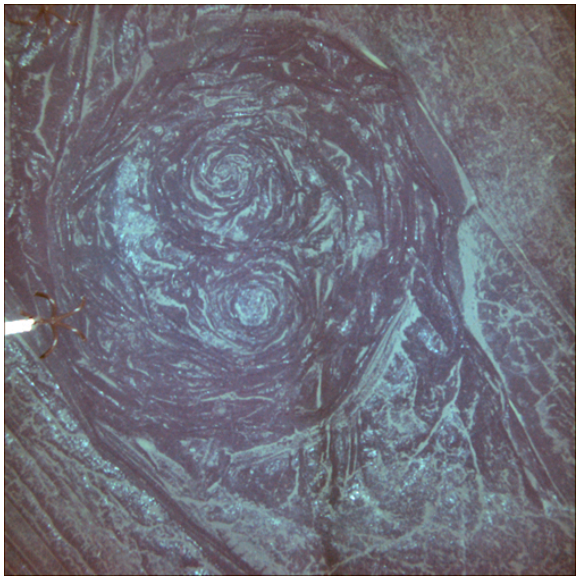
Subsea image showing aluminum scale 1 m long with 0.5 m cross hanging below the camera at 7 m altitude.

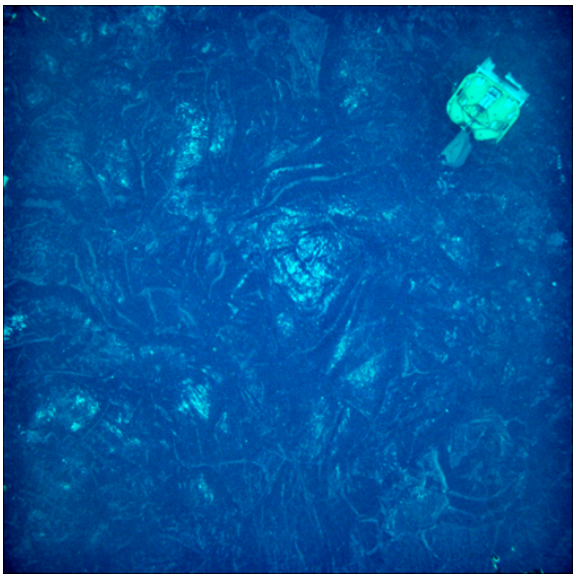
The system operated successfully for the first two lowerings providing good seafloor imagery at altitudes up to 12 m from the seafloor with the available 600 watt/sec of strobe

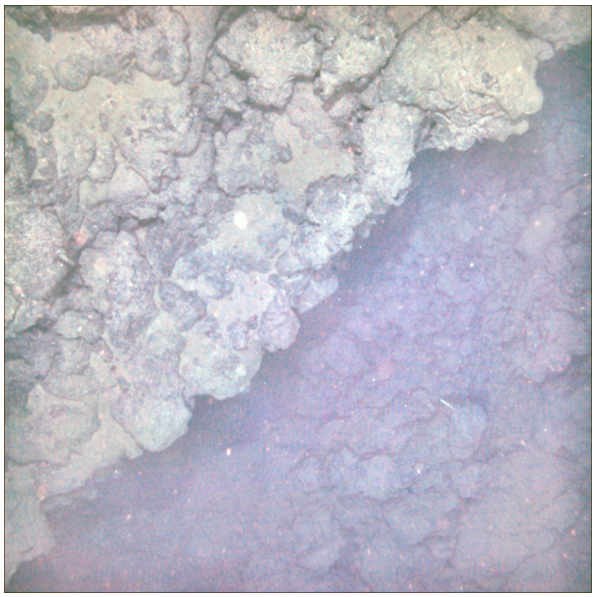
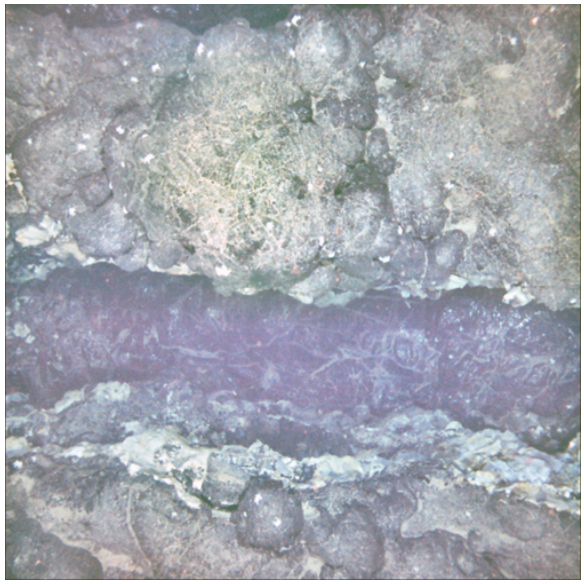
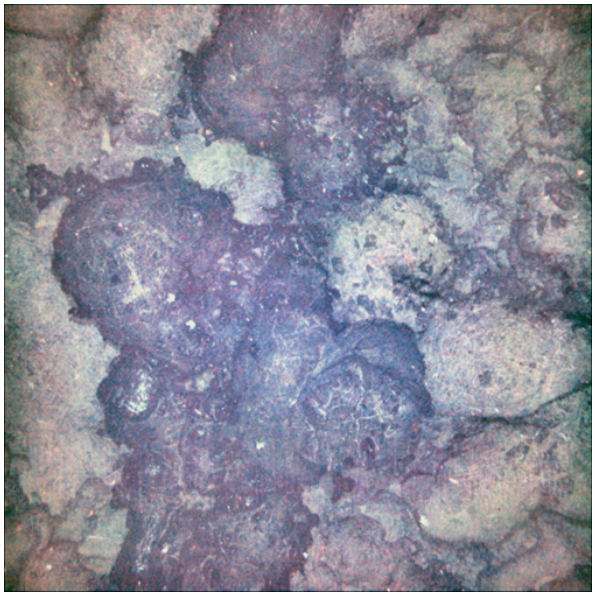
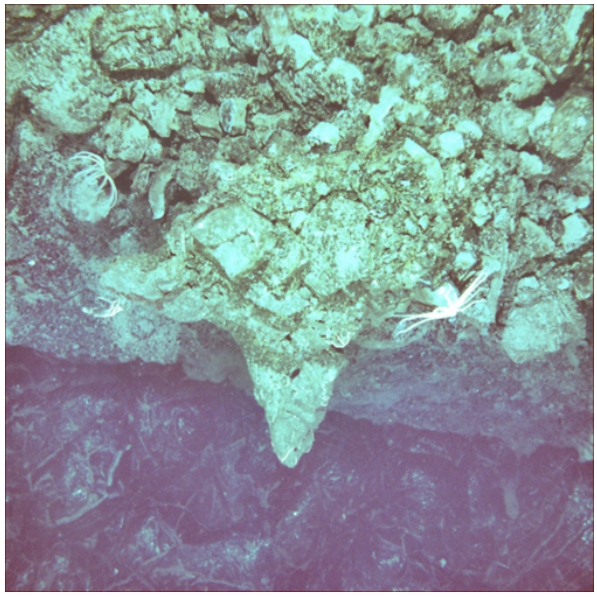
lighting provided by the TowCam system. CT#2 was 9.5 hrs long on the bottom taking photos every 10 seconds before the strobe power fell below what was required to sufficiently recharge the strobe capacitors. During CT#3 the camera stopped functioning after ~2 hrs. on the bottom and telemetry to the camera and CTD could not be reestablished. Once on deck the system was restarted and telemetry reestablished, however, a problem was suspected in the fiber optic to ethernet telemetry link so discussions with DSL engineers took place to try to isolate the problem. After deployment on CT#4 and similary telemetry failure at 100 m depth, the subsea housing containing the fiber optic to ethernet telemetry converter was inspected and found to be not the right match for the topside converter. A spare was installed and the system was put back together and successfully tested. This proved to be the problem and after that repair, subsea operations of the fiber optic TowCam were rountine. The only other problem with telemetry occurred during recovery on CT#6 and CT#7 where at ~ 500 m from the surface the telemetry ceased. It is not clear if there is a problem in the wire at this point or not but DSL and WHOI engineers have been alerted to the occurrence.

The fiber optic TowCam was used for seven tows during the AT15-6 cruise. Navigation of the system was by LBL transponder network for CT#1, 2, 5 and 6, and layback and ADCP for CT#3, 4 and 7. The TowCam on AT15-6 was configured with a self recording 3-axis magnetometer for near bottom magnetometer data acquisition (M. Tivey-WHOI), and an ADCP mounted on the front of the frame pointing downward configured for bottom-lock relative movement detection to assist in computing vehicle layback position and speed. During three tows (CT#1, CT#2 and CT#5) TowCam was used to search for and attempt to recover two OBSs (206 and 210) close to the EPR axis. Both OBSs were located and imaged showing they are partly buried in the new lava flow. Recovery attempts with grapple hooks configured below the TowCam bottom rail were unsuccessful despite repeated attempts to both hook the OBSs and to land near them and 'nudge' them. In one case for OBS206 it is believe the TowCam may have bumped the instrument. Total use time of the fiber optic TowCam (surface to surface) was approximately 40 hours and time on the total bottom for all tows was approximately 23 hours.

Example Images from Fiber Optic TowCam on AT15-6





APPENDIX 3

Transponder Deployment Information

AT15-6 Transponder Navigation

Three Benthos XT6001 expendable transponders were deployed during the cruise to serve as a permanent network for submersible navigation at the EPR ISS. Analysis of the available high resolution ABE bathymetric and EM300 multibeam data was carried out by Adam Soule (WHOI). This was done to best determine placement of the transponders to optimize Alvin navigation between 9° 49'N and 9° 51'N along the axial summit trough (AST) where most of the hydrothermal activity has traditionally been located and where much of the recent activity is focused after the 2005-2006 eruptions.

The table below provides the information on the intended drop positions and the final surveyed positions calculated following a complete circle survey that encompassed all transponders at a range of ~1.5 km from each them. Note that the net origin is consistent with what has been traditionally used at the EPR ISS since the 1989 ARGO I survey of this area [Haymon et al., 1991].

Transponder Drops Von Damm AT15-06 25 Jun 2006

9 North BioTransect - Origin 09N08 104W20 Mag Var 8 East UTM Zone 13 Time Zone -6

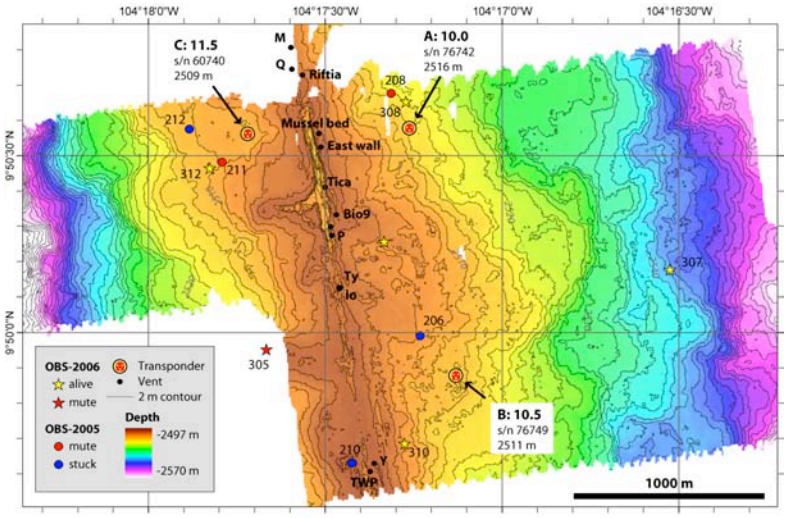
Xpdr Freq	Owner	S/N	Net ID	Rel Code	Proposed Lat.	Proposed Lon	Surveyed Lat	Surveyed Lon	Survey Depth
9.0/10.0	EPR-ISS	76742	A	none	9N50.58	104W17.26	9N50.467' (Y=78283)	104W17.286' (X=4972)	2344M
9.0/10.5	EPR-ISS	76749	B	none	9N49.88	104W17.13	9N49.745' (Y=76952	104W17.069' (X=5369)	2354M
9.0/11.5	EPR-ISS	60740	C	none	9N50.56	104W17.72	9N50.514' (Y=78369)	104W17.755' (X=4113)	2343M

Notes: Pull-pin releases only.
All transponders have 12 hour timeout.
Pull-pin releases only.
Survey error <0.48 RMS on all transponder
152M anchor lines

N.B.: All transponders have 'A' enable code

Anchor lines are 5/16" braided polypro with 316 stainless double pull pin at anchor (see photos below).

AT15-6 EPR ISS Alvin Response Cruise, Transponder Drop Locations, 23 June 2006



Transponder A s/n 76742 10 kHz
9.842977°N, -104.287695°W
9°50.57862'N, -104°17.26170'W
Depth: 2516 m

Transponder B s/n 76749 10.5 kHz
9.831304°N, -104.285507°W
9°49.87824'N, -104°17.13042'W
Depth: 2511 m

Transponder C s/n 60740 11.5 kHz
9.842708°N, -104.295325°W
9°50.56248'N, -104°17.71950'W
Depth: 2509 m

Transponder drop locations for EPR ISS deployed during AT15-6 response cruise (RESET06). Positions of OBSs also shown, as are old hydrothermal vent sites. ABE 5 m grid cell, 1 m vertical resolution bathymetry from Fornari et al. [2004].

Photographs of transponder anchors used at EPR ISS during AT15-06. Note pull-pin arrangement, designed so that transponders can be recovered after ~ 3 years and re-batteried and redeployed.

APPENDIX 4

Ridge2000 Data Management Forms

A01: Overview of Expedition

Form completed by: Marv Lilley/Karen Von Damm date: 07/06/2006

Cruise summary:

Cruise ID: AT15-6

Ship name: Atlantis

Captain: Chiljean

Start date: 06/18/2006

End date: 07/07/2006

Ports of Call with dates: Puntarenas, Costa Rica (06/18/2006); San Diego, CA (07/07/2006)

Name of Chief/Co-chief scientist(s): Karen Von Damm

Funding initiative: RIDGE2000

Funding award numbers: OCE 0327126

Focus site: 9N ISS site

Tectonic setting: Ridge Crest

Science projects:

Please list all funded projects that are part of your cruise: project title, funding source (e.g. NSF, NOAA, WHOI internal funds, Field Museum, etc), lead PI on project, and project summary. Note: Project summary is not needed for NSF-funded projects – project title will be used to retrievet award abstract from Fastlane.

Project #1

Title: RESET06; R2K Atlantis/Alvin Response to 9N ISS Eruption

Lead PI for project:: Von Damm; Lutz, Luther, Shank, Vetriani; Sievert, Taylor, Summons; Fornari; Rubin; Lilley; Perfit

Funding source/award number: Supplements/SGER

Summary (for non-NSF-funded projects):

Project #2

Title:

Lead PI for project:

Funding source/award number:

Summary (for non-NSF-funded projects):

Project #3

Title:

Lead PI for project:

Funding source/award number:

Summary (for non-NSF-funded projects):

Project #4

Title:

Lead PI for project:

Funding source/award number:

Summary (for non-NSF-funded projects):

A02: Science Party

Cruise ID: _AT15-6_____ Form completed by: ___Marv Lilley_____, date: 07/06/2006

** only Co-/Chief Scientist information will be released*

Name (last, first)	Role on cruise	Project # involvement (see form **A01**)	Speciality	Home institution*	e-mail address*
Examples					
1. Kerr, Jennifer	Chief Scientist	all	geophysicist	WHOI	lasta@whoi.edu
2. Harrison, Diane	Scientist	1,2	Geochemist	SIO	firstb.lastb@ucsd.edu
3. Watts, Geoffrey	Observer	1,2	Marine mammals	MBARI	firstb@mbari.org
4. Potter, Suzie	Watch-stander	3	Student_Graduate	LDEO	lastc@columbia.edu
5. Brearley, Mike	Watch-stander	2,4	Student_Undergraduate	LDEO	lastd@columbia.edu.
1. Von Damm, Karen	Chief Scientist	1	geochemist	UNH	kvd@eos.sr.unh.edu
2. McDermott	Scientist	1 ` `	student, graduate	UNH	Jill.M.McDermott@dartmouth.edu
3. Carmichael, Sarah	Scientist	1	post-doc	UNH	scarmichael@jhu.edu
4. Bates, Mike	Scientist	1	student, graduate	UNH	mbates@unh.edu
5. Prado, Florencia	Scientist	1	student, graduate	UNH	mfmprado@gmail.com
6. Shank, Tim	Scientist	1	biologist	WHOI	tshank@whoi.edu
7. Govenar, Breea	Scientist	1	post-doc	WHOI	bgovenar@whoi.edu
8. Buckman, Kate	Scientist	1	student, graduate	WHOI	kbuckman@whoi.edu
9. Lutz, Richard	Scientist	1	biologist	Rutgers	lutz_richard@hotmail.com
10. Voordeckers, James	Scientist		student, graduate	Rutgers	silentwolf782002@yahoo.com
11. Sievert, Stefan	Scientist	1	microbiologist	WHOI	ssievert@whoi.edu
12. Taylor, Craig	Scientist	1	microbiologist	WHOI	ctaylor@whoi.edu

Examples

13. Molyneaux, Steven	Scientist	1	tech	WHOI	smolyneaux@whoi.edu
14. Sylva, Sean	Scientist	1	tech	WHOI	ssylva@whoi.edu
15. Luther, George	Scientist	1	chemist	UDelaware	luther@cms.udel.edu
16. Nuzzio, Don	Scientist	1	chemist	AIS	ais@aishome.com
17. Moore, Tommy	Scientist	1	student, graduate	UDelaware	tsmoore@udel.edu
18. Lilley, Marv	Scientist	1	chemist	UW	lilley@u.washington.edu
19. Greene, Ron	Scientist	1	tech	NOAA/PMEL	Ronald.R.Greene@noaa.gov
20. Fornari, Dan	Scientist	1	geologist	WHOI	dfornari@whoi.edu
21. Soule, Adam	Scientist	1	geologist	WHOI	ssoule@whoi.edu
22. Perfit, Mike	Scientist	1	geologist	WHOI	perf@nervm.nerdc.ufl.edu
23. Rubin, Ken	Scientist	1	geologist	UHawaii	krubin@hawaii.edu
24. Rapa, Martin	Scientist	1	tech	SIO	mrapa@ucsd.edu

B01: Station log: CTD

mgDMS Forms v3.5 Nov, 2005

Cruise ID: AT15-6
Log sheet Completed By: Marvin Lilley
Log sheet Completion date: 7/3/2006

Add more columns to the right-hand edge, as needed
Ignore columns that are not applicable to your program
** If preferred, use decimal degrees with five or six decimal places*

Examples are shown in grey

CTD Station #	CTD cast #	Date	Time (UTC)	Latitude* whole degrees	Latitude* decimal minutes	Longitude* whole degrees	Longitude* decimal minutes	Collection Depth (m)	Max. CTD Depth (m)	Data collected Digital filename	# of Fluid samples	Instrument type/ID	Contact person	Comments
Examples	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*			*Examples*	*Examples*	*Examples*
CTD-002	1	2001-02-17	11:23	-27	22.807	-109	3.201	180	180	ASM2m04.alb	n/a	SeaBird SBE-19/023	Steve Asher	
CTD-003	6	2001-02-18	17:48	-27	14.362	-109	29.572	355	355	n/a	12	SeaCat SBE16/44	Mark Waugh	
CTD-001	1	2006-07-01	0:48	9	50.27	104	17.41	2492	2518	15-06\1506001	23	Seabird SBE-9	Marv Lilley	cast done 100 m east of I

B06: Log: BOTTOM INSTRUMENTS and MARKERS

mgDMS Forms v3.5 Nov, 2005

Cruise ID: AT15-6
Log sheet Completed By:
Log sheet Completion date:

Add more columns to the right-hand edge, as needed
Ignore columns that are not applicable to your program
** If preferred, use decimal degrees with five or six decimal places*

Examples are shown in grey

Instrument Type	Instrument ID #	Action	Dive #	Date	Time (UTC)	Location method	Position of instrument: Latitude* whole degrees	Latitude* decimal minutes	Longitude* whole degrees	Longitude* decimal minutes	Grid origin (fat/lon)	Grid X (m)	Grid Y (m)	Depth (m)	Dive #	Transponder: frequency (kHz)	Transponder: disabled? (y/n)	Location description	Data collected: Digital filename	Data collected: Fluid sample ID	Contact Person	Comments
Examples	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	*Examples*	
OBS	012	Deployment	n/a	1998-03-17	06:13	drop location	-29	47.302	-111	43.834				2507	n/a	n/a	n/a	WINDY area	n/a	n/a	Shane Waugh	
OBS	005	Recovery	n/a	1998-04-13	13:22	surveyed-in	-29	46.916	-111	43.622	-29.7884363/-111.7305595	4206	-1070	2507	n/a	11.0	no	WINDY area	S2-Ellie-SN3-2002143-ch1.segy	n/a	Mieke Edwards	
Temp. probe	HOBO-287	Service	3960	1998-03-24	22:44	transponder	-29	48.1816	-111	41.9238	-29.8026445/-111.6987302	32.1	508.2	2659	A-021	n/a	n/a	SNOWY area	623247_Bio7_D3960.dtf	n/a	Petra Nava	
Marker	037	Deployment	3961	1998-03-25	19:51	transponder	-30	17.4413	-112	18.1534	-29.99100ß2/-112.4230795	5094.3	1162.6	3086	n/a	n/a	n/a	SUNNY area	n/a	n/a	Sarah.Clarke	
EM	EM-030	Recovery	n/a	1998-03-22	14:55	transponder	-30	2.08112	-112	4.8775	3053.861,112W3.635	1638.4	7330.8	2812	n/a	11.0	yes	RAINY area	em4_0322.dat	n/a	David Biddles	
resistivity probe	T-44	deployment	4207	2006-07-01	20:44	transponder						4639	77606	2504	4207			lo vent			Marvin Lilley	Will be recov
crab trap	n/a	deployment	4203	2006-06-27	20:52	transponder						4677	77599	2504	4203			Mkr 8			Tim Shank	
crab trap	n/a	recovery	4207	2006-07-01		transponder						n/a	n/a	2504	4207			Mkr 8			Tim Shank	
colonization substrate	CV1 "round"	deployment	4203	2006-06-27	20:58	transponder						4677	77599	2504	4203			Mkr 8			Costatino Vetriani	
colonization substrate	CV2 "round"	deployment	4203	2006-06-27	20:58	transponder						4677	77599	2504	4203			Mkr 8			Costatino Vetriani	
colonization substrate	MB-37 "baby-trap"	deployment	4203	2006-06-27	20:59	transponder						4677	77599	2504	4203			Mkr 8			Monika Bright	
colonization substrate	MB-38 "baby-trap"	deployment	4203	2006-06-27	21:01	transponder						4677	77599	2504	4203			Mkr 8			Monika Bright	
colonization substrate	MB-39 "baby-trap"	deployment	4203	2006-06-27	20:59	transponder						4677	77599	2504	4203			Mkr 8			Monika Bright	
colonization substrate	sandwich	deployment	4203	2006-06-27	21:02	transponder						4677	77599	2504	4203			Mkr 8			Lauren Mullineaux	
colonization substrate	sandwich	deployment	4203	2006-06-27	21:06	transponder						4677	77599	2504	4203			Mkr 8			Lauren Mullineaux	
colonization substrate	sandwich	deployment	4203	2006-06-27	21:06	transponder						4677	77599	2504	4203			Mkr 8			Lauren Mullineaux	
colonization substrate	sandwich	deployment	4206	2006-06-30	18:22	transponder						4632	77928	2508	4206			Between Bio9 and P vent			Lauren Mullineaux	
colonization substrate	sandwich	deployment	4206	2006-06-30	18:23	transponder						4632	77928	2508	4206			Between Bio9 and P vent			Lauren Mullineaux	
colonization substrate	sandwich	deployment	4206	2006-06-30	18:25	transponder						4632	77928	2508	4206			Between Bio9 and P vent			Lauren Mullineaux	
colonization substrate	TS-8 "TAM"	deployment	4203	2006-06-27	21:09	transponder						4677	77599	2504	4203			Mkr 8			Tim Shank	
colonization substrate	TS-9 "TAM"	deployment	4203	2006-06-27	21:10	transponder						4677	77599	2504	4203			Mkr 8			Tim Shank	
colonization substrate	TS-7 "TAM"	deployment	4203	2006-06-27	21:11	transponder						4677	77599	2504	4203			Mkr 8			Tim Shank	
colonization substrate	TS-6 "TAM"	deployment	4203	2006-06-27	21:12	transponder						4677	77599	2504	4203			Mkr 8			Tim Shank	
colonization substrate	TS-3 "TAM"	deployment	4203	2006-06-27	21:15	transponder						4677	77599	2504	4203			Mkr 8			Tim Shank	
colonization substrate	TS-4 "TAM"	deployment	4203	2006-06-27	21:16	transponder						4677	77599	2504	4203			Mkr 8			Tim Shank	
colonization substrate	AT1	deployment	4203	2006-06-27	21:19	transponder						4677	77599	2504	4203			Mkr 8			Stefan Sievert	
colonization substrate	AT2	deployment	4203	2006-06-27	21:16	transponder						4677	77599	2504	4203			Mkr 8			Stefan Sievert	
colonization substrate	AT1	recovery	4207	2006-07-01	15:50	transponder						4684	77594	2504	4207			Mkr 8			Stefan Sievert	
colonization substrate	AT2	recovery	4207	2006-07-01	15:34	transponder						4664	77594	2504	4207			Mkr 8			Stefan Sievert	
sediment trap	mooring 1	deployment	4206	2006-06-30	16:45	transponder						4608	77940		4206			Between Bio9 and P vent	mooring1_bio9_capture.txt		Lauren Mullineaux	
sediment trap	mooring 1	recovery	n/a	2006-06-25	n/a	acoustic deck box	9	50.316	-104	17.565		n/a	n/a	n/a				near Bio9	mooring1_capture.txt, mooring1_currentmeter.dsu		Lauren Mullineaux	
sediment trap	mooring 2	deployment	n/a	2006-06-29	20:25	drop location						4514	77582	n/a				Mkr 8	mooring2_bm82_capture.txt		Lauren Mullineaux	
sediment trap	mooring 2	recovery	4203	2006-06-27	18:17	transponder						4423	78129	4203				near Tica	mooring2_capture.txt		Lauren Mullineaux	
colonization substrate	TS-1 "TAM"	deployment	4203	2006-06-27	21:12	transponder						4677	77599	2504	4203			Mkr 8			Tim Shank	
colonization substrate	TS-2 "TAM"	deployment	4203	2006-06-27	21:12	transponder						4677	77599	2504	4203			Mkr 8			Tim Shank	
colonization substrate	TS-5 "TAM"	deployment	4207	2006-07-01	16:24	transponder						4663	77660	2504	4207			Mkr 8			Tim Shank	
colonization substrate	TS-12 "TAM"	deployment	4207	2006-07-01	16:44	transponder						4663	77660	2504	4207			Mkr 8			Tim Shank	
colonization substrate	TS-21 "TAM"	deployment	4207	2006-07-01	16:41	transponder						4663	77660	2504	4207			Mkr 8			Tim Shank	
colonization substrate	TS-16 "TAM"	deployment	4207	2006-07-01	16:42	transponder						4663	77660	2504	4207			Mkr 8			Tim Shank	
colonization substrate	TS-14 "TAM"	deployment	4207	2006-07-01	16:49	transponder						4663	77660	2504	4207			Mkr 8			Tim Shank	
colonization substrate	TS-22 "TAM"	deployment	4207	2006-07-01	16:24	transponder						4663	77660	2504	4207			Mkr 8			Tim Shank	
colonization substrate	TS-11 "TAM"	deployment	4207	2006-07-01	16:47	transponder						4663	77660	2504	4207			Mkr 8				
colonization substrate	CV4 "round"	deployment	4207	2006-07-01	16:39	transponder						4663	77660	2504	4207			Mkr 8				
chemical sensor	ISEA	deployment	4207	2006-07-01	18:28	transponder						4652	77591	2503	4207			Mkr 8			George Luther	
pump	McClane	deployment	4206	2006-06-30	20:26	transponder						4675	77584	2504	4206			Mkr 8			Stefan Sievert	
pump	McClane	recovery	4207	2006-07-01	16:17	transponder						4663	77592	2504	4207			Mkr 8			Stefan Sievert	
marker	1	deployment	4202	2006-06-26	16:17	transponder						4135	78897	2504	4202			basalt sample 1			Tim Shank	
marker	13	deployment	4202	2006-06-26	17:55	transponder						4418	78878		4202			M vent			Tim Shank	
marker	12	deployment	4203	2006-06-27	17:51	transponder						4456	78072	2500	4203			basalt samples 1, 2			Tim Shank	
marker	10	deployment	4203	2006-06-27	19:39	transponder						4580	77910	2509	4203			P vent			Tim Shank	
marker	11	deployment	4203	2006-06-27	21:35	transponder						4603	77591	2503	4203			basalt with colonists			Tim Shank	
marker	8	deployment	4203	2006-06-27	20:53	transponder						4677	77599	2504	4203			colonization experiments			Tim Shank	
marker	9	deployment	4205	2006-06-29	17:47	transponder						5972	70518	2527	4205			base of L vent			Tim Shank	
marker	4	deployment	4205	2006-06-29	19:20	transponder						5790	70987		4205			bucket lid at A vent			Tim Shank	
marker	14	deployment	4205	2006-06-29	20:27	transponder						5476	72200	2510	4205			U vent			Tim Shank	
marker	5	deployment	4206	2006-06-30	18:11	transponder						4632	77929	2508	4206			colonization experiments			Tim Shank	
temperature probe	HOBO-20	deployment	4202	2006-06-26	19:54	transponder						4426	78775	2502	4202						Karen Von Damm	
temperature probe	HOBO-21	deployment	4203	2006-06-27	19:39	transponder						4575	77921	2509	4203						Karen Von Damm	
temperature probe	HOBO-23	deployment	4207	2006-07-01	20:48	transponder						4639	77606	2504	4207			"lo"			Karen Von Damm	

B12: VEHICLE DIVE SAMPLES (e.g. from Alvin, Jason II)

mgDMS Forms v1

Cruise ID: AT15-6
Log sheet Completed By: M. Lilley, B. Govenar, S. Sievert
Log sheet Completion date: JULY 7, 2006

Add more columns to the right-hand edge, .
Ignore columns that are not applicable to y

* If preferred, use decimal degrees with
** See README for definition of dive stu

*** See SESAR section in README

Examples are shown in grey

**Sample #	Dive #	**Station # if applicable	Virtual Van Event #	Date	Time (UTC)	Navigation grid origin (lat/lon) (give once only if unchanging)	Location, if applicable: Marker #	Vent name	Position on vent	Collection of sample: Grid X (y)	Grid Y (x)	Latitude whole dd	Latitude decimal minutes	Longitude whole dd	Longitude decimal minutes	Depth (m)	Vehicle heading	Vehicle altitude (m)	Characteristics of sample: class	type	size	Collection method	Level 1	RGS Classification for ROCK samples*** Level 2	Field name	size/weight	Sample IGSN number (if known)***	Associated data: Temp (deg C)	Salinity (ppm)	Chlorinity (mmol/kg)	Contact person	Comments
Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	Examples	
AL9703-5-rock-001	AL9703	AL9703-5	214	2005-09-30	09:27	47.8939133	BSV-2	Bastille	base of vent	5603.1	9747.4	47	56.867	-129	5.9635	2210	048	1.5	rock	sulfide	150g	grab	Sedimentary	Vent precipitate	sulfide	150g chunk	WHK75A2M4					Jesse Jones
AL9703-5-bio-002	AL9703	AL9703-5	13329	2005-09-30	15:32		BSV-2	Bastille	mid-vent	5603.8	9747.4	47	56.867	-129	5.9635	2210	052	4	biology	shrimp	small	scoop										Brooke Grey
AL9703-5-fluid-003	AL9703	AL9703-5	14431	2005-09-30	16:03		BSV-2	Bastille	vent opening	5603.9	9747.5	47	56.867	-129	5.9635	2210	053	6.5	fluid	vent fluid	bottle	gas tight										Kapil Dav
AL9703-7-bio-001	AL9703	AL9703-7	462	2005-09-30	16:48	47.8933217	BSV-14	Rampart	mid-vent	2133.9	9920	47	56.441	-129	6.0382	2203	092	3	biology	crab	medium	scoop					90	35970	296	Brooke Grey	
4202-1-R	4202			2006-06-26	16:08					4135	78897					2504	144		rock	lava		grab									Michael Perfit	Possibly deployed RESET06 Marker #1, off-axis cou
4202-2A-R	4202			2006-06-26	17:11		M	base of vent		4415	78879					2503	111		rock	lava		grab									Michael Perfit	Volunteer probably from ledge below M vent
4202-2A-microbio	4202			2006-06-26	17:11		M	base of vent		4415	78879					2503	111		rock	microbiology		grab									Stefan Sievert	Volunteer probably from ledge below M vent
4202-2B-R	4202			2006-06-26	17:11		RESET06-13	M	base of vent	4415	78879					2503	111		rock	sulfide		grab									Michael Perfit	Volunteer probably from ledge below M vent
4202-3-R	4202			2006-06-26	17:16		RESET06-13	M	top of vent	4416	78879					2503	109		rock	sulfide		grab									Michael Perfit	Sulfide attached to Hobo probe that was removed fi
4202-3-R	4202			2006-06-26	17:16		RESET06-13	M	top of vent	4416	78879					2503	109		rock	sulfide		grab									Rachel Haymon	Sulfide attached to Hobo probe that was removed fi
4202-3-microbio	4202			2006-06-26	17:16		RESET06-13	M	top of vent	4416	78879					2503	109		rock	microbiology		grab									Stefan Sievert	Sulfide attached to Hobo probe that was removed fi
4202-4-R	4202			2006-06-26	17:51		RESET06-13	M		4418	78879					2504	16		rock	lava		grab									Michael Perfit	New flow wraps around base of M chimney
4202-4-microbio	4202			2006-06-26	17:51			M		4418	78879					2504	16		rock	microbiology		grab									Stefan Sievert	New flow wraps around base of M chimney
4202-5-R	4202			2006-06-26	18:54			Q	vent opening	4428	78775					2501	218		rock	lava		grab									Michael Perfit	Sample of orifice from top of Q
4202-5-R	4202			2006-06-26	18:54			Q	vent opening	4428	78775					2501	218		rock	lava		grab									Rachel Haymon	Sample of orifice from top of Q
4202-5-bio	4202			2006-06-26	18:54			Q	vent opening	4428						2501	218		biology	invertebrates		grab									Timothy Shank	Sample of orifice from top of Q
4202-5-microbio	4202			2006-06-26	18:54			Q	vent opening	4428						2501	218		biology	microbiology		grab									Sievert/Vetriani	Sample of orifice from top of Q
4202-6	4202			2006-06-26	20:35			Q	vent opening	4429	78776					2504	92		rock	lava		grab									Michael Perfit	New flow about 5 m from Q vent
4202-4-fluid	4202			2006-06-26	19:26			Q	vent opening	4426	78775					2502	216		fluid	vent fluid	750 ml	major						23			Karen Von Damm	
4202-14-fluid	4202			2006-06-26	19:28			Q	vent opening	4426	78775					2502	216		fluid	vent fluid	750 ml	major						19			Karen Von Damm	
4202-23-fluid	4202			2006-06-26	19:08			Q	vent opening	4426	78775					2502	206		fluid	vent fluid	750 ml	major						19			Karen Von Damm	
4202-24-fluid	4202			2006-06-26	19:08			Q	vent opening	4426	78775					2502	206		fluid	vent fluid	750 ml	major						20			Karen Von Damm	
4202-gt5-fluid	4202			2006-06-26	19:44			Q	vent opening	4426	78775					2502	220		fluid	vent fluid	150 ml	gas tight						30			Marvin Lilley	
4202-gt11-fluid	4202			2006-06-26	19:36			Q	vent opening	4426	78775					2502	220		fluid	vent fluid	150 ml	gas tight									Marvin Lilley	
4202-gt16-fluid	4202			2006-06-26	19:46			Q	vent opening	4426	78775					2502	220		fluid	vent fluid	150 ml	gas tight						30			Marvin Lilley	
4203-1-R	4203			2006-06-27	17:48		RESET06-12			4456	78022					2500	324		rock	lava		grab									Michael Perfit	Young lobate in contact with older lavas, off-axis ~3
4203-2-R	4203			2006-06-27	17:51		RESET06-12			4456	78022					2500	324		rock	lava		grab									Michael Perfit	Young lobate in contact with older lavas, off-axis ~3
4203-3-R	4203			2006-06-27	19:10		RESET06-10	P	vent opening	4577	77921					2509	57		rock	sulfide		grab									Michael Perfit	Vent N of old "P" vent, one of 3 vents in a row. Sulf
4203-3-R	4203			2006-06-27	19:10		RESET06-10	P	vent opening	4577	77921					2509	57		rock	sulfide		grab									Rachel Haymon	Vent N of old "P" vent, one of 3 vents in a row. Sulf
4203-3-bio	4203			2006-06-27	19:10		RESET06-10	P	vent opening	4577	77921					2509	57		biology	invertebrates		grab									Timothy Shank	Vent N of old "P" vent, one of 3 vents in a row. Sulf
4203-3-microbio	4203			2006-06-27	19:10		RESET06-10	P	vent opening	4577	77921					2509	57		biology	microbiology		grab									Sievert/Vetriani	Vent N of old "P" vent, one of 3 vents in a row. Sulf
4203-5-R	4203			2006-06-27	21:32		RESET06-11			4603	77591					2504	182		rock	lava		grab									Michael Perfit	New Flow around old "Ty" vent, folded sheet flow v
4203-5-bio	4203			2006-06-27	21:32		RESET06-11			4603	77591					2504	182		biology	invertebrates		grab									Timothy Shank	New Flow around old "Ty" vent, folded sheet flow v
4203-5-microbio	4203			2006-06-27	21:32		RESET06-11			4603	77591					2504	182		biology	microbiology		grab									Stefan Sievert	New Flow around old "Ty" vent, folded sheet flow v
4203-6-R	4203			2006-06-27	21:32		RESET06-11			4603	77591					2504	182		rock	lava		grab									Michael Perfit	New Flow around old "Ty" vent, folded sheet flow v
4203-6-bio	4203			2006-06-27	21:32		RESET06-11			4603	77591					2504	182		biology	invertebrates		grab									Timothy Shank	New Flow around old "Ty" vent, folded sheet flow v
4203-6-microbio	4203			2006-06-27	21:32		RESET06-11			4603	77591					2504	182		biology	microbiology		grab									Stefan Sievert	New Flow around old "Ty" vent, folded sheet flow v
4203-7-R	4203			2006-06-27	20:26			Ty	vent orifice	4600	77604					2503	314		rock	sulfide		grab									Rachel Haymon	Sulfide attached to Hobo from "Ty" vent orifice
4203-11-fluid	4203			2006-06-27	22:43		RESET06-8	BM82(NEW8)	diffuse	4608	77580					2503	310		fluid	diffuse	750 ml	major						34			Karen Von Damm	
4203-11-microbio	4203			2006-06-27	22:43		RESET06-8	BM82(NEW8)	diffuse	4608	77580					2503	310		fluid	microbiolo	750 ml	major						34			Sievert/Vetriani	
4203-15-fluid	4203			2006-06-27	22:43		RESET06-8	BM82	diffuse	4608	77580					2503	310		fluid	diffuse	750 ml	major						30			Karen Von Damm	
4203-15-microbio	4203			2006-06-27	22:43		RESET06-8	BM82(NEW8)	diffuse	4608	77580					2503	310		fluid	microbiolo	750 ml	major						34			Sievert/Vetriani	
4203-20-fluid	4203			2006-06-27	20:49		RESET06-8	BM82	diffuse	4608	77580					2503	310		fluid	diffuse	750 ml	major						38			Karen Von Damm	
4203-20-microbio	4203			2006-06-27	22:43		RESET06-8	BM82(NEW8)	diffuse	4608	77580					2503	310		fluid	microbiolo	750 ml	major						34			Sievert/Vetriani	
4203-22-fluid	4203			2006-06-27	20:49		RESET06-8	BM82	diffuse	4608	77580					2503	310		fluid	diffuse	750 ml	major						37			Karen Von Damm	
4203-22-microbio	4203			2006-06-27	22:43		RESET06-8	BM82(NEW8)	diffuse	4608	77580					2503	310		fluid	microbiolo	750 ml	major						34			Sievert/Vetriani	
4203-23-fluid	4203			2006-06-27	19:21		RESET06-10	P	vent orifice	4577	77921					2509	386		fluid	vent fluid	750 ml	major						9			Karen Von Damm	
4203-24-fluid	4203			2006-06-27	19:21		RESET06-10	P	vent orifice	4577	77921					2509	386		fluid	vent fluid	750 ml	major						14			Karen Von Damm	
4203-25-fluid	4203			2006-06-27	19:16		RESET06-10	P	vent orifice	4577	77921					2509	386		fluid	vent fluid	750 ml	major						9			Karen Von Damm	
4203-26-fluid	4203			2006-06-27	19:16		RESET06-10	P	vent orifice	4577	77921					2509	386		fluid	vent fluid	750 ml	major						12			Karen Von Damm	
4203-gt2-fluid	4203			2006-06-27	20:45		RESET06-8	BM82	diffuse	4608	77580					2503	310		fluid	diffuse	150 ml	gas tight									Marvin Lilley	
4203-gt6-fluid	4203			2006-06-27	19:32		RESET06-10	P	vent orifice	4577	77921					2509	386		fluid	vent fluid	150 ml	gas tight						30			Marvin Lilley	
4203-gt10-fluid	4203			2006-06-27	19:29		RESET06-10	P	vent orifice	4577	77921					2509	386		fluid	vent fluid	150 ml	gas tight						8			Marvin Lilley	
4203-gt15-fluid	4203			2006-06-27	20:46		RESET06-8	BM82	diffuse	4608	77580					2503	310		fluid	diffuse	150 ml	gas tight									Marvin Lilley	
4204-1-R	4204			2006-06-28	16:15					3418	82861					2559	90		rock	lava		grab									Michael Perfit	New flow; ornamented pillow lava transitional to lot
4204-2-R	4204			2006-06-28	16:55					3929	82842					2559	90		rock	lava		grab									Michael Perfit	New flow, lobate crust
4204-3-R	4204			2006-06-28	19:03					4235	83001					2547	90		rock	lava		grab									Michael Perfit	Old pillow at contact with New flow
4204-4A-R	4204			2006-06-28	19:09					4234	82998					2547	90		rock	lava		grab									Michael Perfit	New flow at contact with older flow #3
4204-4B-R	4204			2006-06-28	19:15					4234	82998					2547	90		rock	lava		grab									Michael Perfit	New flow at contact with older flow #4
4204-5-R	4204			2006-06-28	19:35					4422	83058					2546	90		rock	lava		grab									Michael Perfit	New off-axis fissure ridge, lobate flow west side
4204-6-R	4204			2006-06-28	19:54					4577	83121					2544	90		rock	lava		grab									Michael Perfit	New off-axis fissure ridge, lobate flow east side of f
4204-6-bio	4204			2006-06-28	19:59					4579	83119					2544	120		biology	seastar		grab									Timothy Shank	
4204-7-microbio	4205			2006-06-29	20:30					4527	83080					2543			microbio												Sievert/Vetriani	slurp pump sampling for microbes
4204-8-R	4204			2006-06-28	21:00					4526	83090					2545	135		rock	lava		grab									Michael Perfit	New flow, jumbled-hackly sheet flow
4204-8-microbio	4204			2006-06-28	21:00					4526	83090					2545	135		rock	microbiology		grab									Stefan Sievert	New flow, jumbled-hackly sheet flow, coating
4204-9-R	4204			2006-06-28	21:20					4535	82862					2545	135		rock	lava		grab									Michael Perfit	New flow, hackly sheet flow
4204-4-microbio	4204			2006-06-28	21:21					4535	82862					2545			fluid	microbiolo	750 ml	major									Sievert/Vetriani	ambient seawater taken w/ majors
4204-14-fluid	4204			2006-06-28	21:21					4535	82862					2545			fluid	seawater	750 ml	major						38			Karen Von Damm	
4205-1-R	4205			2006-06-29	15:40					5892	70503					2518	103		rock	lava		grab									Michael Perfit	Lobate flow, young (likely 1991-92?), at contact wit
4205-2-R	4205			2006-06-29	16:23		RESET06-97	L	vent opening	5975	70519					2523	358		rock	sulfide		grab									Rachel Haymon	Sulfide taken from top spire on L vent
4205-2-bio	4205			2006-06-29	16:23		RESET06-97	L	vent opening	5975	70519					2523	358		biology	invertebrates		grab									Tim Shank	Sulfide taken from top spire on L vent
4205-2-microbio	4205			2006-06-29	16:23		RESET06-97	L	vent opening	5975	70519					2523	358		biology	microbiology		grab									Sievert/Vetriani	Sulfide taken from top spire on L vent
4205-3-R	4205			2006-06-29	17:34		older "Legacy" marker			5876	70518					2526	214		rock	lava		grab									Michael Perfit	New flow, lobate from base of L vent; in vigourous :
4205-3-bio	4205			2006-06-29	17:34		older "Legacy" marker			5876	70518					2526	214		biology	invertebrates		grab									Tim Shank	
4205-3-microbio	4205			2006-06-29	17:34		older "Legacy" marker			5876	70518					2526	214		biology	microbiology		grab									Sievert/Vetriani	
4205-4-R	4205			2006-06-29	19:16		RESET06-	"A" marker	top of vent	5799	70983					2514	254		rock	sulfide		grab									Rachel Haymon	Large piece of chimney top, sulfide
4205-4-bio	4205			2006-06-29	19:16		RESET06-	"A" marker	top of vent	5799	70983					2514	254		biology	invertebrates		grab									Tim Shank	
4205-4-microbio	4205			2006-06-29	19:16		RESET06-	"A" marker	top of vent	5799	70983					2514	254		biology	microbiology		grab									Sievert/Vetriani	
4205-5-R	4205			2006-06-29	19:25					5812	71011					2523	40		rock	lava		grab									Michael Perfit	New flow, collapsed lobate crust at edge of new flo
4205-6-R	4205			2006-06-29	20:25		RESET06-14			5475	72199					2515	277		rock	lava		grab									Michael Perfit	New flow, lobate crust at contact with older pillar
4205-7-R	4205			2006-06-29	20:56					5414	72398					2512	299		rock	lava		grab									Michael Perfit	Older, stained flow just N of "V" vent in diffuse fluid
4205-11-fluid	4205			2006-06-29	19:04			A	vent orifice	5799	70983					2514	241		fluid	vent fluid	750 ml	major						19			Karen Von Damm	
4205-15-fluid	4205			2006-06-29	19:04			A	vent orifice	5799	70983					2514	241		fluid	vent fluid	750 ml	major						21			Karen Von Damm	
4205-20-fluid	4205			2006-06-29	20:43			V	vent orifice	5415	72333					2511	268		fluid	vent fluid	750 ml	major						27			Karen Von Damm	
4205-21-fluid	4205			2006-06-29	20:43			V	vent orifice	5415	72333					2511	268		fluid	vent fluid	750 ml	major						27			Karen Von Damm	
4205-23-fluid	4205			2006-06-29	20:46			V	vent orifice	5415	72333					2511	268		fluid	vent fluid	750 ml	major						23			Karen Von Damm	
4205-24-fluid	4205			2006-06-29	20:48			V	vent orifice	5415	72333					2511	268		fluid	vent fluid	750 ml	major						22			Karen Von Damm	
4205-25-fluid	4205			2006-06-29	17:05			L	vent orifice	5973	70519					2522	345		fluid	vent fluid	750 ml	major						22			Karen Von Damm	
4205-26-fluid	4205			2006-06-29	17:05			L	vent orifice	5975	70519					2522	345		fluid	vent fluid	750 ml	major						27			Karen Von Damm	
4205-gt5-fluid	4205			2006-06-29	16:50			L	vent orifice	5975	70519					2522	345		fluid	vent fluid	150 ml	gas tight						26			Marvin Lilley	
4205-gt6-fluid	4205			2006-06-29	19:10			A	vent orifice	5799	70983					2514	241		fluid	vent fluid	150 ml	gas tight						30			Marvin Lilley	
4205-gt7-fluid	4205			2006-06-29	20:50			V	vent orifice	5415	72333					2511	268		fluid	vent fluid	150 ml	gas tight						28			Marvin Lilley	
4205-gt11-fluid	4205			2006-06-29	20:52			V	vent orifice	5415	72333					2511	268		fluid	vent fluid	150 ml	gas tight						28			Marvin Lilley	
4205-gt16-fluid	4205			2006-06-29	19:06			A	vent orifice	5799	70983					2514	241		fluid	vent fluid	150 ml	gas tight						27			Marvin Lilley	
4206-1-R	4206			2006-06-30	16:02					4377	77878					2505	68		rock	lava		grab									Michael Perfit	New flow? Off-axis sheet flow area
4206-2-R	4206			2006-06-30	19:21					4617	77611					2502	85		rock	lava		grab									Michael Perfit	Near elevator, W of AST ~ 50 m
4206-4-fluid	4206			2006-06-30	21:24			near to	diffuse	4683	77608					2504			fluid	diffuse	750 ml	major						34			Karen Von Damm	
4206-4-microbio	4206			2006-06-30	21:24			near to	diffuse	4683	77608					2504			fluid	microbiolo	750 ml	major						34			Sievert/Vetriani	
4206-11-fluid	4206			2006-06-30	20:49			to	vent orifice	4677	77601					2504	352		fluid	vent fluid	750 ml	major						22			Karen Von Damm	
4206-14-fluid	4206			2006-06-30	21:24			near to	diffuse	4683	77608					2504			fluid	diffuse	750 ml	major						35			Karen Von Damm	
4206-14-microbio	4206			2006-06-30	21:24			near to	diffuse	4683	77608					2504			fluid	microbiolo	750 ml	major						35			Sievert/Vetriani	
4206-15-fluid	4206			2006-06-30	20:49			to	vent orifice	4677	77601					2504	352		fluid	vent fluid	750 ml	major						24			Karen Von Damm	
4206-23-fluid	4206			2006-06-30	21:01			to	vent orifice	4677	77601					2504	352		fluid	vent fluid	750 ml	major						23			Karen Von Damm	
4206-24-fluid	4206			2006-06-30	21:01			to	vent orifice	4677	77601					2504	352		fluid	vent fluid	750 ml	major						24			Karen Von Damm	
4206-gt2-fluid	4206			2006-06-30	21:11			to	vent orifice	4677	77601					2504	352		fluid	vent fluid	150 ml	gas tight						24			Marvin Lilley	
4206-gt15-fluid	4206			2006-06-30	21:08			to	vent orifice	4677	77601					2504	352		fluid	vent fluid	150 ml	gas tight						32			Marvin Lilley	
4207-1-R	4207			2006-07-01	15:34					4669	77594											grab									Michael Perfit	
4207-2-R	4207			2006-07-01	15:50					4651	77591					2504	155					grab									Michael Perfit	
4207-3A-R	4207			2006-07-01	19:24					4651	77591					2504	155		rock	lava		grab									Michael Perfit	Jumbled sheet at insect deployment in AST (two pix
4207-3A-bio	4207			2006-07-01	19:24					4651	77591					2504	155		biology	invertebrates		grab									Timothy Shank	Jumbled sheet at insect deployment in AST (two pix
4207-3B-R	4207			2006-07-01	19:24											2504	155		rock	lava		grab									Michael Perfit	Jumbled sheet at insect deployment in AST (two pix
4207-3B-bio	4207			2006-07-01	19:24											2504	155		biology	invertebrates		grab									Timothy Shank	Jumbled sheet at insect deployment in AST (two pix
4207-3B-microbio	4207			2006-07-01	19:24											2504	155		biology	microbiology		grab									Sievert/Vetriani	Jumbled sheet at insect deployment in AST (two pix
4207-4-R	4207			2006-07-01	20:17			to	vent orifice	4639	77606					2504	155		rock	sulfide		grab						28			Rachel Haymon	
4207-4-bio	4207			2006-07-01	20:17			to	vent orifice	4639	77606					2504	155		biology	invertebrates		grab									Timothy Shank	
4207-4-microbio	4207			2006-07-01	20:17			to	vent orifice	4639	77606					2504	155		biology	microbiology		grab									Sievert/Vetriani	
4207-11-fluid	4207			2006-07-01	20:22			to	vent orifice	4639	77606					2504	155		fluid	vent fluid	750 ml	major						22			Karen Von Damm	
4207-14-fluid	4207			2006-07-01	20:17			to	vent orifice	4639	77606					2504	155		fluid	vent fluid	750 ml	major						28			Karen Von Damm	
4207-15-fluid	4207			2006-07-01	20:22			to	vent orifice	4639	77606					2504	155		fluid	vent fluid	750 ml	major						21			Karen Von Damm	
4207-23-fluid	4207			2006-07-01	20:24			to	vent orifice	4639	77606					2504	155		fluid	vent fluid	750 ml	major						19			Karen Von Damm	
4207-24-fluid	4207			2006-07-01	20:24			to	vent orifice	4639	77606					2504	155		fluid	vent fluid	750 ml	major						24			Karen Von Damm	
4207-gt6-fluid	4207			2006-07-01	20:34			to	vent orifice	4639	77606					2504	155		fluid	vent fluid	150 ml	gas tight						27			Marvin Lilley	
4207-gt7-fluid	4207			2006-07-01	20:37			to	vent orifice	4639	77606					2504	155		fluid	vent fluid	150 ml	gas tight						31			Marvin Lilley	

ATL 15-6
RESET06 Macrobiology Samples

Alvin Dive #	Date	Time	X	Y	Hdg	Depth	Area	Marker	Sample Substrate	Dive Sample ID	Individual ID	Prelimnary identification Specimen(s)
4202	6/26/2006	1854	4426	78775	218	2501	Q vent		sulfide	5	4202-B1	Alvinella pompejana
4202	6/26/2006	1854	4426	78775	218	2501	Q vent		sulfide	5	4202-1	Alvinella pompejana
4202	6/26/2006	1854	4426	78775	218	2501	Q vent		sulfide	5	4202-B2	> 1mm debris
4202	6/26/2006	1854	4426	78775	218	2501	Q vent		sulfide	5	4202-B3	250 um- 1mm debris
4202	6/26/2006	1854	4426	78775	218	2501	Q vent		sulfide	5	4202-B4	63 um- 250 um debris
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-1	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-2	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-3	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-4	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-5	Lepetodrilus elevatus
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-6	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-7	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-8	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-9	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-10	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-11	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-12	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-13	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-14	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-15	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-16	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-17	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-18	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-19	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-B15	250 um- 1mm debris
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5	4203-B16	32- 250 um debris
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-20	Nodopelta
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-21	Nodopelta
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-22	Nodopelta
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-23	Paralvinella pandorae
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-24	Ophryotrocha akessoni
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-25	Alvinella caudata
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-26	Paralvinella grasslei
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-27	Alvinella pompejana
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-28	Alvinella caudata
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-29	Paralvinella grasslei
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-30	Paralvinella grasslei
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-31	Alvinella pompejana
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-32	Alvinella caudata
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-33	Alvinella pompejana
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-34	Alvinella pompejana
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-35	Alvinella pompejana
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-36	Alvinella pompejana
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-B1	Paralvinella grasslei
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-37	Alvinella caudata
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-38	vestimentiferan
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-39	vestimentiferan
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-B2	> 1mm debris
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-B3	250 um- 1mm debris
4203	6/27/2006	1910	4577	77921	26	2509	P vent	10	sulfide	3	4203-B4	63 um- 250 um debris
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-B5	Lepetodrilus elevatus
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-B6	Peltospira operculata
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-B7	Lepetordilus pustulosis
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-B8	Ctenopelta porifera
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-40	Ctenopelta porifera

4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-41	Ctenopelta porifera
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-42	Ctenopelta porifera
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-B9	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-43	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-44	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-45	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-46	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-47	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-48	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-B10	> 1mm debris
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-B11	250 um- 1mm debris
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-B12	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-B13	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-B14	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203_B17	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	5 and 6	4203-B15	vestimentiferans
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-49	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-50	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-51	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-52	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-53	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-54	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-55	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-56	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-57	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-58	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-59	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-60	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-61	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-62	Paralvinella pandorae
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-63	Lepetodrilus elevatus
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-64	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-65	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-66	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-67	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-68	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-69	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-70	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-71	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-72	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-73	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-74	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-75	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-76	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-77	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-78	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-79	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-80	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-81	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-82	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-83	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-84	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-85	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-86	vestimentiferan
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-B18	> 1mm debris
4203	6/27/2006	2132	4603	77591	182	2504	BM 82/ Mkr 8	11	basalt	6	4203-B17	32- 250 um debris
4204	6/28/2006	1959	4579	83119	120	2544	~9.53'N	~9.53'	basalt	6	4204-1	Brisingid seastar
4205	6/29/2006	1624	5975	70519	356	2523	L vent		sulfide	2		Alvinella pompejana
4205	6/29/2006	1624	5975	70519	356	2523	L vent		sulfide	2		Hesiolyra bergi

4205	6/29/2006	1624	5975	70519	356	2523	L vent		sulfide	2	4205-B22	Alvinella pompejana
4205	6/29/2006	1624	5975	70519	356	2523	L vent		sulfide	2	4205-B31	Hesiospina vestimentifera
4205	6/29/2006	1624	5975	70519	356	2523	L vent		sulfide	2	4205-B35	Hesiospina vestimentifera
4205	6/29/2006	1624	5975	70519	356	2523	L vent		sulfide	2	4205-B36	Lepidonotopodium fimbriatum
4205	6/29/2006	1624	5975	70519	356	2523	L vent		sulfide	2	4205-B32	Hesiolyra bergi
4205	6/29/2006	1624	5975	70519	356	2523	L vent		sulfide	2	4205-B39	Ophryotrocha akessoni
4205	6/29/2006	1624	5975	70519	356	2523	L vent		sulfide	2	4205-B40	32- 250 um debris
4205	6/29/2006	1910	5799	70982	241	2513	A vent	4	sulfide	4	4205-B33	Bathymodiolus thermophilus
4205	6/29/2006	1910	5799	70982	241	2513	A vent	4	sulfide	4	4205-B34	Branchipolynoe symmytilida
4205	6/29/2006	1910	5799	70982	241	2513	A vent	4	sulfide	4	4205-B38	copepods
4205	6/29/2006	1910	5799	70982	241	2513	A vent	4	sulfide	4	4205-B37	Lepidonotopodium fimbriatum
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B38	250 um- 1mm debris
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B39	32- 250 um debris
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B1	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B2	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B3	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B4	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B5	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B6	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B7	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B8	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B9	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B10	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B11	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B12	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B13	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B14	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B15	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B16	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B17	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B18	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B19	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B20	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B21	Paralvinella pandorae
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B22	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B23	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B24	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B25	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B26	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B27	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B28	Tevnia jerichonana
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B29	vestimentiferan
4205	6/29/2006	1737	5977	70518	214	2527	L vent (base)	9	basalt	3	4205-B30	vestimentiferan
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B1	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B2	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B3	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B4	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B5	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B6	Amphisamytha galapagensis
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B7	Paralvinella pandorae
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B8	Paralvinella pandorae
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B9	Paralvinella pandorae
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B10	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B15	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B16	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B28	32- 63 um debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B29	63 um- 250 um debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B30	250 um- 1mm debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B31	32- 63 um debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B32	63 um- 250 um debris

4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B33	250 um- 1mm debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3b	4207-B34	> 1mm debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a/3b	4207-B20	32- 63 um debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a/3b	4207-B21	63 um- 250 um debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a/3b	4207-B22	250 um- 1mm debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a/3b	4207-B23	limpet
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a/3b	4207-B24	Ctenopelta porifera
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a/3b	4207-B25	copepod
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a/3b	4207-B26	Paralvinella pandorae
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a/3b	4207-B27	Lepetordilus pustulosis
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a/3b	4207-B35	Lepidonotopodium
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a/3b	4207-B36	Paralvinella pandorae
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B11	32- 63 um debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B12	63 um- 250 um debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B13	250 um- 1mm debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B14	> 1mm debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B17	32- 63 um debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B18	63 um- 250 um debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B19	250 um- 1mm debris
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B37	63 um- 250 um debris
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B38	250 um- 1mm debris
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B39	> 1mm debris
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B40	vestimentiferan
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B41	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B42	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B43	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B44	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B45	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B46	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B47	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B48	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B49	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B50	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B51	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B52	Tevnia jerichonana
4207	7/1/2006	1924	4651	77591	155	2504	BM 82/ Mkr 8	8	basalt	3a	4207-B53	Tevnia jerichonana
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B54	Alvinella pompejana
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B55	Alvinella pompejana
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B56	Alvinella pompejana
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B57	Alvinella pompejana
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B58	Alvinella pompejana
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B59	Alvinella pompejana
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B60	Alvinella pompejana
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B61	Alvinella pompejana
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B62	Alvinella pompejana
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B63	Alvinella caudata
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B64	Hesiolyra bergi
4207	7/1/2006	1935	4646	77607	70	2505	"Io"		sulfide	4	4207-B65	Ctenopelta porifera