Axial 2017 Cruise Report

Axial Seamount, Juan de Fuca Ridge

R/V Roger Revelle

July 13 – July 23, 2017

Jason Dives J2-965 – J2-969

Chief Scientist: Bill Chadwick
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JASON Expedition Leader: Tito Collasius
SENTRY Expedition Leader: Sean Kelley
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Axial 2017 Expedition Cruise Report

1 - Axial 2017 Cruise Summary

Bill Chadwick, Chief Scientist

Our research expedition to Axial Seamount was a great success, thanks to the combined efforts of the crew of the *R/V Revelle*, the *Jason* ROV and *Sentry* AUV teams, and the science party (and good luck with the weather!). We were able to complete five *Jason* dives, five *Sentry* dives, three CTD casts, and we deployed four instrument moorings and recovered five of them that had been out collecting data for the last two years. It was a big relief to feel we accomplished all our goals as we returned to Newport, OR, but the work of analyzing data and samples will continue for many months.

Two of the *Jason* ROV dives were mainly devoted to making pressure measurements at an array of seafloor benchmarks to measure how much the volcano had re-inflated since our last survey two years ago. We found the center of the caldera has risen 80 cm in the last two years, and 1.25 m since the end of the 2015 eruption. That means the volcano has recovered half of the deflation that occurred during the last eruption in just two and a quarter years. However, during that time the rate of re-inflation has also slowed substantially, from initial rates of 80 cm/yr to current rates of about 40 cm/yr (as of October 2017). That means the second half of re-inflation will take longer than the first and the next eruption is probably not due before 2020, depending on how the inflation rate varies between now and then. We'll be keeping an eye on it through the real-time data from the OOI Cabled Observatory, and will be attempting to forecast the next eruption as it gets closer.

Two of the other *Jason* ROV dives were devoted to sampling vent fluids and sulfide chimneys for chemical and microbiological analysis. One of those dives was in the caldera at vent sites that had been visited many times before, and we discovered that the "blue mat" has returned to the Marker N3 Vent site, which was paved over with new lava during the 2011 eruption. It's remarkable that there is something unique about the chemistry of the vent fluid at that site that the blue mat (a protozoan ciliate) really likes. The other chemistry dive was to a new vent site discovered just a year ago by an MBARI-led expedition making dives on Axial's the north rift zone. There they found "mini-smokers" that are very unusual in that they are high-temperature (we measured up to 321°C), but are located on top of the thick 2015 lava flows. We found that these vents have a very different chemistry than the other hydrothermal vent sites in the caldera. The final *Jason* ROV dive was made along a graben along the NE rim of the caldera that traces the path of the dike that connects the 2015 lava flow on the NE caldera floor to another one on the rim. These parts of the 2015 eruption had not been visited previously, so we collected 14 new lava samples to fill in that gap. It's always interesting to get to explore new areas, and it's clear that Axial Seamount can still surprise us even after all these years!

Four of the five *Sentry* AUV dives were made to resurvey previously run multibeam sonar lines to look for volcanic ground deformation as depth changes between this year's survey and ones in previous years. This is done to complement the pressure measurements that we make at the benchmarks. The AUV resurveys have lower resolution for detected depth change, but we can make them quickly over a much larger area than is practical to cover with the pressure measurements. This year's AUV surveys included crisscrossing lines inside the caldera, radial lines extending outside the caldera like an asterisk, and two sets of circumferential ovals at different distances outside the caldera. This extra data on the surface displacements at Axial will help us better model the subsurface magma storage and supply system. The fifth *Sentry* AUV dive was made to collect high-resolution bathymetry in an area NE of the caldera where no high-resolution data had been collected before.

As always, we are grateful to the National Science Foundation and NOAA who supported our research, and we appreciate the support from the Scripps Institution of Oceanography, the captain and crew of *R/V Revelle*, the Woods Hole Oceanographic Institution, the National Deep Submergence Facility, and the *Jason* and *Sentry* teams.

2 – Science Participants

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3 – Operations Log

Pacific Time (-7 GMT)	Date/Time GMT	Event
7/13 1700	7/14 0000	Depart Newport heading to Axial, Departure was delayed by ~ 8 hours due to Jason gear not being ready (from 0900 to 1700 local).
		Logging EM302 multibeam during the transit (~23 hours).
7/13 2100	7/14 0400	XBT #15401
7/14 1540	7/14 2240	Arrive on station at Axial. Preparing for recovery of BPR-South2 mooring.
7/14 1541	7/14 2241	Stop logging EM302 multibeam and all other acoustics. Ship at BPR-South2. 45° 54.959' -129° 59.609'
7/14 1543	7/14 2243	BPR-South2: Sending acoustic signal to locate release and receiving acknowledgement.
7/14 1546	7/14 2246	Sending release signal
7/14 1547	7/14 2247	Mooring has been released
7/14 1640	7/14 2340	**BPR-South-2** mooring recovered on board
		Next tasks is to deploy the elevator with a transponder for Jason USBL navigation calibration.
7/14 1715	7/15 0015	Elevator in the water a little north of Mkr-113 vent. 45° 55.389' -129°59.502'
7/14 1818	7/15 0118	BPR-Center mooring released from seafloor.
7/14 1910	7/15 0210	**BPR-Center** on deck.
7/14 2034	7/15 0334	**OBH-Center** mooring deployed. Drop position: 45° 57.454' 130° 00.211'
		Next deployment will be BPR-North mooring.
7/14 2138	7/15 0438	**BPR-North** mooring deployed. Drop position: 45° 58.352' -130° 01.122
7/14 2250	7/15 0550	**BPR-West** mooring deployed. Drop position: 45° 57.012' -130° 02.166
		Next task: USBL calibration by Jason/Sentry teams using elevator on seafloor, previously deployed.
7/15 0232	7/15 0932	Start USBL calibration.
7/15 0637	7/15 1337	End USBL calibration.
		USBL calibration "good". Was going to deploy Jason at 0800 local but delayed 5 hours because Jason was not ready to go.
7/15 0815	7/15 1515	Elevator release command sent to burn wire.
7/15 0830	7/15 1530	Elevator released and coming up (was used for calibration).
7/15 0935	7/15 1635	Elevator on deck.
7/15 1102	7/15 1802	Sentry in the water. **Sentry dive #442**.
7/15 1235	7/15 1935	Jason off deck for dive J2-964 (first attempt).
7/15 1240	7/15 1940	Jason in the water.
7/15 1255	7/15 1955	Jason out of the water (dive aborted).
7/15 1303	7/15 2003	Jason on deck.
7/15 1401	7/15 2101	CTD in the water: Vertical cast **CTD V17A-01** over Castle vent in the International District.
7/15 1529	7/15 2229	CTD on deck.
7/15 1616	7/15 2316	Jason off deck. Will use the same dive number J2-964.
7/15 1619	7/15 2319	Jason in the water for second attempt at dive J2-964.
7/15 1703	7/16 0003	Problems with the Jason winch at 140 m (again).
7/15 1710	7/16 0010	Dive J2-964 is officially over. The head pin on the sheave that measures cable tension was damaged when it hit the edge of the winch frame.
7/15 1740	7/16 0040	Jason on deck.
7/15 2129	7/16 0429	**CTD V17A-02** over Vixen at Coquille vent field. 45° 55.050 -129° 59.577.
7/15 2253	7/16 0553	CTD on deck.
7/16 0013	7/16 0713	**BPR-South-2** mooring deployed. Launch target: 45° 54.959' -129° 59.609'
7/17 0333	7/17 1033	Sentry recovered on deck after dive #442.

Pacific Time (-7 GMT)	Date/Time GMT	Event
7/16 ~0400	7/16 ~1100	Considered deploying BPR-Center next but Res-tech needed sleep; so ship waited for ~ 5 hours for Jason to be ready for next launch attempt at 0900 local.
		Overnight Jason team repaired Jason winch. Had to replace head pin at center hub of sheave on the level wind of the winch damaged during the last launch attempt due to improper setup on the winch.
		Winch repair lasted from 0100 - 1100 UTC. Jason team also needed to re-calibrate the tension meter on the head pin so entire delay lasted until ~1500 UTC (~14 hrs).
7/16 0840	7/16 1540	**Jason** in the water for dive **J2-965** at the International District. (First successful dive)
7/16 2006	7/17 0306	Jason on deck. End of dive J2-965.
7/16 2045	7/17 0345	Sentry deployed. **Sentry Dive #443**. 45° 57.332 -130°00.507'
		Sentry will be climbing caldera wall so will wait to deploy BPR-center.
7/16 2215	7/17 0515	Sentry has successfully climbed the NE caldera rim so now can prepare to deploy the BPR-Center mooring.
7/16 2252	7/17 0552	**BPR-Center** mooring deployed. 45° 57.447' -130° 00.658'
7/16 2310	7/17 0610	Calibrating position of OBH-Center mooring - deployed earlier (7/15 0334 UTC)
7/17 0100	7/17 0800	OBH-Center calibration complete.
7/17 0403	7/17 1103	Jason on deck preparing to deploy.
7/17 0416	7/17 1116	**Jason** in the water. Start of **dive J2-966.**
7/17 1850	7/18 0150	Waiting for Sentry recovery while Jason is diving
7/17 1950	7/18 0250	Sentry recovered. End of dive 443. Jason resumes pressure dive J2-966.
7/18 1457	7/18 2157	Sentry in the water. **Sentry dive 444**.
7/19 1603	7/19 2303	Jason recovered on deck. End of dive J2-966.
7/19 1636	7/19 2336	Sentry in transit to ship
7/19 1704	7/20 0004	Sentry recovered on deck. End of dive 444.
7/19 1710	7/20 0010	On the way to recover MAPR mooring on the NRZ.
7/19 1805	7/20 0105	Arrived at MAPR mooring recovery site
7/19 1905	7/20 0205	After not hearing from the MAPR mooring, repositioned the ship close to OBH-NRZ mooring.
7/19 1915	7/20 0215	Released OBH-NRZ mooring from the seafloor.
7/19 2030	7/20 0330	**OBH-NRZ** mooring recovered on deck.
7/19 2035	7/20 0335	Sent signal to MAPR mooring at OBH recovery site. No response.
		Moving to MAPR site directly to try to talk to the MAPR mooring.
7/19 2046	7/20 0346	Again - sending signal to MAPR mooring.
7/19 2049	7/20 0349	No reply from the MAPR mooring.
7/19 2056	7/20 0356	Moving ship due west of mooring to try a different angle.
7/19 2105	7/20 0405	No reply from the MAPR mooring at this location west of the mooring.
		Moving ship to the south to try again.
7/19 2125	7/20 0425	Ship located south of the MAPR mooring now.
7/19 2130	7/20 0430	Sent last signal to MAPR mooring. No response. Giving up for now due to fading daylight. Will try again another day.
		Transiting to Jason launch site at Vixen.
7/19 2355	7/20 0655	On site at Vixen dive location for Jason dive J2-967.
7/20 0007	7/20 0707	Start of **Jason dive J2-967**
7/20 1848	7/21 0148	Sentry has launched. **Sentry dive #445**
7/21 0619	7/21 1319	End of Jason dive J2-967.
7/21 0720	7/21 1420	Sentry just dropped its weights and is headed for the surface.
7/21 0816	7/21 1516	Sentry recovered and secured. End of dive #445.
7/21 0925	7/21 1625	Back at MAPR mooring site on NRZ. Sent MAPR mooring enable signals but got no response. Location is about 1 km SE of the mooring.
7/21 0935	7/21 1635	Moving ship to within 500 m of the mooring and will try again.

Pacific Time (-7 GMT)	Date/Time GMT	Event
7/21 1014	7/21 1714	Moved to within 300 m away with DP on. Attempting to enable again.
7/21 1017	7/21 1717	No response. Giving up on trying to enable the MAPR mooring. Decided to just send release command (blind) - looking for it at the surface.
7/21 1035	7/21 1735	The **MAPR mooring at surface.** Never heard a response from it.
7/21 1112	7/21 1812	MAPR mooring floats on board - being recovered through A-frame.
		While recovering the MAPR mooring Jason is preparing for NRZ mini black smoker chimney dive. Weather is good enough; Winds are dying down and seas are calming.
7/21 1140	7/21 1840	1st MAPR from the wire aboard. Sea Pickle (pyrosome) was hitchhiking on it.
7/21 1143	7/21 1843	2nd MAPR aboard.
7/21 1147	7/21 1847	3rd MAPR aboard.
7/21 1150	7/21 1850	4th MAPR aboard.
7/21 1153	7/21 1853	5th MAPR aboard.
7/21 1155	7/21 1855	Acoustic release and entire MAPR mooring aboard.
7/21 1156	7/21 1856	Short transit to Jason dive target site.
7/21 1230	7/21 1930	Fire and boat drill.
7/21 1319	7/21 2019	**Jason** in the water for dive **J2-968.**
7/21 2016	7/22 0316	End of Jason dive J2-968.
7/21 2132	7/22 0432	Sentry in the water. **Sentry dive 446**.
		Ship stayed near Sentry during first part of survey until time to be at the Jason launch location at 4am local.
7/22 0405	7/22 1105	Start of **Jason** dive **J2-969**.
7/22 1225	7/22 1925	End of Jason dive J2-969.
7/22 1320	7/22 2020	Sentry on board. End of dive 446.
7/22 ~ 1430	7/22 ~2130	**CTD cast: V17A-03** over NRZ Happy Hour vent field (mini black smokers). 46° 7.252' -129° 58.208'.
7/22 1546	7/22 2246	CTD back on board.
7/22 1600	7/22 2300	Started mapping bathy and water column data after CTD. Using CTD data for SVP. Heading to port.
7/22 1600	7/22 2300	EM302 line 51: start processing with this line - before that it was turn data. 46° 6.87' -129° 56.66'.
7/22 1645	7/22 2345	Depart Axial on way back to Newport
7/23 ~1515	7/23 ~ 2215	Arrived at NOAA MOC-P dock in Newport.

4 – Discipline Summaries

4.1 Geology/Geophysics

4.1.1 Pressure Measurements to Monitor Volcanic Deformation at Axial Seamount

Bill Chadwick, Scott Nooner, and Matt Cook

We have made ROV-based campaign-style pressure measurements with a "mobile pressure recorder" (MPR) on seafloor benchmarks at Axial Seamount since 2000 to monitor vertical movements of the seafloor due to volcanic inflation and deflation caused by magma movements beneath the volcano. In addition, we have deployed various kinds of continuously-recording bottom pressure recorders (BPRs) throughout the caldera. Some BPRs are autonomous moorings that record for 1-3 years at a time (2 of these were deployed and recovered from 2015-2017, and 4 were deployed in 2017). Three others are BPR/Tilt instruments that are connected to the OOI Cabled Array (and a 4th OOI BPR/Tilt instrument was deployed on a UW/OOI cruise in August 2017). In addition, we deploy "mini-BPRs" (deployed and recovered by ROV) on some of the MPR benchmarks. The aim is to have both campaign-style and continuous pressure measurements at all of our monitoring sites (the array of 10 seafloor benchmarks). Where the MPR measurements are co-located with a BPR, then the MPR data can determine the instrumental drift of the BPR. What is new this year is that for the first time we can constrain the drift rates of all the BPRs at Axial. This section summarizes this year's operations.

Autonomous BPR moorings

We recovered the two autonomous BPR moorings (Center and South2) that were deployed in August 2015 and they both had successfully recorded. These two BPRs were turned-around at sea and redeployed in the same locations. Two additional BPRs were also deployed. The BPR formerly deployed at the "South1" location in previous years (and had to be returned to Seattle for maintenance after our 2015 cruise) was deployed this year in a new location "North" of the caldera center. A fourth new BPR (not previously used at Axial) was deployed at another new location "West" of the caldera (see table below). All the moored BPRs are built by NOAA/PMEL and record pressure and temperature every 15 seconds in psi, which is converted to depth by multiplying by 0.670 m/psi.

Table 4.1.1-1 BPR Mooring Deployment Locations in 2017 (drop positions – not surveyed by Workboat)

Name	Lat Deg	Lat Min	Lon Deg	Lon Min	Lat	Lon	Depth
BPR-Center	45	57.447	-130	00.658	45.95745	-130.01097	1530
BPR-South2	45	54.958	-129	59.619	45.91597	-129.99365	1530
BPR-West	45	57.011	-130	02.141	45.95018	-130.03568	1418
BPR-North	45	58.350	-130	01.128	45.97250	-130.01880	1578

By comparing the BPR-Center and BPR-South2 data with the 2015-2017 MPR survey at benchmarks AX-101 (Center) and AX-104 (South-2), we determined the drift rate of the autonomous BPRs. How those rates compare with the previous 2013-2015 data is shown in the following table.

Table 4.1.1-2 Autonomous Moored BPR Drift Rates Determined by Comparing with MPR Surveys

Name	S/N	Dynamic range (psi)	Drift rate 2015-2017 (cm/yr)	Drift rate 2013-2015 (cm/yr)	Drift rate 2011-2013 (cm/yr)
BPR-Center	103402	10,000	-15.365	-20.101	-8.576
BPR-South2	125320	3,000	-3.514	-5.048	n/a
BPR-South1	51185	10,000	n/a	-8.169	n/a

This shows that (1) the same BPR deployed in the same location can have a different drift rate from deployment to deployment, and (2) BPRs with larger dynamic ranges tend to have larger drift rates.

Mini-BPRs (TG11s)

During Jason dives J2-966 and J2-967 this year, we recovered 6 mini-BPRs that were deployed on MPR benchmarks in 2015 (see table below). These 6 mini-BPRs were built at Scripps and are owned by Glenn Sasagawa and Scott Nooner. They were deployed with a wrap of lead sheeting secured with hose clamps and tape around the pressure case to make them each about 5 pounds heavy in water. All but one recorded for the entire period - the batteries in Mini-BPR #08 exhausted prematurely on April 24, 2017 (3 months before recovery).

Mini-BPR units 06, 07, 08, 09, 12, and 13 were deployed at the benchmarks listed in the following table, which also includes the Paros S/Ns, models, psi-ranges, and drift rates in cm/yr of the mini-BPRs (based on a comparison with the 2015-2017 MPR results at the same benchmarks):

Table 4.1.1-3 MINI-BPRs RECOVERED in 2017

BENCHMARK NAME	Mini-BPR	Paros S/N	Paros model	Range (psi)	Drift rate (cm/yr)
AX-105 Pillow Mound	#13	132674	46K	6000	-14.159
AX-106 Ashes	#09	127331	43K	3000	+30.154
AX-302 Trevi	#06	125331	42K	2000	+3.147
AX-303 Marker 33 site	#12	132673	46K	6000	-8.601
AX-307 Magnesia West	#07	125573	42K	2000	+19.876
AX-308 BPR-South1	#08	127329	43K	3000	-10.279

The drift rates are highly variable and the largest drift rates are not on sensors with the largest dynamic range. The miniBPRs reported pressures in kPa every 100 seconds (1 min 40 sec). The pressure was converted from kPa to psi using 1kPa = 0.14503773800722 psi and then to depth in meters using 1 psi = 0.670 meters.

All the non-cabled BPR data this year were de-tided by subtracting predicted tides provided by Rick Thomson at the Institute of Ocean Sciences in Sydney, BC, based on the first year of OOI BPR data from instrument BOTPT-A301-MJ03F on the OOI Cabled Array (located at 45.954850° -130.008753°, at the Central Caldera). In other words, he used real data to calculate the tidal constituents for Axial, which provides better predicted-tides than the generic tide-prediction program SPOTL which we have used in previous years.

MiniBPR unit 09 had two one-line bad-data records in the raw data (05/06/2016 19:21:40 and 06/16/2016 03:41:40). MiniBPR unit 12 had periods of noise in the middle of the record, roughly from 05/09/2016 to 12/10/2016 solidly, then intermittently to 03/25/2017, and the data are fine thereafter. We don't know why yet.

Another note of interest is that we noticed that Mini-BPR #13 (the one at the MPR reference benchmark, AX-105) was in a different orientation on the benchmark when it was first observed in 2017, compared to when it was last seen in 2015. Mini-BPR #13 was flipped over on its side, not resting on the plastic “feet” that were attached and was in a different orientation. Looking at the data, there was a sudden offset in the pressure record on January 7, 2017 around 16:00. We interpret that this was probably caused by a fish swimming by and getting caught in the handle of the mini-BPR and then freaking out briefly to get away, which probably flipped the instrument. To correct the detided time-series for this offset, the detided data during the fish-bump depth offset were removed (between 15:00-16:30), the detided data after the offset were offset to match the detided data before the offset, and the detided data during the offset were interpolated. The raw depth time-series was not corrected.

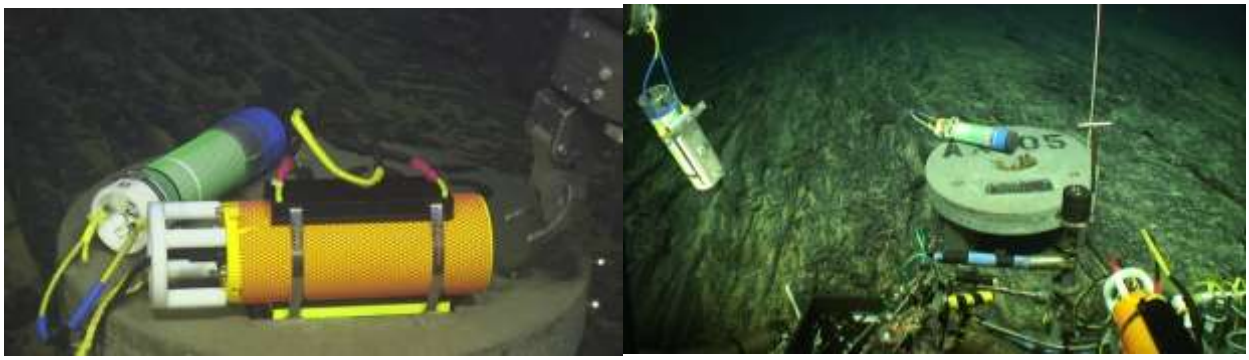


Fig. 4.1.1-1 Frame grabs of Mini-BPR #13 on benchmark AX-105 in 2015 (left) and in 2017 (right).

To replace the mini-BPRs we recovered, we deployed four new mini-BPRs (units 02, 04, 05, and 10) that were built by Glenn Sasagawa at Scripps through an NSF-grant to Bill Chadwick and these were deployed at MPR benchmarks in July 2017 as follows:

Table 4.1.1-4 MINI-BPRs DEPLOYED in 2017

BENCHMARK NAME	Mini-BPR	Paros S/N	Paros model	Range (psi)
AX-303 Marker 33 site	#02	137987	43K	3000
AX-105 Pillow Mound	#04	137988	43K	3000
AX-302 Trevi	#05	137989	43K	3000
AX-307 Magnesia West	#10	137990	43K	3000

That left only one MPR benchmark (AX-308) without a BPR on the benchmark or nearby.

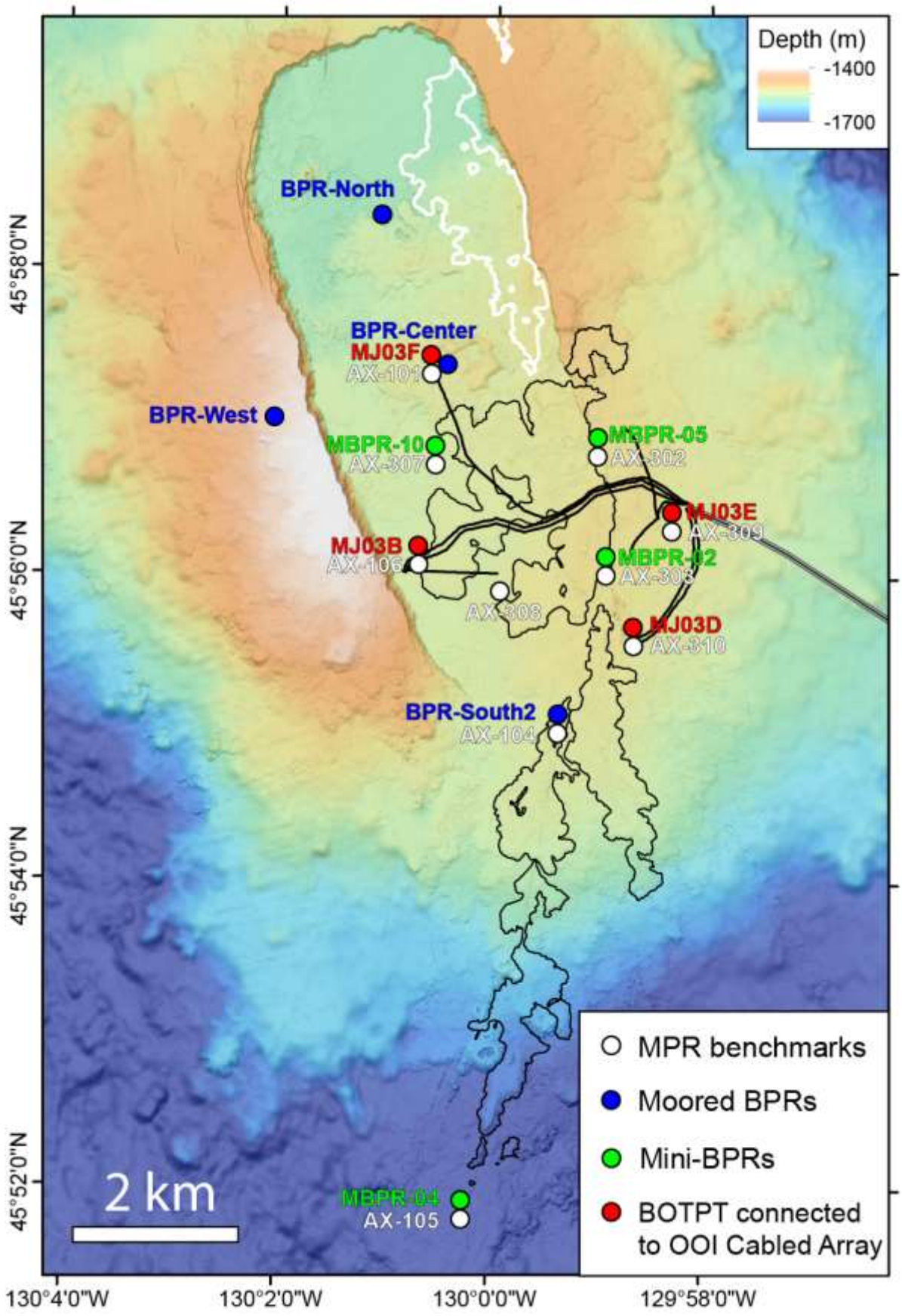


Fig. 4.1.1-2 Figure showing MPR benchmarks and co-located BPRs (after the 2017 cruise).

MPR measurements

The MPR measurements provide a precise depth for each benchmark *relative* to the reference site AX-105 (Pillow Mound), which is located ~10 km south of the center of the caldera. This year, the pressure was measured at the benchmarks during Jason dives J2-966 and J2-967. We had intended to conduct the measurements during a single dive, but dive J2-966 had to be aborted due to telemetry problems (control for the thrusters was dropping out and a board had to be replaced).

This was the first year that we conducted the MPR survey with ROV Jason in single body mode. This meant that Jason could only transit between sites at a speed of 0.5 knots, instead of the usual 0.8 knots when Jason is in dual-body mode operating with Medea. We found that operating in single-body mode made the most difference for the longest transit between AX-104 and AX-105 (6 km), which took 7 hours this year instead of 4 hours in previous years with Medea. On the other hand, the shorter transits, for example between AX-308 and AX-106 (1 km), were about the same as in previous years, because although the ship had to transit slower, the bottom approach and departure with the ROV were quicker due to not having to wait for Medea to settle out after a transit. Basically, Jason usually drove on the bottom from one site to another and as soon as we arrived we could start working. Each full transect took about 24 hours, and overall we made almost 3 transects. We made 3 repeat measurements at AX-106, AX-302, and AX-303, and 2 repeat measurements at AX-101, AX-105, AX 307, and AX-308. Bag City (AX-104) was the tie point between the two dives, with 2 repeat measurements on each dive.

As in previous years, each measurement was made by placing the MPR on top of a benchmark and recording for 20 minutes. Data were recorded in a laptop PC in the Jason control room. The two Paros pressure gauges that we have used in the past (s/n 43535 and 62201) were used again this year. We conducted some fluid sampling for Dave Butterfield during both pressure dives. The MPR pressure data were converted to depth then corrected for ocean tides using data collected by the Mini-BPR #13, which was recovered at AX-105 at the end of the 2nd pressure dive. Instrument drift was calculated during the survey and was removed. The uncertainty in the pressure measurements was determined by the scatter of repeated measurements at each benchmark and was ± 1.0 cm this year. The 2015-2017 MPR results show uplift (inflation) at all stations relative to AX-105.

Table 4.1.1-5 Depth changes from August 2015 to July 2017 at MPR benchmarks. Uncertainty is ±1.0 cm.

BENCHMARK NAME	Depth change (cm)
AX-101 Caldera Center	88.3
AX-104 Bag City	42.7
AX-105 Pillow Mound	0.0
AX-106 Ashes	59.5
AX-302 Trevi	50.0
AX-303 Marker 33 site	53.4
AX-307 Magnesia West	83.1
AX-308 South1	70.6
AX-309 RSN-PN	37.6
AX-310 Intern. District	47.7

The MPR survey also allowed us to constrain the drift rate of the OOI Cabled Array BPRs for the first time since they were powered up in September 2014, since both of our previous MPR surveys were during their period of operation. The MPR data show that the drift at all three of the OOI-BPRs (BOTPT-A301-MJ03F - Central Caldera near benchmark AX-101, BOTPT-A302-MJ03E - Eastern Caldera near benchmark AX-309, and BOTPT-A303-MJ03D - International District near benchmark AX-310) was less than 1 cm/yr, which we consider “essentially zero”, considering the errors. Thus, no drift corrections need to be made to the OOI NANO-BPR data from the BOTPT instruments on the cabled observatory inside the summit caldera. Note that a 4th BOTPT instrument was deployed in the ASHES vent field on the OOI Cabled Array in mid-August 2017 during an OOI operations and maintenance cruise (on one of the R/V Revelle by the University of Washington

OOI group). The drift rate of this new instrument (BOTPT-A304-MJ03B - ASHES Vent Field near benchmark AX-106) will be determined during the next MPR survey.

Results of the Pressure Measurements

The data from the 2017 MPR survey and the BPRs that were recovered show that by mid-July 2017 Axial Seamount had re-inflated about half of the total amount of deflation that occurred during the 2015 eruption (1.25 m of post-eruption re-inflation compared to 2.54 m of co-eruption deflation). However, the rate of re-inflation since the 2015 eruption has decreased with time, so it is likely the "second half" of re-inflation will take longer. It appears Axial will not be ready to erupt again before 2020. A more specific forecast of the timing of the next eruption will have to await more data and will depend on how re-inflation proceeds over the coming years. We will be able to track the re-inflation with the real-time BPR data from the OOI Cabled Array (see plots of those data at this URL: https://www.pmel.noaa.gov/eoi/rsn/). The spatial distribution of re-inflation is consistent with the source geometry derived from modeling of our previous MPR surveys – that is, a prolate spheroid (cigar-or-football shape) that is located at a depth of about 3.8 km beneath the eastern wall of the caldera near AX-302 (Trevi) and oriented with the long-axis nearly vertical but steeply dipping to the WNW. Complementary bathymetric re-surveys with the Sentry AUV to reveal volcanic deformation over a larger area are described in the next section.

Table 4.1.1-6 Cement Benchmark Locations

AXIAL CEMENT BENCHMARK NAMES	LAT	LON	Depth	LAT DEG	LAT MIN	LON DEG	LON MIN
AX-101 Caldera Center	45.95520	-130.00987	1532	45	57.312	-130	0.592
AX-104 Bag City	45.91617	-129.98950	1534	45	54.970	-129	59.370
AX-105 Pillow Mound	45.86317	-130.00376	1718	45	51.790	-130	0.225
AX-106 Ashes	45.93445	-130.01160	1542	45	56.067	-130	0.696
AX-302 Trevi	45.94642	-129.98378	1522	45	56.785	-129	59.027
AX-303 Marker 33 site	45.93346	-129.98225	1516	45	56.008	-129	58.935
AX-307 Magnesia West	45.94535	-130.00906	1544	45	56.721	-130	0.544
AX-308 BPR-South1	45.93160	-129.99880	1533	45	55.896	-129	59.928
AX-309 RSN-PN	45.93835	-129.97208	1527	45	56.301	-129	58.325
AX-310 Intern. District	45.92580	-129.97787	1531	45	55.548	-129	58.672

4.1.2 - Rock Collections
Bill Chadwick

Eighteen lava-rock samples, five sulfide samples, and one sulfur sample were collected during this expedition. Four of the eighteen lava samples were collected on Jason dive J2-967 and fourteen others were collected on Jason dive J2-969. Of the four rocks samples on dive J2-967, all were collected near the 1998 "southern pillow mound" at the end of the second pressure dive, which ended near benchmark AX-105. Of the four, two (J967-Geo-27 and 28) were collected on the southern edge of the 1998 lava flow. These were collected first, but were numbered and logged later, so their sample numbers out of order in the sampling sequence. These two samples will be used as teaching specimens and therefore are not included in our SESAR sample list for this cruise. The other two rock samples from that dive (J967-Geo-25 and 26) were collected from two separate small pads of 2011 lava, the first (J967-Geo-25) from the western 2011 eruptive fissure and the second (J967-Geo-26) from the eastern 2011 eruptive fissure (where the dive ended). Neither of these 2011 lava flows had been sampled before.

The five sulfide chimney samples were collected for geo-microbiological work for collaborators Srishti Kashyap and Jim Holden (University of Massachusetts at Amherst). During Jason dive J2-965, two sulfide samples were collected at the top of El Guapo chimney in the International District vent field (J965-Geo-11 and J965-Geo-12). On Jason dive J2-966, two more sulfide samples were collected from the top of Inferno chimney in the ASHES vent field (J966-Geo-06 and J966-Geo-11). The final sulfide sample was collected on Jason dive J2-968 on Axial's north rift zone at the mini-smoker site (J968-Geo-01). The one sulfur sample was also collected with Jason's suction sampler on this dive at the mini-smoker site (J968-Geo-11).

The remaining fourteen lava samples were collected on Jason dive J2-969, which started on the floor of the caldera near the southern end of the eruptive fissures for the 2015 lava flow in the NE caldera and then continued up the eastern caldera wall and onto the NE rim of the caldera. On the rim, Jason traversed along the graben that subsided during the 2015 eruption (shown by before and after MBARI AUV bathymetry) and connects the 2015 lava flow in the NE caldera to the next 2015 lava flow to the north on the NE rim of the caldera. The graben formed along the path of the dike that erupted both flows. All the fourteen rock samples are of 2015 lava from areas that had not been visited before. The dive found that 2015 lava had erupted from the graben about 200 m further south than was evident from depth changes in the before-and-after AUV bathymetry. There was also a lot of complex lava-sediment interaction observed along the graben where 2015 lava sometimes burrowed under sediment and other times flowed on top of it.

All of the rock samples from dive J2-969 are of 2015 lava. The first four lava samples (J969-Geo-01 to 04) were collected on the floor of the caldera, near the eruptive fissure for the 2015 flow in the NE caldera. The remaining ten samples (J969-Geo-05 to 14) were collected on the NE rim of the caldera. Samples J969-Geo-09 and 11 were collected for museum display specimens. Glass from these specimens was sent to Dave Clague at MBARI for microprobe analysis. The remaining samples were sent to Ken Rubin at University of Hawaii or archiving.

Fig. 4.1.2-1 Samples (l to r) J969-GEO-11 (East Rim), J965-GEO-12 sulfide from El Guapo and J969-GEO-11.

Table 4.1.2-1 Geology Samples

Sample	date - time (UTM)	latitude	longitude	total depth	Sampling comment	Location	PI
J965-Geo-11	2017/07/16 20:50:09	45.92651	-129.97952	1515	J965-GEO-11 Sample of chimney wall at top of El Guapo near HFS and gas samples. Placed in aft-port quadrant of milk crate.	El Guapo	James Holden
J965-Geo-12	2017/07/16 20:51:59	45.92651	-129.97952	1515	J965-GEO-12 Additional piece of chimney from El Guapo top. Can see chalcopyrite on sample. Placed in stbd biobox.	El Guapo	James Holden
J966-Geo-06	2017/07/19 19:44:58	45.93356	-130.01367	1541	J966-GEO-06. Piece of chimney on side of Inferno Vent encased in diffuse flow. Covered in a biological mat. Small piece. Placed in port-side biobox.	Inferno Vent	James Holden
J966-Geo-11	2017/07/19 20:37:40	45.93356	-130.01367	1541	J966-GEO-11 A small sample of the Inferno chimney was placed in the port-side biobox. Sample crumbled and consisted primarily of tubeworms taken from same area as fluid samples.	Inferno Vent	James Holden
J967-Geo-27	2017/07/21 09:38:34	45.86324	-130.00368	1718	J967-Geo-27. Piece of intact pillow from 1998 flow just past where new lava flowed out of the fissure. Small bud below a tube spanning two pillows. Some glass shattered off rock while sampling. Put into milk crate. (Sample number out of order as recorded after dive). South Pillow Mounds.	South Pillow Mounds	Scott Nooner (teaching specimen)
J967-Geo-28	2017/07/21 10:19:04	45.86470	-130.00339	1718	J967-Geo-28. Grabbed piece of freshly crushed bud from striated pillow. Can see upper glass layer. Pillow adjacent to flatter-smaller intact lavas. 1998 lava flow. (Sample number out of order as recorded after dive). South Pillow Mounds.	South Pillow Mounds	Scott Nooner (teaching specimen)
J967-Geo-25	2017/07/21 11:01:34	45.86720	-130.00211	1710	J967-Geo-25. Here in the 2011 lava flow. In a little mound surrounded by 1998 flow. Sampled a 2011 pillow toe. Put in stbd milk crate.	South Pillow Mounds	Clague/Rubin
J967-Geo-26	2017/07/21 12:00:33	45.86922	-129.99852	1724	J967-Geo-26 Large pillow toe from 2011 flow surrounded by 1998 flow. Put in stbd biobox.	South Pillow Mounds	Clague/Rubin
J968-Geo-01	2017/07/21 22:07:10	46.12069	-129.96967	1766	J968-geo-01. Little black chimney at the top of a mound. Some bag creatures nearby. Same location visited by MBARI in 2016.	Prosecco	James Holden

Sample	date -	time (UTM)	latitude	longitude	total depth	Sampling comment	Location	PI
J968-Geo-11	2017/07/22	00:04:50	46.12023	-129.96995	1771	J968-GEO-11 Suction of the sulfur deposits at the Limoncello site. Getting some other sediment as well. Small snails on frozen-molten sulfur. Shook sample hose and took second 2 more suctions of the site. Tilted hose up to ensure sample got into the chamber.	Limoncello	David Butterfield
J969-Geo-01	2017/07/22	12:20:17	45.97191	-129.99667	1531	J969-Geo-01 Crust near the 2015 eruptive fissure. Lobe (pillow-like) flow with collapse off to the side. Piece of upper crust with glassy surface. Placed in forward port side bin 5.	Axial caldera	Clague/Rubin
J969-Geo-02	2017/07/22	12:34:23	45.97311	-129.99675	1527	J969-Geo-02. Grabbing a piece of jumbled lobate from the edge of the collapse. Small fist-sized piece of thin glassy crust. Grabbed several pieces; shiny and fragile. In front-stbd center rock box.	Axial caldera	Clague/Rubin
J969-Geo-03	2017/07/22	12:50:30	45.97365	-129.99585	1525	J969-Geo-03 Piece of smooth pillow lobate. Small glassy lobate. Smooth exterior. Taken at the contact between 2015 lavas and the talus of the eastern caldera wall. Into bin 3.	Axial caldera	Clague/Rubin
J969-Geo-04	2017/07/22	13:10:04	45.97516	-129.99635	1527	J969-Geo-04. Piece of jumbled 2015 lava right at the contact with the talus. Thin glass crust. Platy.	Axial caldera	Clague/Rubin
J969-Geo-05	2017/07/22	15:16:33	45.98859	-129.99859	1473	J969-Geo-05 Piece of skin of newly erupted lava pillow on a fissure. Took a second piece. Forward-port quadrant of stbd rock box.	Axial East Rim	Clague/Rubin
J969-Geo-06	2017/07/22	15:28:27	45.99017	-129.99914	1473	J969-Geo-06 Piece of fresh skin on east side of where lava overflowed fissure on east side. Piece from overflow near top of fissure. Very glassy and covered with sediment. In the stbd rock box front-stbd quadrant. Took 3 pieces.	Axial East Rim	Clague/Rubin
J969-Geo-07	2017/07/22	15:35:02	45.99071	-129.99938	1474	J969-Geo-07 Piece of new flow crust a little more than halfway to waypoint #10 from #9. Crust over-topping the fissure on its east side. Fissure has heavy ash sediment on top. Aft-port section of center rock box.	Axial East Rim	Clague/Rubin

Sample	date -	time (UTM)	latitude	longitude	total depth	Sampling comment	Location	PI
J969-Geo-08	2017/07/22	15:51:13	45.99241	-129.99960	1475	J969-Geo-08 Piece of this newly collapsed skin (when Jason was setting up) of the flow on top of the older sediment covered substrate-small Kipuka. Area with more significant extrusion of lava on top of ash sediment. Aft-stbd compartment of center rock box.	Axial East Rim	Clague/Rubin
J969-Geo-09	2017/07/22	16:05:23	45.99346	-129.99992	1478	J969-Geo-09 Piece of collapsed pillow crust from western wall of eruptive fissure. New flow with less sediment than eastern side of fissure. Just west of waypoint 11. Great pointy-lava drips. One piece in port rock box and second piece aft of center rock box.	Axial East Rim	Clague/Chadwick (display specimen)
J969-Geo-10	2017/07/22	16:35:44	45.99412	-130.00111	1483	J969-Geo-10 Piece of lineated sheet flow to the west of the fissure. Aft-stbd quadrant of stbd rock box.	Axial East Rim	Clague/Rubin
J969-Geo-11	2017/07/22	16:48:00	45.99375	-130.00189	1481	J969-Geo-11 Tiny lava "pillar". Under a ledge. Skinny ~ 1 foot tall pillar-looking piece. Area with new lava and sediment. Placed in dive weight box.	Axial East Rim	Clague/Chadwick (display specimen)
J969-Geo-12	2017/07/22	17:49:20	45.99521	-130.00140	1484	J969-Geo-12 Piece of crust in the sheet flow at the fissure within the eruptive fissure (western edge visible in sonar). In the weight box with Geo-11 (pillar sample). Sheet flow collapsed as Jason pulled away.	Axial East Rim	Clague/Rubin
J969-Geo-13	2017/07/22	17:57:04	45.99575	-130.00169	1482	J969-Geo-13 Piece of pillar top in collapse area after large area of sheet flow in the 2015 lava flow. Near western edge of eruptive fissure. Several pieces collected while parked on top of pillar. Pillar collapsing while sampling. Aft-port quadrant of stbd rock box.	Axial East Rim	Clague/Rubin
J969-Geo-14	2017/07/22	18:14:18	45.99663	-130.00208	1484	J969-Geo-14 Piece of crust from bottom of the wall on edge of the collapse area. Near or in the eruptive fissure. Some sediment. Placed in stbd swing arm biobox.	Axial East Rim	Clague/Rubin

Latitude and longitude values have been adjusted post-cruise and may not be the logged positions in the Virtual Van files.

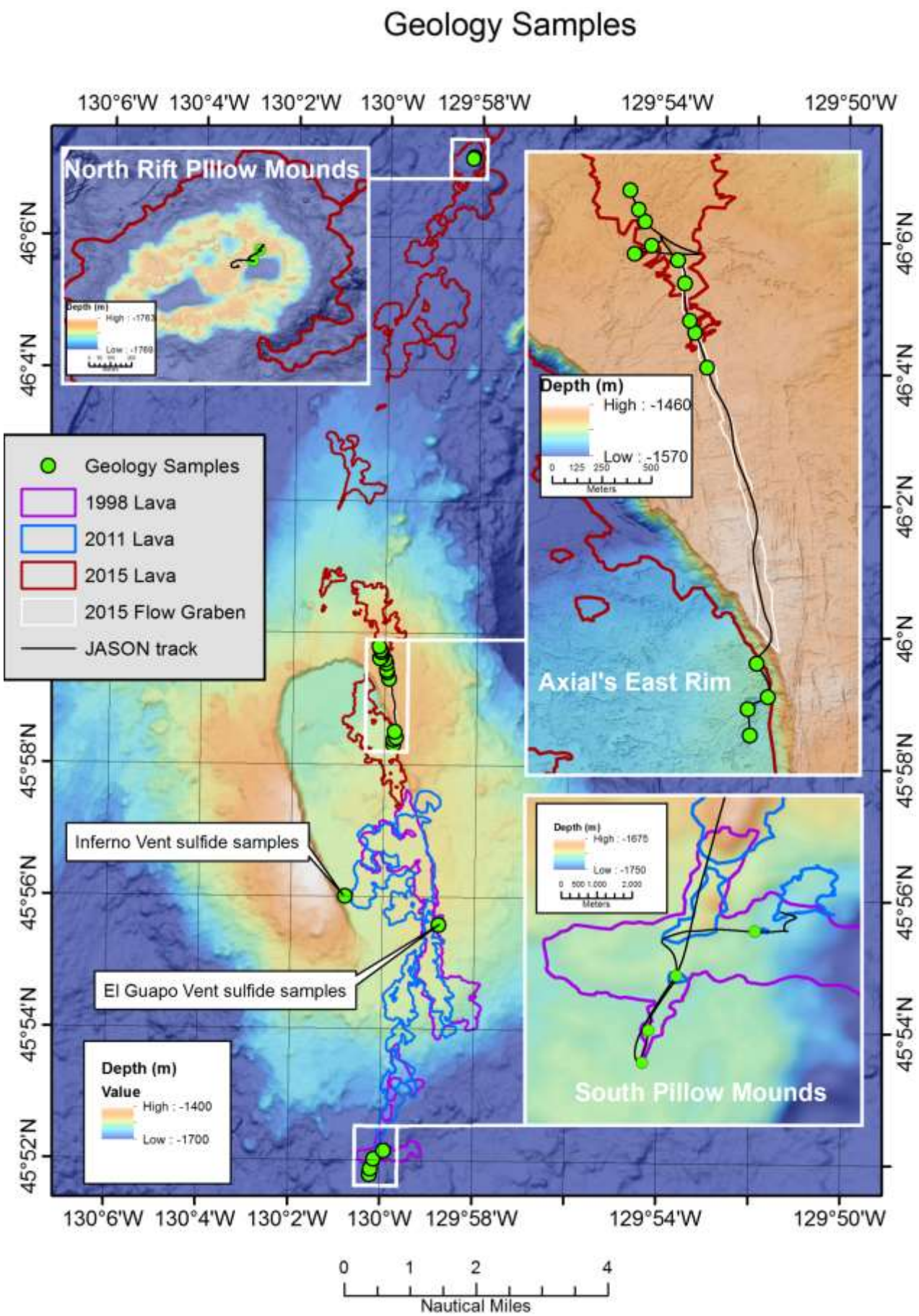


Figure 4.1.2-2 Map of geology samples for Axial 2017 expedition.

4.1.3 Tephra Samplers
Bill Chadwick

Several years ago Nick Deardorff (then a grad student at University of Oregon and now a faculty member at Indian University of Pennsylvania) designed and built some tephra samplers to collect samples at NW Rota seamount in the Mariana arc. After we found that the 2015 eruption at Axial Seamount produced tephra that we discovered deposited on our pressure benchmarks we decided to deploy those tephra samplers at Axial before the next eruptions, in case it too produces tephra. Last summer during the August 2016 MBARI cruise to Axial on R/V Western Flyer (D. Clague, Chief Scientist), we deployed two of these tephra samplers and this summer we deployed four more. The table and map below show the locations of the tephra samplers.

Table 4.1.3-1 Tephra samplers deployed in 2016 and 2017.

Instrument	Location	Depth	Latitude	Longitude	Dive Deployed	date	time
Tephra H	Castle	1516	45.92617	-129.97996	J-965	2017/07/16	19:18
Tephra C	AX-101	1530	45.95522	-130.00993	J-966	2017/07/17	18:32
Tephra D	AX-302	1518	45.94642	-129.98378	J-966	2017/07/17	22:01
Tephra F	East Rim graben	1466	45.97803	-129.99613	J-969	2017/07/22	13:54
Tephra A	NRZ	1644	46.04405	-130.01225	MBARI-880	2016/08/11	06:19
Tephra B	East Rim	1539	45.98632	-129.97214	MBARI-780	2016/08/10	01:17

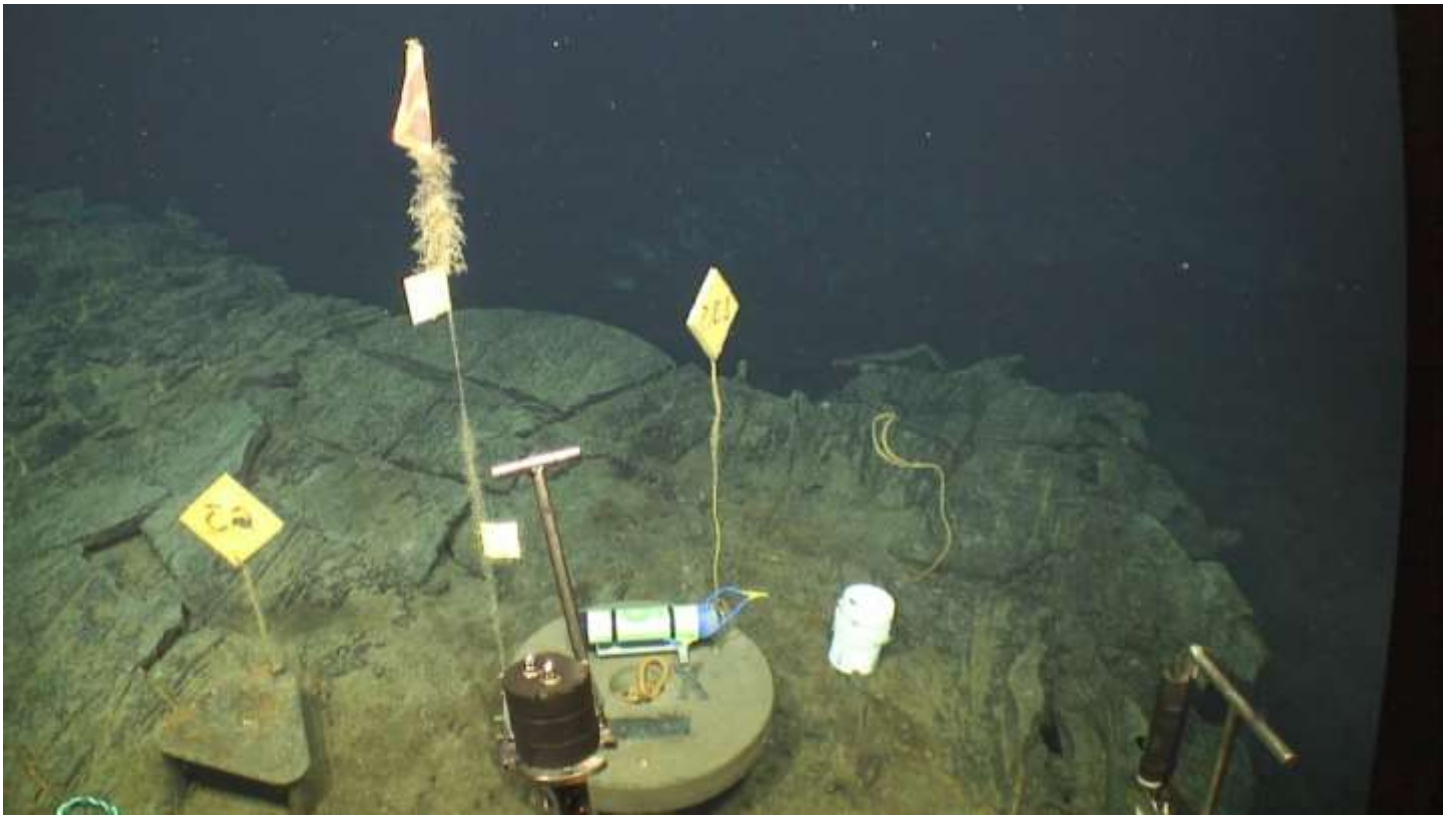
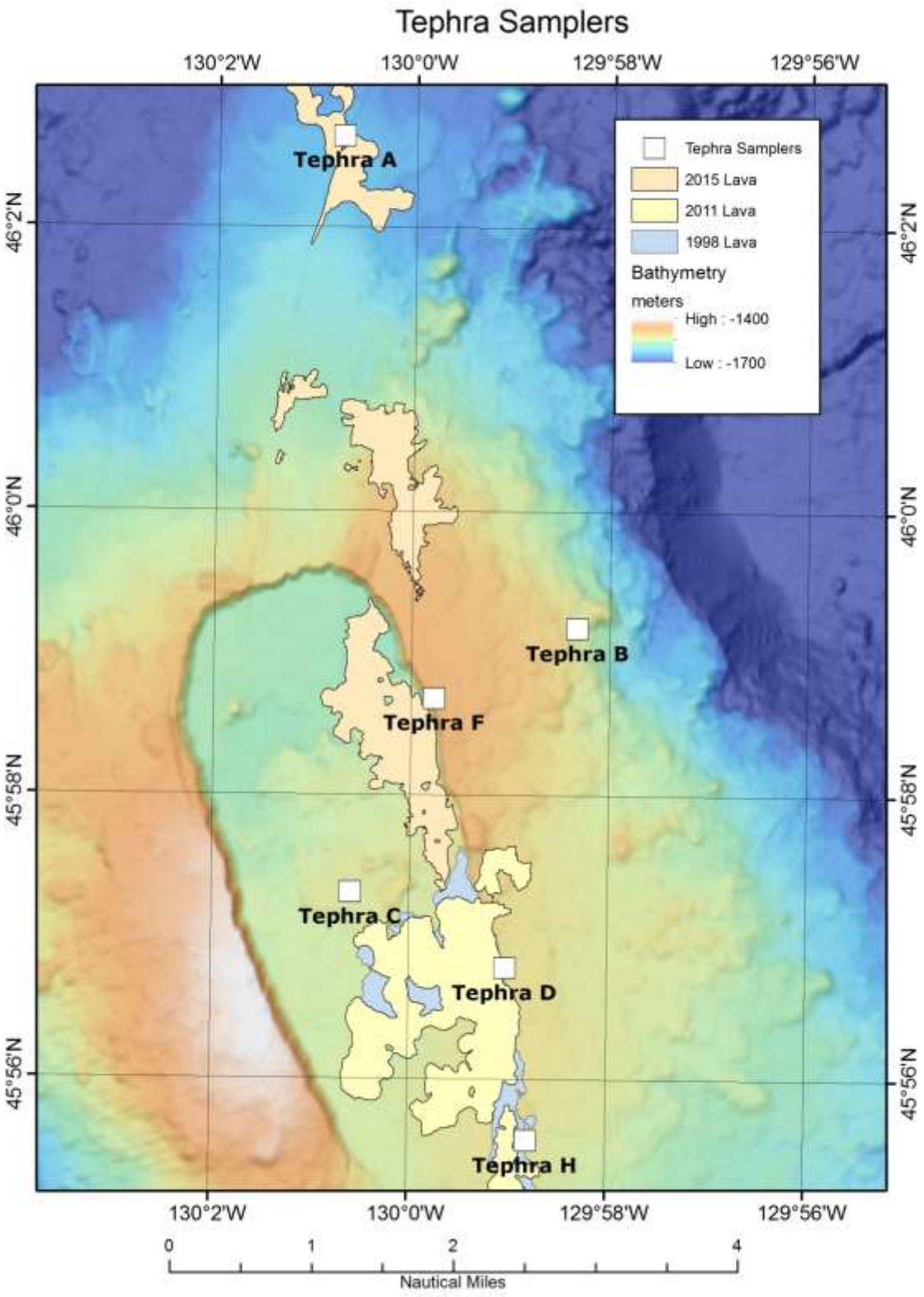


Fig. 4.1.3-1 Tephra D sampler at benchmark AX-302 Trevi site on 2011 lava flow.

Figure 4.1.3-2 Locations of Tephra samplers currently deployed at Axial Seamount.



4.2 Fluid Sampling

Hydrothermal Fluid Chemistry and Microbiology
Dave Butterfield

For this expedition, the primary participants for fluid chemistry were David Butterfield and Kevin Roe, who were responsible for collecting samples with HFPS, preserving and analyzing the samples onboard. Our shipboard analysis included pH, alkalinity titration, spectrophotometric hydrogen sulfide, ammonia and dissolved silica, and gas chromatography for hydrogen and methane. Two chemists were not enough to keep up with all of the sample collection, processing and analysis, and as a result, some of the gas chromatography and some ammonia analyses could not be completed. Fortunately, Tamara Baumberger and Millie were on board collecting titanium gas-tight samples, so there will be complete gas chemistry for many of the vents. Dr. Jim Holden's graduate student Srishti Kashyap was on board to collect samples for microbiology (with an emphasis on solid chimney samples). Srishti helped set up and process the in-situ filters that will go to Julie Huber and Carol Stepien.

Our goals for the expedition were to re-sample as many of the vent sites around the caldera as possible to continue the long-term time series for chemistry and microbiology. We have collected time-series samples in almost every year since 1998, with earlier sampling in 1995, and 1986-88, making this the longest and most complete time-series of any deep-ocean hydrothermal site. High-temperature vents were the priority this year, and sampling was very successful. We collected 32 successful fluid samples from 15 separate vents around the southern caldera (ASHES, International District, Coquille, Trevi) and 7 successful samples from 4 separate vents on the North Rift Zone. We also collected 11 in-situ filters for DNA analysis. Vent fluid samples and processing are described in Table 1. Samples taken for microbiology (including chimney samples) and processed by Srishti Kashyap on board are described in Table 2.

The setup for HFPS was similar to previous expeditions. There were no major changes between the December 2016 Falkor expedition and this expedition, but our success rate with sampling in 2017 was better, which we attribute in part to having enough space in the Revelle main lab to properly set up and maintain the sampler. Out of 49 attempted HFPS water samples (see Table) on this expedition, 9 recovered too little volume to analyze and 1 was over-pressurized and split open the bag. This is still a higher failure rate than desirable, but with replicate sampling we still recovered samples from all of the visited vent sites (except Casper, where only one sample was attempted). We used an SBE63 oxygen sensor attached to HFPS to measure oxygen in low-temperature vents and ambient seawater. Oxygen values reported during the dives are approximate and may be revised after post-cruise data analysis and calibration check. The AMT pH sensor (refurbished and calibrated in 2016 prior to the Falkor expedition) did not produce any valid data during this expedition.

In addition to the piston and bag samplers, we used membrane filters for in-situ filtration of diffuse vent fluid with addition of RNA-Later preservative for Julie Huber's lab and the same technique for near-bottom and water-column samples for Carol Stepien's e-DNA analysis. These latter samples are intended to capture the DNA from any organisms living around the vent fields, with the goal of using water-column e-DNA to identify animals. The Stepien lab is working on the methodology to screen for a wide range of animals (e.g. fish, tubeworms, limpets, etc.). Sample J965-HFS-04 represents near-bottom water within the International District vent field, J965-HFS-19 was taken during a transit from Diva vent (Int. Dist.) to Marker 113 at approximately 1400 m depth, 120 m above the seafloor, J965-HFS-26 was taken during ascent at the end of the dive above Marker 113, sample J967-HFS-10 was taken in transit between marker 33 and Trevi. The four eDNA filter samples are similar, but cover slightly different geographic areas. Results from these samples will determine if HFS is a suitable instrument to characterize bottom communities through environmental DNA.

The OOI team was planning to move the RAS/PPS-Mass Spectrometer combination instrument from El Gordo to a new site, and was considering the "Tiny Towers" site just south of Diva anhydrite vent. We sampled this vent to characterize the temperature and fluid composition before OOI installed the instrument. We found temperatures up to 173°C with very high gas content, making this a risky spot to place a RAS instrument due

to the possibility of excess gas pressure bursting the sample bags (as has happened at the El Gordo RAS site for some samples). We passed that information on to the OOI team from the ship. They decided to deploy the instrument at the Tiny Towers site, but to try to avoid the hottest part of the vent.

Exploring and sampling the field of small high-temperature chimneys on the thick 2015 NRZ lava flow was one of the most exciting events of the 2017 expedition. The small chimneys were venting dark black smoky fluids, with temperatures from 240 to 318°C. The chimney collected from Prosecco vent appears to be massive anhydrite coated with pyrrhotite, and is quite strong. The reaction zone for these fluids is a mystery, and we are looking for clues in the fluid chemistry. We also saw a small deposit of elemental sulfur that had flowed from a crack onto the seafloor near the area of active chimneys. Elemental sulfur is common where magmatic SO2 degassing occurs, but is extremely rare at Axial Seamount, and signals that there is something unusual in the NRZ reaction zone.

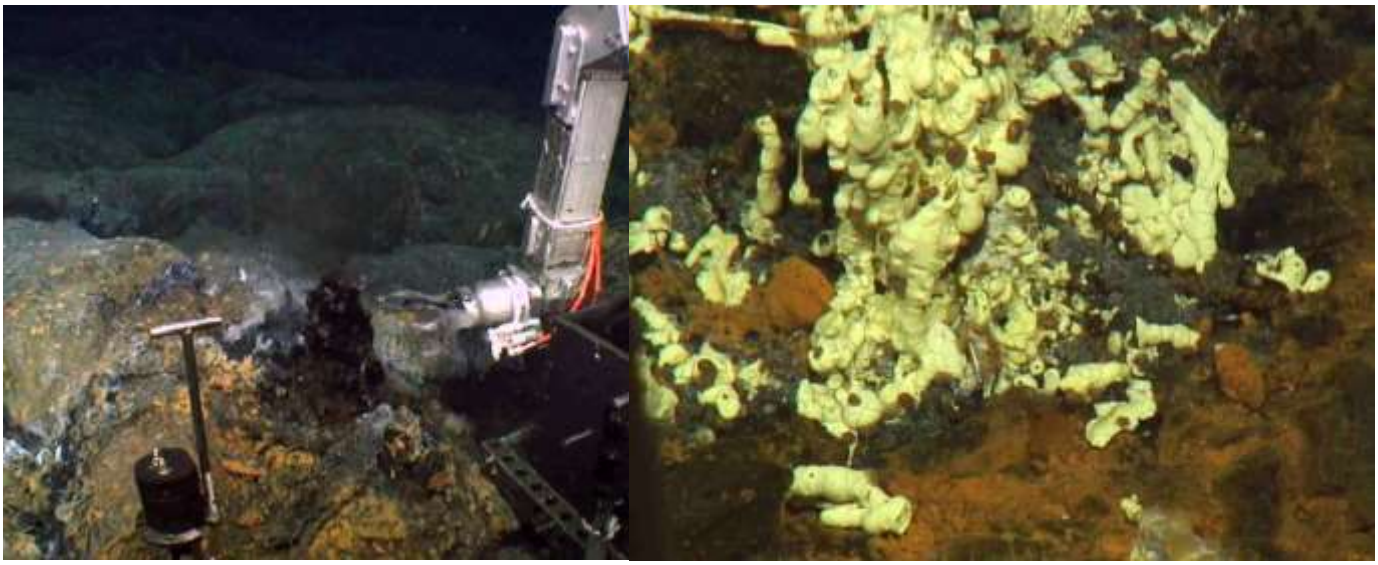


Figure 4.2-1 (left) Prosecco chimney prior to sampling. **Figure 4.2-2** Sulfur flow deposits at Limoncello.

The following table reports the lab and dive sample ID numbers, vent names, maximum temperature in °C, total liquid volume recovered, volume of gas headspace (in mL) if present, and the volume of individual sample aliquots saved. Sample locations and site notes are given in the ROV sample log elsewhere in this report. Gray shading indicates failed samples.

Table 4.2-1 Hydrothermal Vent Fluid Sample Processing. Total water aliquot volumes in ml.

Lab Sample #	Dive Sample #	Vent	Tmax	Total H2O Vol	Gas Head Vol	Gas	H2S/Si	pH/alk	majors	nutrient	Trace Metals	Microbio	Other	piston type
International District														
J965P1	J965-HFS-01	Castle	255.2	186	630	15	17	35	35		84			Ti
J965P2	J965-HFS-02	Castle	252.2	401	1320	16	15	35	35		300			Ti
J965B16	J965-HFS-05	Ambient	2.1	475	0	20	60	35	35	45	240	40		
J965P3	J965-HFS-06	El Guapo	340.8	164	420	15	15	35	35	40	24			Ti
J965P4	J965-HFS-07	El Guapo	341.9	32	0	12	failed sample		20					Ti
J965PF7	J965-HFS-08	El Guapo	341.5	332	530	10	22	35	35	45	125		60	PVC
J965P5	J965-HFS-13	Diva	173.6	386	750	9	18	35	35	45	230		14	Ti
J965PF8	J965-HFS-14	Diva	221.3	335	2440		30	35	30	50	125			PVC
J965PF9	J965-HFS-17	Tiny Towers	173.7	309	520	19	25	10	37	45	173			PVC
J965B17	J965-HFS-18	Tiny Towers	173.6	175	500			35	30		110			
J965B18	J965-HFS-20	Mkr 113	16.4	547	0	17	35	35	35	45	250	120	10	
J965B19	J965-HFS-21	Mkr 113	16.8	422	0	10	30	35	35	45	165	60	42	
J965BF21	J965-HFS-23	Mkr 113	16.1	137	0	7	30	35	15	20	30			
J965BF22	J965-HFS-24	Mkr 113	16.4	199	0	14	30	35	30	40	50			
J965B20	J965-HFS-25	Mkr 113 clams	2	414	0	22	42	35	35	45	150	40	45	
ASHES														
J966P1	J966-HFS-01	Virgin	209.5	369	85	9	25	35	15	35	250			PVC
J966PF9	J966-HFS-02	Virgin	232.2	239	320	10	30	37	35	15	112			Ti
J966P2	J966-HFS-03	Virgin	237.4	empty										Ti
J966P3	J966-HFS-07	Inferno	305.7	empty										Ti
J966P4	J966-HFS-08	Inferno	305.9	638	0	13	20	40	35	45	440		45	PVC
J966PF8	J966-HFS-10	Inferno	306.6	empty										Ti
J966P5	J966-HFS-12	Hell	293.3	562	0	17	28	40	35	45	352		45	PVC
J966PF7	J966-HFS-13	Hell	298.2	499	0	15	25	40	37	40	342			Ti
J966B16	J966-HFS-15	Anemone	28	466	0	25	30	35	35	45	176	120		
J966B17	J966-HFS-16	Anemone	28.7	545	0	16	40	39	35	45	250	120		
Pressure dive#2 multiple sites														

Lab Sample #	Dive Sample #	Vent	Tmax	Total H2O Vol	Gas Head Vol	Gas	H2S/Si	pH/alk	majors	nutrient	Trace Metals	Microbio	Other	piston type
J967P1	J967-HFS-01	Casper	296.5	empty										Ti
J967P2	J967-HFS-03	Vixen	322.8	410	200	10	25	35	35	45	215		45	Ti
J967PF9	J967-HFS-04	Vixen	323.5	340	77	10	25	35	35		235			PVC
J967B16	J967-HFS-06	Mkr 33	25.4	525	0	10	30	35	35	45	250	120		
J967B17	J967-HFS-07	Mkr 33	25	lost	bag split open									
J967BF21	J967-HFS-09	Mkr 33	28.4	450	0	13	32	35	35	45	290			thick bag
J967P3	J967-HFS-11	Trevi	231	410	14	10	30	35	35	45	255			Ti
J967P4	J967-HFS-12	Trevi	230.3	25	failed sample		25							Ti
J967PF8	J967-HFS-13	Trevi	231	429	2	15	29	35	35	45	225		45	PVC
J967B18	J967-HFS-16	Mkr N3	24.4	296	140	20	28	35	35	45	133			
J967PF7	J967-HFS-17	Mkr N3	24.5	577	85	10	25	35	35	42	385		45	PVC
J967B19	J967-HFS-21	Bag City	13.6	575	0	15	45	35	35	45	400			
J967B20	J967-HFS-22	Bag City	13.1	487	0	20	40	37	35	45	250	60		
J967BF22	J967-HFS-23	Bag City	13.1	367	0	10		37	35	45	240			
North Rift Zone														
J968P9	J968-HFS-02	Prosecco	317.9	empty				6	20					Ti
J968P8	J968-HFS-03	Prosecco	317.6	empty										Ti
J968B17	J968-HFS-04	Prosecco	317.5											
J968P1	J968-HFS-05	Prosecco	318.2	573	4	17	33	35	35	45	363		45	PVC
J968B18	J968-HFS-08	Prosecco-diffuse black	25.2	230	0	0	30	35	35	40	90			
J968B19	J968-HFS-09	Prosecco-diffuse black	26.2	500	0	10	35	40	35	45	275	60		
J968P4	J968-HFS-12	Kahlua	246	525	25	10	30	35	35	45	240	40	90	PVC
J968P5	J968-HFS-13	Kahlua	247.7	505	16	15	30	35	35	40	270	35	45	PVC
J968BF23	J968-HFS-15	BlackHoleOf Sambuca	37.3	295	0	10	30	35	35	35	90	60		
J968B20	J968-HFS-16	BlackHoleOf Sambuca	35	293	0	13	30	35	35	40	140			

Table 4.2-2 Microbiology Sample Information

Dive	Sample Name	Bag/Fliter #	FS#	Location	Tmax (°C)	Tavg (°C)	T2 (°C)	Volume (mL)	Allocated
J2-965	HFS-5	B16		Background SW above El Guapo	2.2				Total Counts
J2-965	GEO-11			El Guapo	341.5	341.2	70		Small chimney fragments for sulfide slurry, sparged bottle, frozen sample
J2-965	GEO-12			El Guapo	341.5	341.2	70		Larger chimney grab for sulfide slurry, sparged bottle, frozen and air-dried sample
J2-965	HFS-20	B18	929	Mkr 113	16.4	15.9	9		Total Counts + Enrichments
J2-965	HFS-21	B19	929	Mkr 113	16.8	16	8.5		Replicate Bag for Enrichments
J2-965	HFS-22	F13	929	Mkr 113	16.9	15.6	9.1	3501	RNA Filter
J2-965	HFS-25	B20		Clams near Mkr 113	2	2	2.2		Total Counts
J2-966	GEO-6			Inferno	305.7	305.2	98		Small chimney fragment for sulfide slurry, sparged bottle, frozen sample
J2-966	GEO-11			Inferno	306.6	305.9	70		Stem of a young and actively growing/smoking chimney; Sulfide slurry and remaining in sparged frozen falcon tube
J2-966	HFS-15	B16	930	Anemone	28	25.4	13		Total Counts + Enrichments
J2-966	HFS-16	B17	930	Anemone	28.7	26.2	13		Replicate Bag for Enrichments
J2-966	HFS-17	F13	930	Anemone	22.8	16.9	11	2156	RNA Filter
J2-967	HFS-6	B16	932	Mkr 33	25.4	24.9	10.4		Total Counts + Enrichments
J2-967	HFS-8	F13	932	Mkr 33	28	27.1	12	3000	RNA Filter
J2-967	HFS-18	F15	933	Mkr N3	24.6	24.3	12	3000	RNA Filter
J2-967	HFS-22	B20	931	Bag City	13.1	12.8	7.4		Total Counts + Enrichments
J2-967	HFS-24	F10	931	Bag City	13.3	12.6	6.8	3000	RNA Filter
J2-968	GEO-1			NRZ Mini Smoker Vents Proseco	317.6	316	40		1 ft active chimney whole for sulfide slurries, sparged bottles, frozen and air-dried sample
J2-968	HFS-9	B19	934	NRZ Proseco Diffuse Vent	26.2	23.5	6		Enrichments
J2-968	HFS-10	F13	934	NRZ Proseco Diffuse Vent	21.6	19.4	5	2500	RNA Filter
J2-968	HFS-16	B20		NRZ Sambuca	35	34	4		Total Counts + Enrichments

4.3 Gas Sampling

Tamara Baumberger and Camilla Wilkinson

The majority of samples taken for gas analysis were collected in titanium gas-tight bottles (GTBs), with internal volumes of approximately 150 to 167 ml. For dives J965, J966 and J967, 3 GTBs were placed in the ROV Jason basket and an additional two GTBs were connected to Dave Butterfield's hydrothermal fluid sampler (HFS), mounted on the back of the ROV. Dive J968 only carried 2 GTBs in the basket and 2 GTBs connected to the HFS. A total of 18 gas-tight samples were collected during the 4 ROV dives. Once the samplers were retrieved from the seafloor, they were processed on board using the seagoing vacuum line. Samples were subsampled in 3 cc aluminosilicate ampules for shore-based noble gas analysis and in 35 cc Pyrex ampules for shore-based total gas and isotope analysis. In addition, a subsample from a HFS bag sample was drawn into an evacuated flask and then processed on the seagoing vacuum line. All major Axial vent fields were sampled and gas contents reached from 460 mmol/kg at Diva (International District vent field), to 6.1 mmol/kg from the diffuse Marker 113 field. In terms of their gas contents, the high temperature vent fields can be divided into three groups. Samples with the highest gas contents were obtained from the International District (179 to 460 mmol/kg), intermediate gas contents were found at Ashes, Coquille, and Trevi (34.9 to 92.0 mmol/kg) and the lowest gas contents were observed in the first time sampled Happy Hour vent field (8.3 to 15.0 mmol/kg). The two sampled low temperature vent fields, Marker 113 and Marker 135, yielded gas contents of 6.1 mmol/kg and 57.9 mmol/kg, respectively. Sample J967-GTB-14 leaked fluid and was therefore not processed on the seagoing vacuum line. It was also observed that sample J965-GTB-16 was leaking gas. However, it turned out to be the sample with the highest gas concentration obtained during this cruise. Following inspection of the GTBs, it was determined that anhydrate precipitation around the stem tip and sample inlet was preventing an adequate seal for both leaking samples.

In addition to the above mentioned samples, we also conducted 3 CTD operations. Water samples, for gas analysis, were extracted from Niskin bottles triggered during 3 CTD casts and sealed (using an air operated copper tube crimper) in 2ft copper tubes for transport. We took a number of samples near perceived plume maxima and at depths of 1760 m to 1178 m.

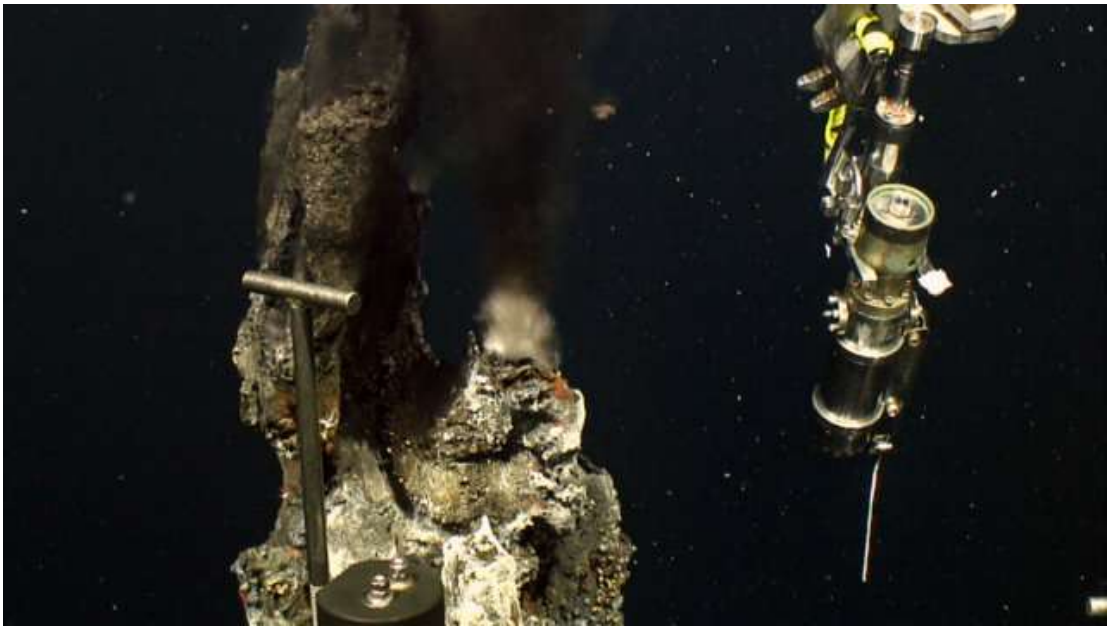


Fig. 4.3-1 Photograph showing the articulated arm of ROV Jason holding a gas-tight bottle with the snorkel pointing down. ROV Jason will maneuver the gas-tight bottle over the chimney; insert the snorkel into the top before hydraulically triggering the bottle in order to collect a sample. (Photo from El Guapo sample on J2-965 in International District.)

Fig. 4.3-2 Map of ROV Jason gas samples

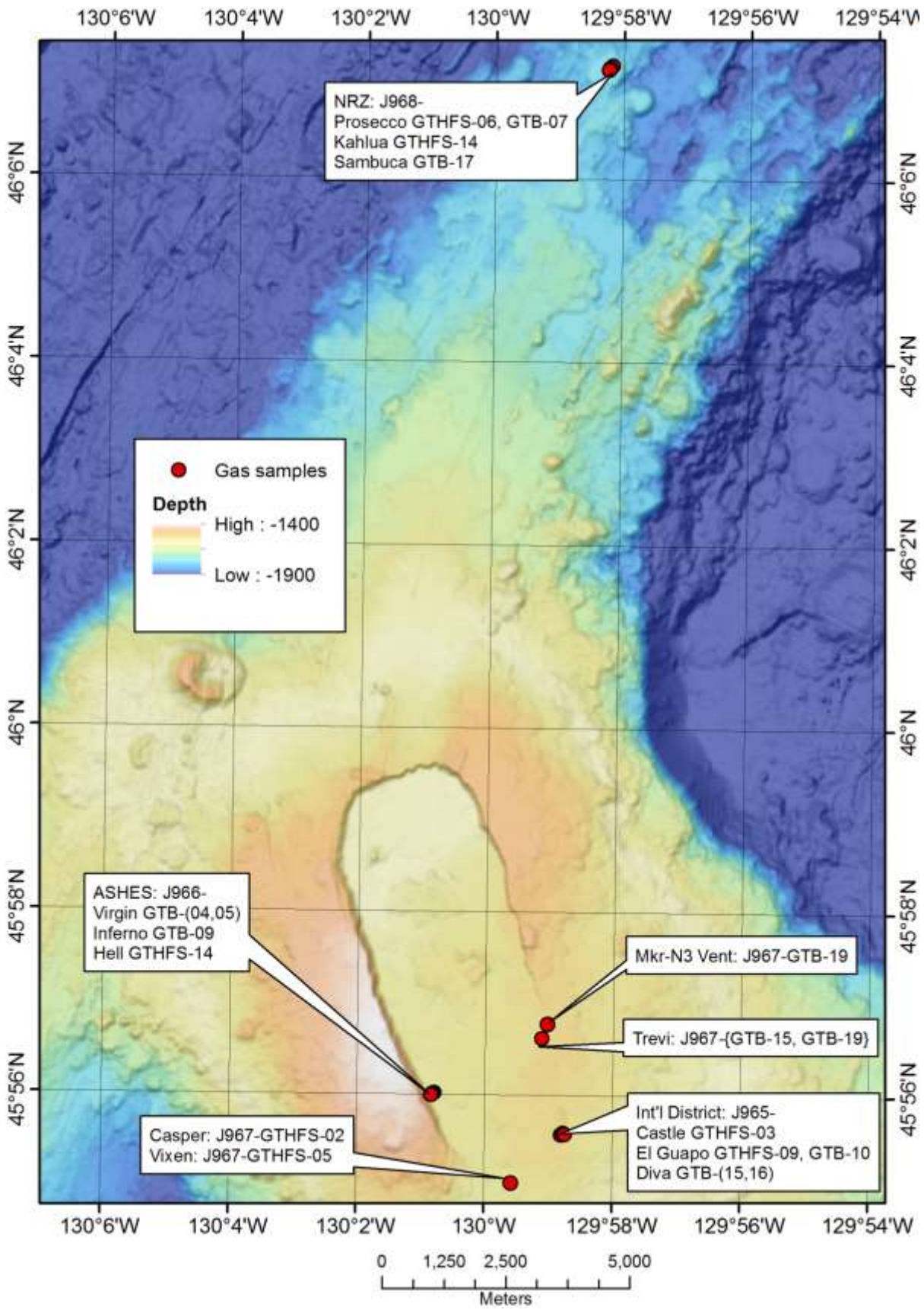


Table 4.3-1 Summary of Jason gas samples

Dive - Sample	Sampler	Descriptor	Chimney - Vent Field	Fluid wt. g	Vent T °C	[gas] mmol/kg	#Splits 3cc/35cc	Comment
J965-GTHFS-03	GT 10	orange-blue	Castle - International District	156.2	257	230	3/3	
J965-GTHFS-09	GT 12	yellow-green	El Guapo - International District	151.2	341	179	3/3	
J965-GTB-10	GT 5	black	El Guapo - International District	148.2	342	6.7	2/2	Poor sample quality
J965-GTB-15	GT 16	orange	Diva - International District	146.6	221	436	3/3	
J965-GTB-16	GT 17	white	Diva - International District	46.7	273	460	1/1	Leak - anhydrate precipitation
J966-GTB-04	GT 9	red	Virgin - Ashes	164.2	257	37.0	3/3	
J966-GTB-05	GT 7	green-red	Virgin - Ashes	164.4	257	52.3	3/3	
J966-GTHFS-09	GT 12	yellow-green	Inferno - Ashes	155.9	306	58.2	3/3	
J966-GTHFS-14	GT 11	nude	Hell - Ashes	153.5	297	34.9	3/3	
J967-GTHFS-02	GT 10	orange-blue	Casper - Coquille	153.9	296	87.3	3/3	
J967-GTHFS-05	GT 16	orange	Vixen - Coquille	144.1	323	92.0	3/3	
J967-GTB-14	GT 5	black	Trevi - Trevi	-	231	-	0/0	Leak - anhydrate precipitation
J967-GTB-15	GT 17	white	Trevi - Trevi	159.0	231	54.7	3/3	
J967-GTB-19	GT 2	green	Marker 135	158.6	13	57.9	3/3	
J968-GTHFS-06	GT 10	orange-blue	Prosecco - Happy Hour	157.6	317	8.3	3/3	
J968-GTB-07	GT 9	red	Prosecco - Happy Hour	152.3	317	7.2	3/3	
J968-GTHFS-14	GT 7	green-red	Kahlua - Happy Hour	167.6	248	11.7	3/3	
J968-GTB-17	GT 11	nude	Sambuca - Happy Hour	159.1	321	15.0	3/3	
Flasks:								
J965-HFS-21-B19	F 22	Flask	Marker 113	35.11	16.8	6.1	2/2	Flask sample from HFS bag 19

Table 4.3-2 Summary of CTD Helium Samples

Date (dd/mm/yy)	Station Number	Latitude of Cast (at bottom)	Longitude of Cast (at bottom)	Bottle #	Sample_ID (CTD deployment number, bottle number)	Depth (pressure_ dbars)	Comments
7/15/2017	1	Latitude of CTD (deployed) 45-55.571N.	Longitude of CTD (deployed) 129-58.780W	1	V17A-01-01A	1511	
					V17A-01-01B		
				3	V17A-01-03A	1502	
					V17A-01-03B		
				5	V17A-01-05A	1477	
					V17A-01-05B		
				7	V17A-01-07A	1452	
					V17A-01-07B		
		Latitude of CTD (at depth 1509m) 45-55.570N.	Longitude of CTD (at depth 1509m) 129-58.780W	9	V17A-01-09A	1427	
					V17A-01-09B		
				11	V17A-01-11A	1402	Bottle leaking, BUT A & B samples both sealed well.
					V17A-01-11B		
				14	V17A-01-14A	1352	
					V17A-01-14B		
		Latitude of CTD (on deck) 45-55.569N.	Longitude of CTD (on deck) 129-58.781W	17	V17A-01-17A	1302	
					V17A-01-17B		
				19	V17A-01-19A	1178	
					V17A-01-19B		
7/16/2017	2	Latitude of CTD (deployed) 45-55.051N.	Longitude of CTD (deployed) 129-59.592W	1	V17A-02-01A	1526	
					V17A-02-01B		
				3	V17A-02-03A	1516	
					V17A-02-03B		
				5	V17A-02-05A	1500	
					V17A-02-05B		
				7	V17A-02-07A	1476	Perceived Plume max
					V17A-02-07B		
				9	V17A-02-09A	1451	

Date (dd/mm/yy)	Station Number	Latitude of Cast (at bottom)	Longitude of Cast (at bottom)	Bottle #	Sample_ID (CTD deployment number, bottle number)	Depth (pressure_ dbars)	Comments
		Latitude of CTD (at depth 1526m) 45-55.055N.	**Longitude of CTD (at depth 1526m) 129-59.592W**		V17A-02-09B		
				11	V17A-02-11A		Top of plume
					V17A-02-11B	1426	
				13	V17A-02-13A		
					V17A-02-13B	1400	
		Latitude of CTD (on deck) 45-55.053N.	**Longitude of CTD (on deck) 129-59.587W**	17	V17A-02-17A		
					V17A-02-17B		
						1297	
				1	V17A-03-01A		
					V17A-03-01B	1760	
		Latitude of CTD (deployed) 46-07.248N.	**Longitude of CTD (deployed) 129-58.195W**	3	V17A-03-03A		
					V17A-03-03B	1750	
				5	V17A-03-05A		
					V17A-03-05B	1727	
				7	V17A-03-07A		
					V17A-03-07B	1702	
7/22/2016	**3**			9	V17A-03-09A		
		Latitude of CTD (at depth 1758m) 46-07.248N.	**Longitude of CTD (at depth 1758m) 129-58.193W**		V17A-03-09B	1677	
				11	V17A-03-11A		
					V17A-03-11B	1653	
				13	V17A-03-13A		
					V17A-03-13B	1627	
		Latitude of CTD (on deck) 46-06.904N.	**Longitude of CTD (on deck) 129-56.811W**	15	V17A-03-15A		
					V17A-03-15B	1602	

4.4 Microbiology

Thermophilic and Hyperthermophilic Biogeochemical Processes

Srishti Kashyap (University of Massachusetts Amherst)

The broad goals and objectives of microbiologists associated with this expedition were to 1) enrich and culture new microbes from diffuse vent fluids and sulfide chimney samples, 2) determine microbe-mineral spatial relationships using various spectroscopy tools, and 3) profile the microbial community and gene expression patterns of (sub)seafloor microbes as part of a long-term time series at Axial.

Figure 4.4-1 Srishti Kashyap with sulfide sample in ship's laboratory.

Hydrothermal and near-bottom fluids from Marker 113, Marker 33, Anemone, Marker N3, Bag City, and north rift zone diffuse vents Prosecco and Sambuca, as well as sulfide chimney samples from El Guapo (2x), Inferno (2x) and north rift zone Prosecco were collected by Jason II to achieve these goals. The following is a list of analyses performed on the collected samples:

- DNA and RNA filter samples from Marker 113, Anemone, Marker 33, Marker N3, Bag City, and north rift zone Prosecco for microbial metagenomic (community analysis) and metatranscriptomic (gene expression) profiles. These were collected for Julie Huber (WHOI) to continue the times series of such analyses.
- DNA filter samples from near-bottom seawater collected along transit at International District, from Diva to Marker 113, transit at Marker 113, from Marker 33 to Trevi, and from Marker N3 to Bag City. These were collected for Carol Stepien who will be performing metagenomic analysis to describe the macrofauna at these hydrothermal sites.
- Sample preservation from all hydrothermal and near bottom fluids to enumerate the total number of microbes in each sample.
- Enrichments using three different types of iron oxide minerals and three different carbon and energy sources (H_2:CO_2; acetate; lactate) at two temperatures (55°C and 80°C) initiated shipboard using five artificial seawater-sulfide chimney slurries (El Guapo (2x), Inferno (2x), and north rift zone Prosecco) as well as three diffuse vent fluids (Marker 113, Marker 33, Anemone). These were set up to culture and isolate novel hyperthermophilic and thermophilic microbes from these sites.
- Sulfide-chimney samples were frozen, anoxically contained, and air-dried for hyperspectral imaging, attenuated total reflectance, as well as Raman spectroscopies to determine the microbe- and/or organic-mineral spatial relationships.
- Cell culturing for novel mesophilic methanogens from hydrothermal fluids was initiated shipboard.
- Samples were collected by a member of the lab of James Holden (UMass) on board the ship for their own use as well as for the labs of Julie Huber (WHOI) and Carol Stepien (NOAA/PMEL).

Table 4.4-1 Samples preserved/collected for microbiology analyses.

Dive	Sample Name	Bag / Filter #	Location	PI	Allocated
J2-965	HFS-4	F10	Transit at Int'l District	Stepien	DNA Filter
J2-965	HFS-5	B16	Background SW above El Guapo	Holden	Total Counts
J2-965	GEO-11		El Guapo	Holden	Enrichments + Spectroscopy
J2-965	GEO-12		El Guapo	Holden	Enrichments + Spectroscopy
J2-965	HFS-19	F11	Transit from Diva to Mkr 113	Stepien	DNA Filter
J2-965	HFS-20	B18	Mkr 113	Holden/Huber	Total Counts + Enrichments
J2-965	HFS-21	B19	Mkr 113	Holden/Huber	Replicate Bag for Enrichments
J2-965	HFS-22	F13	Mkr 113	Huber	RNA Filter
J2-965	HFS-25	B20	Clams near Mkr 113	Holden	Total Counts
J2-965	HFS-26	F14	Ascent from Mkr 113	Stepien	DNA Filter
J2-966	GEO-6		Inferno	Holden	Enrichments + Spectroscopy
J2-966	GEO-11		Inferno	Holden	Enrichments + Spectroscopy
J2-966	HFS-15	B16	Anemone	Holden/Huber	Total Counts + Enrichments
J2-966	HFS-16	B17	Anemone	Holden/Huber	Replicate Bag for Enrichments
J2-966	HFS-17	F13	Anemone	Huber	RNA Filter
J2-967	HFS-6	B16	Mkr 33	Holden/Huber	Total Counts + Enrichments
J2-967	HFS-8	F13	Mkr 33	Huber	RNA Filter
J2-967	HFS-10	F14	Transit from Mkr 33 to Trevi	Stepien	DNA Filter
J2-967	HFS-18	F15	Mkr N3	Huber	RNA Filter
J2-967	HFS-20	F11	Transit from Mkr N3 to Bag City	Stepien	DNA Filter
J2-967	HFS-22	B20	Bag City	Holden/Huber	Total Counts + Enrichments
J2-967	HFS-24	F10	Bag City	Huber	RNA Filter
J2-968	GEO-1		NRZ Mini Smoker Vents Prosecco	Holden	Enrichments + Spectroscopy
J2-968	HFS-9	B19	NRZ Prosecco Diffuse Vent	Huber	Enrichments
J2-968	HFS-10	F13	NRZ Prosecco Diffuse Vent	Huber	RNA Filter
J2-968	HFS-16	B20	NRZ Sambuca	Holden/Huber	Total Counts + Enrichments

4.5 CTD and MAPR Water Column Studies

CTD Survey and MAPR Mooring recovery
Dave Butterfield and Sharon Walker

4.5.1 CTD Operations

To extend the water column hydrothermal plume time-series, we conducted 3 vertical CTD casts using the Revelle CTD and rosette. Dave Butterfield and Tamara Baumberger monitored the casts and took water samples. Tamara and Millie collected helium samples. Tamara and Dave ran the GC for methane and hydrogen analysis. Kevin and Dave collected samples for nutrients and trace metals. Sharon Walker processed the CTD data back on shore.

Auxilliary analog sensors supplied by the ship included oxygen, fluorometer, transmissometer, and altimeter. Sensors to measure turbidity (optical backscatter) and oxidation-reduction potential (ORP) were supplied by PMEL. The Revelle Marine Techs set up the Rosette for sampling prior to the casts.

Table 4.5.1-1 CTD vertical cast locations.

Station Name	Latitude (N)	Longitude (W)	Start time/End time	Bottom Depth (m)	Comments
V17A-01	45° 55.570'	-129° 58.780	15-Jul-2017 21:03 15-Jul-2017 22:28	1516	International District (Castle)
V17A-02	45° 55.055'	-129° 59.592	16-Jul-2017 04:28 16-Jul-2017 05:53	1532	"Vixen" vent site
V17A-03	46° 07.248'	-129° 58.193	22-Jul-2017 21:18 22-Jul-2017 23:00	1766	N Rift Zone "mini-smoker" site on 2015 lava

There were particle and ORP signals over Vixen and Castle vents. A CTD cast placed directly over (0.05 min N of and 0.1 min W of the sampled high-T vent sites) on the NRZ showed no visible plume on the CTD display during the cast, which was surprising given the intense black smoke and high temperatures at this site.

Figure 4.5.1-1 Turbidity anomaly profiles are shown below, along with profiles from the 2015 casts for comparison (note: the three profiles from T15A-01 are the "yo's" closest to station V17A-03).

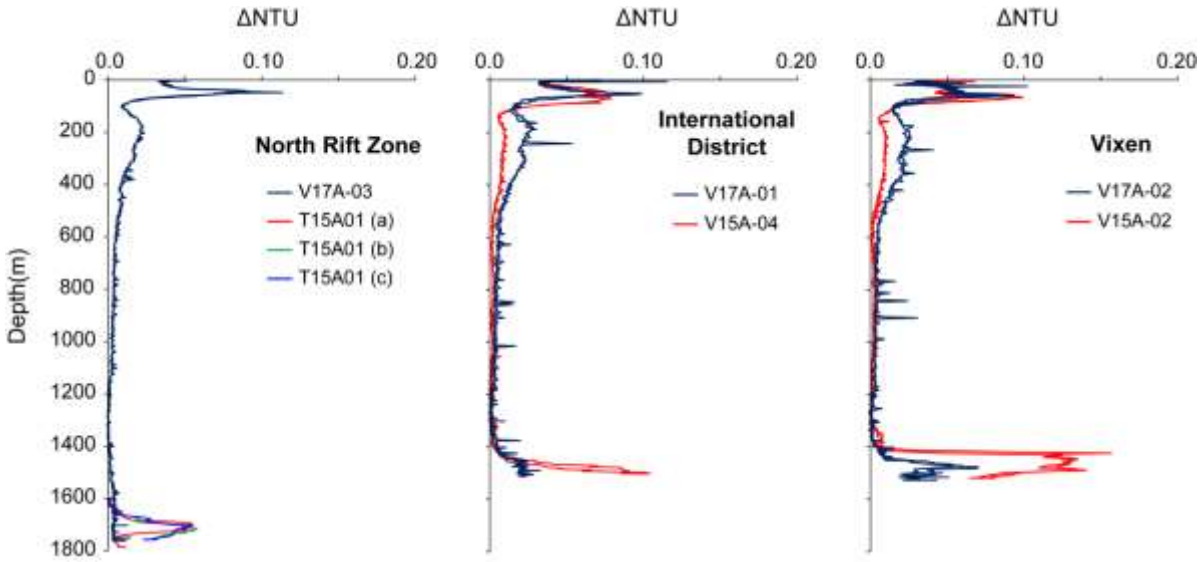


Table 4.5.1-2 V17-A-01 CTD Cast Location and Sampling Information
X indicates that a sample was taken for the given type of analysis.

Cast#	V17A-01					
Station Name:	International District Castle Vent					
Cruise:	RR1712 Axial 2017					
Date	7/15/2017					
Time start down	21:07					
Time at surface	22:26					
Latitude deg min	45	55.571				
Longitude deg min	129	58.796				
File	V17A01.HEX					
Rosette Pos#	depth	Helium	CH4/H2	Trace Met	Nutrients	DNA
1	1511	x	x			
2	1511			x	x	x
3	1502	x	x			
4	1502			x	x	x
5	1477	x	x			
6	1477			x	x	x
7	1452	x	x			
8	1452			x	x	
9	1427	x	x			
10	1427			x	x	
11	1402	x	x			
12	1402		x	x	x	
13	1375		x	x	x	
14	1352	x	x		x	
15	1352					
16	1325		x			
17	1302	x	x	saved for background water		
18	1302			x	x	x
19	1178	x	x			
20	1178					
21	1178					

Table 4.5.1-3 V17-A-02 CTD Cast Location and Sampling Information
X indicates that a sample was taken for the given type of analysis.

Cast#	V17A-02					
Station Name:	Vixen					
Cruise:	RR1712 Axial 2017					
Date	7/16/2017					
Time start down	4:34					
Time at surface	5:52					
Latitude deg min	45	55.059				
Longitude deg min	129	59.604				
File	V17A02.HEX					
Rosette Pos#	depth	Helium	CH4/H2	Trace Met	Nutrients	DNA
1	1526	x	x			
2	1526			x	x	x
3	1516	x	x			
4	1516			x	x	x
5	1501	x	x			
6	1501			x	x	x
7	1476	x	x			
8	1476			x	x	
9	1450	x	x			
10	1450			x	x	
11	1426	x	x			
12	1426			x	x	
13	1400	x	x			
14	1400			x	x	
17	1298	x	x			
18	1298				x	

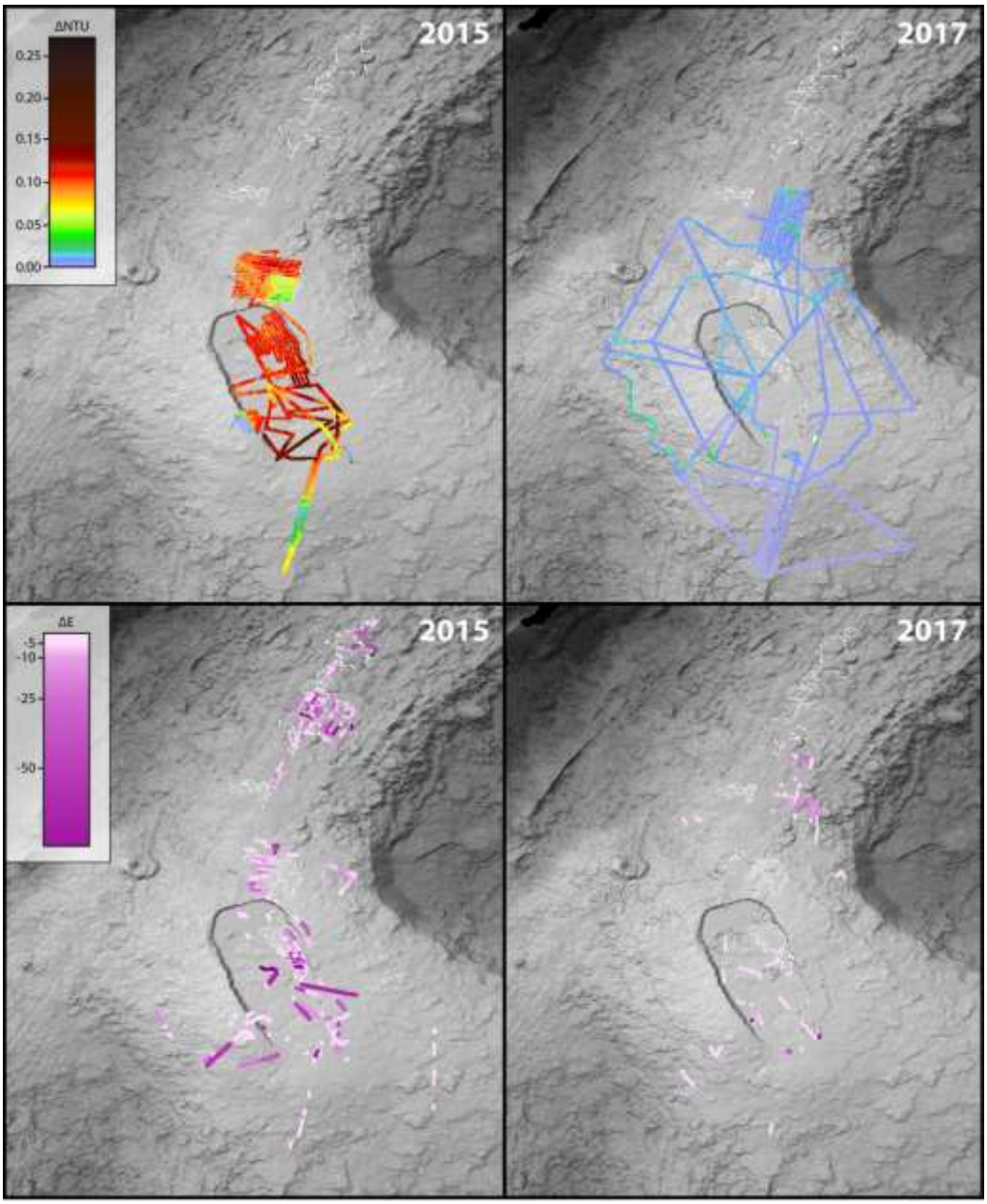
Table 4.5.1-4 V17-A-03 CTD Cast Location and Sampling Information X indicates that a sample was taken for the given type of analysis.						
Cast#	V17A-03					
Station Name:	NRZ Happy Hour Vent Field					
Cruise:	RR1712 Axial 2017					
Date	7/22/2017					
Time start down	21:30					
Time at surface	22:45					
Latitude deg min	46	7.253				
Longitude deg min	129	58.21				
File	V17A03.HEX					
Rosette Pos#	depth	Helium	CH4/H2	Trace Met		
1	1760	x	x			
2	1760			x		
3	1750	x	x			
4	1750			x		
5	1727	x	x			
6	1727			x		
7	1702	x	x	x		
8	1677			x		
9	1677	x	x			
10	1652			x		
11	1653	x	x			
12	1627			x		
13	1627	x	x			
14	1601			x		
15	1602	x	x			
16	1577			x		
17	1577		x			
19	1550		x			
21	1500		x			
23	1400		x			

4.5.2 MAPR Plume data

Plume data from Sentry missions (MAPR)
Sharon Walker

A PMEL MAPR (Miniature Autonomous Plume Recorder) was mounted on Sentry for each mission during cruise RR1712. The MAPR measured temperature, pressure, turbidity (optical backscatter) and ORP. The latter two sensors are identical to those on the CTD. In general, the turbidity and OPR data from the sensors on the MAPR were of much better quality than the comparable sensors integrated directly into Sentry. While Sentry mission tracklines were different in 2015 and 2017, the surveys were conducted 65-70 m above bottom both years. The maps below are a useful comparison for broader plume distributions and intensities between 2015 and 2017 (top = turbidity (ΔNTU); bottom = ORP anomaly (ΔE); left = 2015; right = 2017).

Figure 4.5.2-1 MAPR turbidity and ORP anomaly maps for Sentry dives.



MAPR mooring (2015-2017)
Sharon Walker

A MAPR mooring was installed in 2015 during the response to the eruption. The mooring was intended to track the evolution of the plume in conjunction with a time-series RAS sampler collecting vent fluids in a low-temperature vent on the nearby lava flow. The MAPR mooring was placed near the thick NRZ lava flows where a strong plume was seen in 2015. The mooring was supposed to be recovered in 2016 during an OOI cruise, but time ran out on that cruise and the mooring was left in the water.

The MAPR mooring was recovered during this cruise (located at 46° 05.607'N 129° 58.889'W; 1780m water depth). MAPRs were located at ~25 m intervals in the bottom 130 m of the water column. All MAPRs had significant bio-fouling upon recovery (photos below; seen in data especially after about mid-March 2016). Data was successfully recovered from 4 of the 5 MAPRs. MAPR-41, 30 meters above bottom, failed to begin sampling (no data). Unfortunately, this was the only ORP-capable MAPR on the mooring. MAPR-34 sampled for the entire duration of the mooring, while the other MAPRs sampled for only ~3 months. The short sampling period is due to excessive power use by the version of MAPR electronics installed in those MAPRs (MAPR-34 is equipped with older, but more reliable boards). Despite these setbacks, the data that was acquired was of good quality, and the record from MAPR-34 (~55 m above bottom) suggests that bio-fouling was not a significant problem until well after the other MAPRs stopped sampling. Significant variability in plume intensity (turbidity) can be seen in the first 3 months after deployment (4-7 months post-eruption).

Figure 4.5.2-2 Comparison of recovered MAPRs showing differences in bio-fouling.

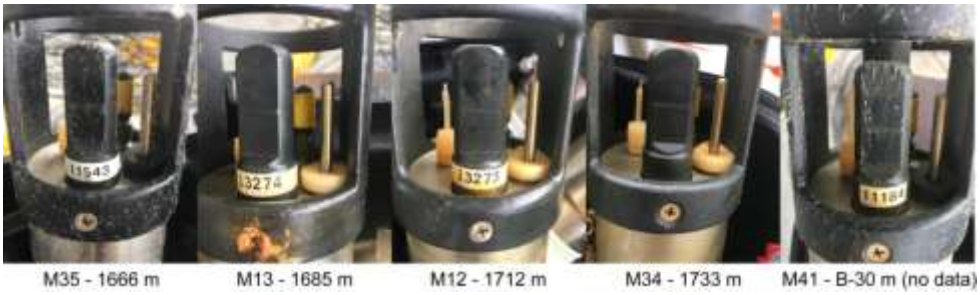
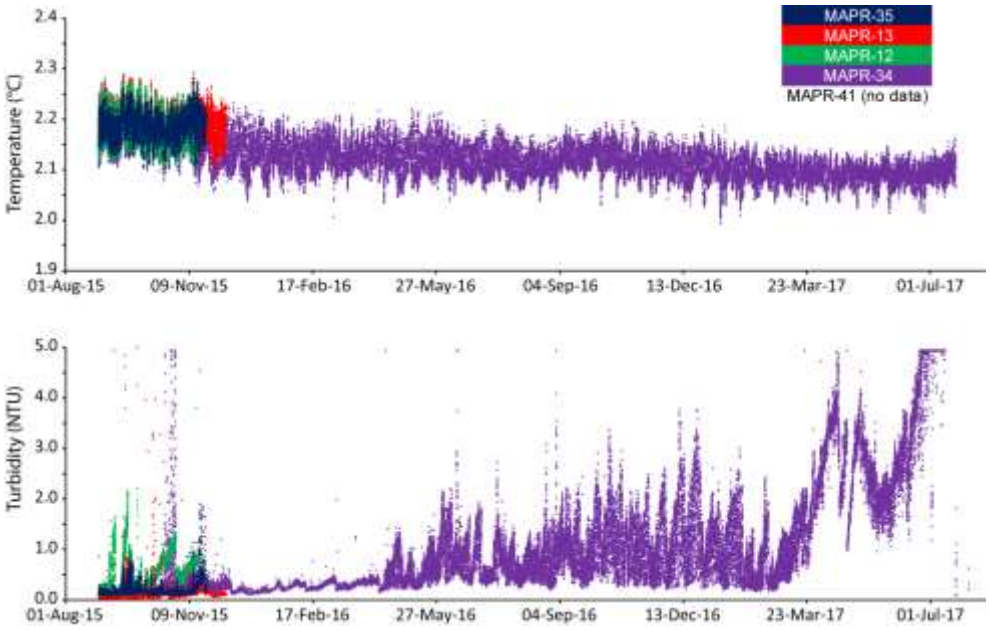


Figure 4.5.2-3 Temperature (top) and turbidity (bottom) data from the MAPRs.



4.6 Axial 2017 Moorings

Lauren Roche

Objectives:

Recover 2 Bottom Pressure Recorders (BPRs) (BPR-South-2, BPR-Center)
Service and Redeploy 2 Recovered BPRs (BPR-South-2, BPR-Center)
Recover 1 Ocean Bottom Hydrophone (OBH)
Recover 1 Miniature Autonomous Plume Recorder Mooring (MAPR)
Deploy 2 new BPRS (BPR-North, BPR-West)
Deploy and Survey 1 OBH

BPR and OBH Recoveries

Moorings were recovered using the a-frame and capstan.
BPR-South-2 and BPR-Center were recovered on 7/14/17 and 7/15/17 in calm daylight conditions. Release commands were sent 0.3 nm from mooring location; each mooring took 20 minutes to reach the surface. Moorings were deconstructed and BPRs taken into the lab for servicing.
OBH was recovered on 7/20/17. Acoustic release was successfully enabled but further communication was unsuccessful. Ship moved closer to OBH location and anchor was successfully released after attempting to communicate and various power and sensitivity settings. OBH platform had extensive corrosion.

BPR Turnarounds

BPR-South-2 and BPR-Center successfully recorded data for the duration of their 2-year deployments. BPR-South-2 had a clock error of +30 seconds; BPR-Center had a clock error of +24 seconds. The sensor coefficients for BPR-South-2 were not in the paros.txt file provided; coefficients for another instrument were inputted to be able to check the data. BPR-South-2 did not have the watchdog jumper on JP6; a jumper was taken from BPR-Center JP18 (Dirk Tagawa confirmed this jumper is not needed). For both BPRs, Paros valves were visually inspected, batteries were replaced, and o-rings were replaced. The face seal o-rings were small and therefore difficult to keep in place while attempting to assemble BPRs. CF cards and file names were reused (data was copied over and then erased from cards). BPRs were initialized on 7/16/17.

BPR and OBH Deployments

Deployments were performed with the a-frame and capstan.
BPR-North and BPR-West were initialized and deployed on 7/15/17.
OBH-Center was deployed on 7/15/17 and surveyed on 7/16/17. Had difficulty enabling release and once enabled, had some difficulty getting slant ranges. May have been due to interference from AUV Sentry although frequencies were different. *R/V Revelle* performed mooring calibration survey from four points around OBH-Center with a radius of 750 meters. Location was calculated using the program Angulate.
BPR- South-2 was redeployed on 7/15/17 and BPR-Center on 7/16/17. These instruments were rebuilt with new acoustic releases, line, anchors, and hardware. Sling links, platforms, and floats were reused. One shackle on BPR-Center became side loaded when a slip line was pulled out, but it righted itself as deployment continued. AUV Sentry was deployed between the BPR-South-2 and BPR-Center deployments; BPR-Center recorded data on deck for about 24 hours before deployment.
The hardware on the reused float packages (used for BPR-West and BPR-North) was rusted; this should be taken into consideration on next servicing
All releases tested and disabled.

MAPR Recovery

The MAPR mooring recovery was first attempted on 7/20/17. Acoustic release did not communicate when using various power and sensitivity settings from multiple locations around and directly on top of mooring. Recovery was postponed as nightfall approached. The following day, communication was attempted again but unsuccessful. Performed a blind release by sending release code multiple times while ship was in place for recovery. Blind release was successful; mooring surfaced in 20 minutes. MAPR mooring was recovered using a-frame and capstan, stopping to remove MAPRs as line came in. MAPR conditions were documented.

Table 4.6-1 Recoveries

Instrument	Date (UTC)	Time (UTC)	Depth (m)	Latitude	Longitude	Comments
BPR-South-2	7/14/2017	23:30	1530	45 55.081 N	129 59.550 W	time/location instrument on deck
BPR-Center	7/15/2017	2:20	1530	45 57.201 N	130 00.562 W	time/location instrument on deck
OBH	7/20/2017	3:06		46 05.736 N	129 58.780 W	time/location instrument on deck
MAPR	7/21/2017	18:55	1780	46 05.284 N	129 59.466 W	time/location instrument on deck

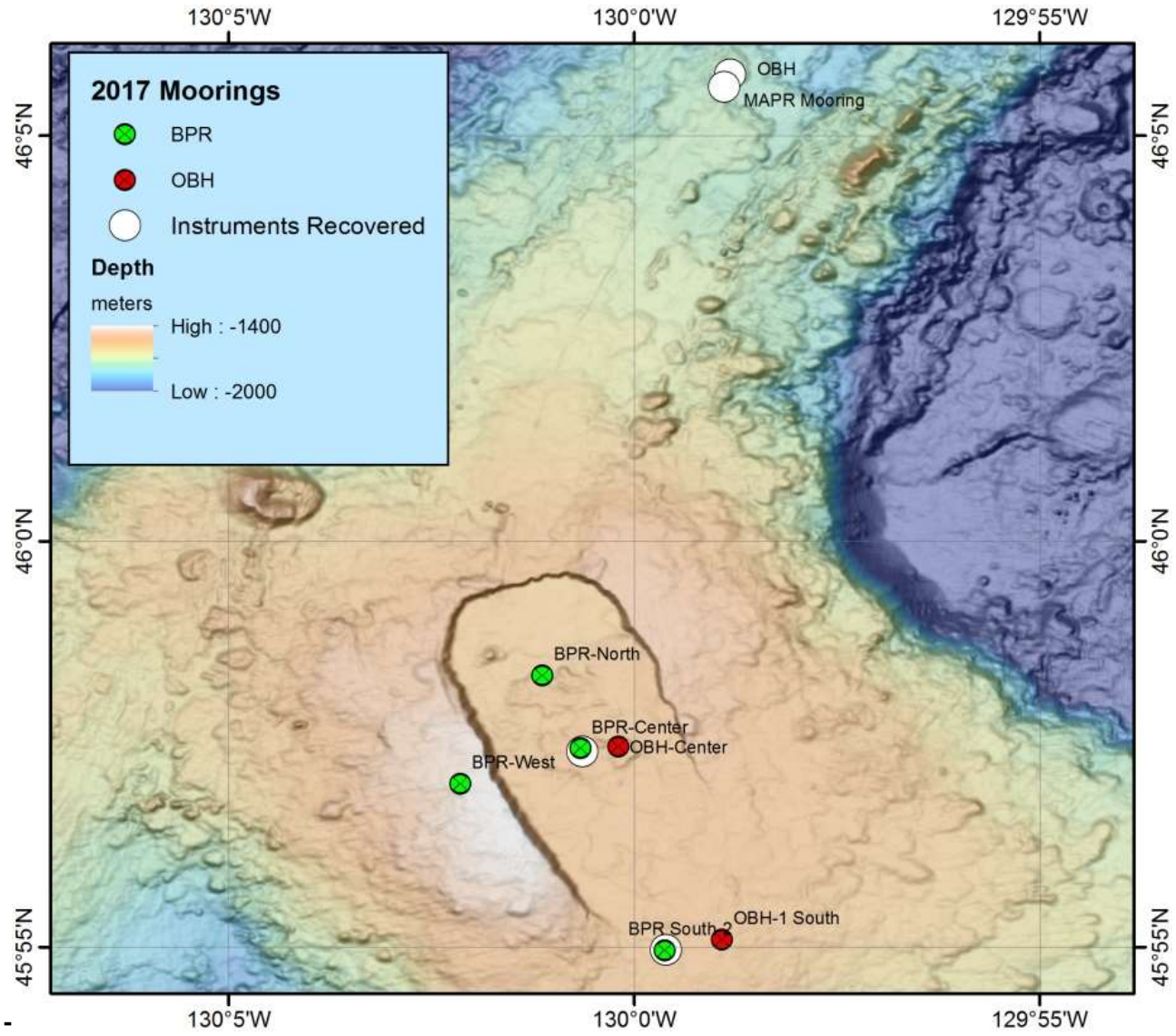
Table 4.6-2 Deployments

Instrument	Date (UTC)	Time (UTC)	Depth (m)	Latitude	Longitude	Comments
BPR-South-2	7/16/2017	7:13	1530	45 54.958 N	129 59.619 W	
BPR-Center	7/17/2017	5:52	1530	45 57.447 N	130 00.658 W	
BPR-North	7/15/2017	4:38	1578	45 58.350 N	130 01.128 W	
BPR-West	7/15/2017	5:50	1418	45 57.011 N	130 02.141 W	
OBH Center	7/15/2017	3:35	1558	45 57.467 N	130 00.195 W	Location calculated from survey

Table 4.6-3 Release Codes

Instrument	Release S/N	Enable	Disable	Release	Comments
BPR-South-2	35161	104600	104623	125267	
BPR-Center	34473	272474	272505	253162	
BPR-North	52409	613424	613441	631056	OSU release
BPR-West	43296	463105	463126	446426	
OBH	34394	270774	271001	252277	

Figure 4.6-1 2017 Moorings. (OBH-1 South was deployed previously and remains in place).



4.7 Mapping

4.7.1 AUV Sentry Bathymetric Surveys

Bill Chadwick and Scott Nooner

The primary goal of the Sentry dives was to collect multibeam sonar data along tracklines inside and outside the caldera that will be compared to past and future surveys to document depth changes due to volcanic deformation. These repeat bathymetric surveys will be used to augment and expand the deformation monitoring at Axial Seamount conducted by the seafloor pressure measurements. The pressure data are higher vertical resolution (±1 cm) and are continuous in time, but are only being made at 10 measurement points (analogous to campaign- and continuous-GPS on land). On the other hand, the AUV bathymetric resurveys have lower vertical resolution (±20 cm), but can extend over a much larger area and are spatially continuous along survey tracklines. Thus they form a powerful combination.

The AUV Sentry mapping dives were conducted such that: (1) the survey altitude was 65 meters for 1.5 meter lateral resolution, (2) the survey speed was ~1.8 knots, (3) dive durations were between 16-26 hours, (4) AUV Sentry came back into acoustic communication range for navigation updates at least every 6-8 hours, and (5) an battery powered and internally recording PMEL MAPR instrument was mounted on AUV Sentry for all dives. The MAPR data collection was successful on all dives, but will require on-shore data analysis and is not discussed further here.

We made 5 successful AUV Sentry dives during this cruise (dives 442-446). Each dive mission was designed as a series of waypoints in consultation with Sentry Expedition Leader Sean Kelley. Each dive track was designed to coordinate with the planned movements of the ship and ROV Jason. Vehicle configurations, sensor performance, vehicle statistics, and post-dive summaries are detailed in the Sentry operations report "2017-nooner-cruise-report.pdf". The multibeam mapping sonar on the vehicle is a Reson 7125 400 kHz multibeam sonar. USBL updates were given periodically throughout each mission when the AUV was with range of the ship and these were incorporated into the AUV navigation in post-processing. Preliminary processing of the multibeam sonar data was done at sea, but final processing of the data and comparison with earlier surveys will be done by Dave Caress and Jenny Paduan at MBARI.

Sentry Dive Summaries

The first four of the five Sentry dives (442, 443, 444, and 445) were all parts of the overall repeat mapping pattern for measuring deformation between surveys. This continues a time series begun with the MBARI Mapping AUV in 2011, 2014, 2016, and by AUV Sentry in 2015 and now 2017. The fifth and final dive (446) was a standard bathymetric mapping dive to collect new high-resolution bathymetry in an unmapped area NE of the caldera ("mowing the lawn").

Table 4.7.1-1

Sentry Dive Lowering Statistics					
Lowering	**Start Time**	**End Time**	**Survey Time hours**	**Deck-to-Deck hours**	**Distance Travelled (km)**
Sentry 442	7/15/2017 18:03	7/16/2017 10:32	15.1	16.5	52.84
Sentry 443	7/17/2017 03:44	7/18/2017 02:48	21.8	23.1	73.29
Sentry 444	7/18/2017 21:51	7/20/2017 00:02	24.8	26.2	82.29
Sentry 445	7/20/2017 22:56	7/21/2017 15:14	11.9	16.3	40.29
Sentry 446	7/22/2017 04:31	7/22/2017 20:26	14.5	15.9	50.55

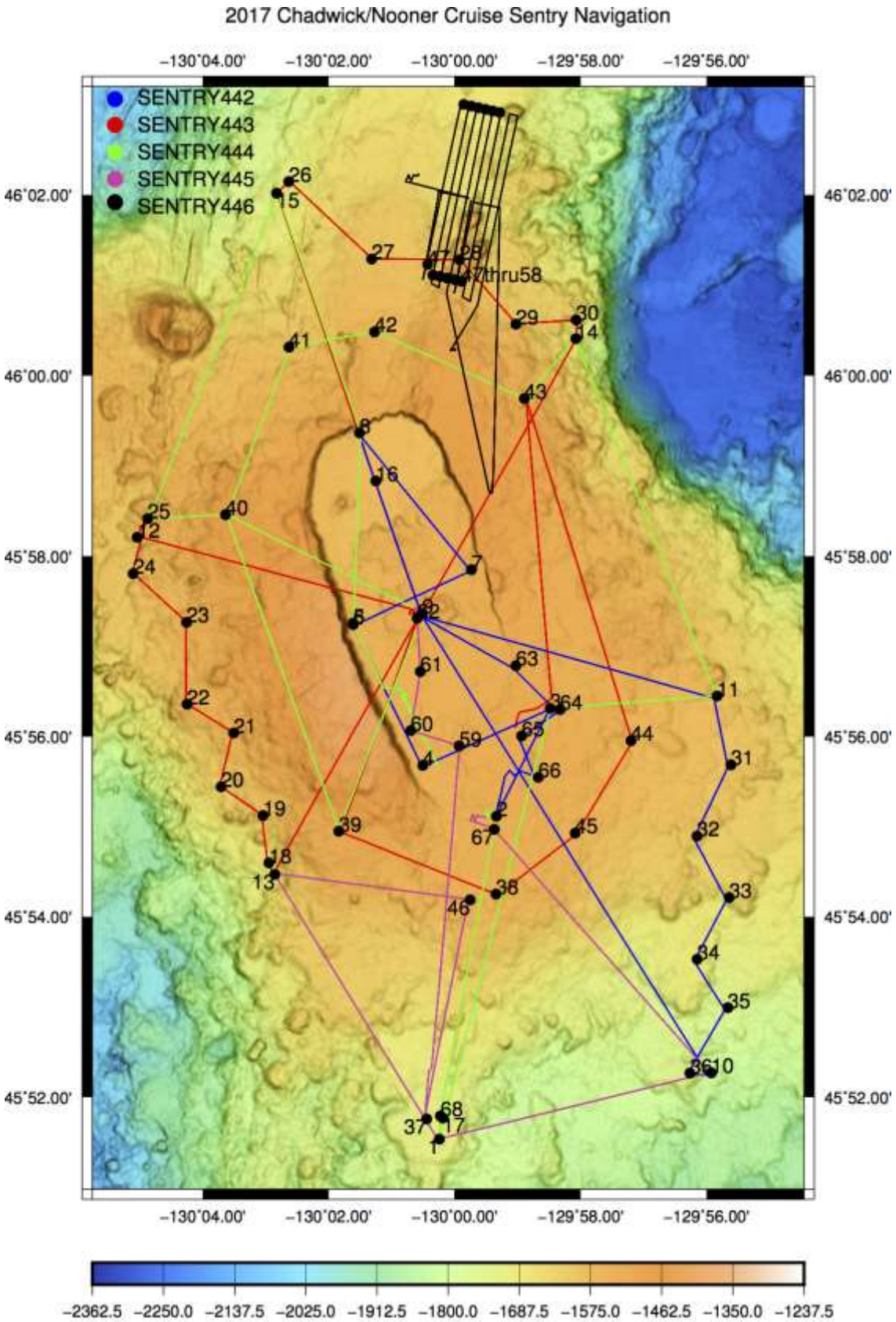


Figure 4.7.1-1 Map showing tracklines of the five AUV Sentry dives (color-coded according to dive number).

4.7.2 RR1712 R/V *Revelle* EM122 Multibeam Seafloor and Water Column Data

Susan G. Merle

Multibeam seafloor data (bathymetry and backscatter) were collected on the transit to and from Axial, whereas water column data were collected on the transit back to Newport only. 8,661 km^2 of seafloor were mapped, nearly all of which were repeat data.

The seafloor data were noisy, which is not surprising given the data were collected as the ship was transiting at 10 kts. Bad beams near nadir and noisy (washboard) ragged swath edges were persistent artifacts evident throughout the entire dataset. The data were cleaned using the MBSystem 3D mbeditviz program. The bad beams were mostly removed but it was impossible to clean up the washboard edges of the data.

Three bubble streams were detected in the water column data, located 28 and 37 nautical miles offshore in water depths of 295 and 345 m respectively.

The data will be archived at NCEI, formerly NGDC.

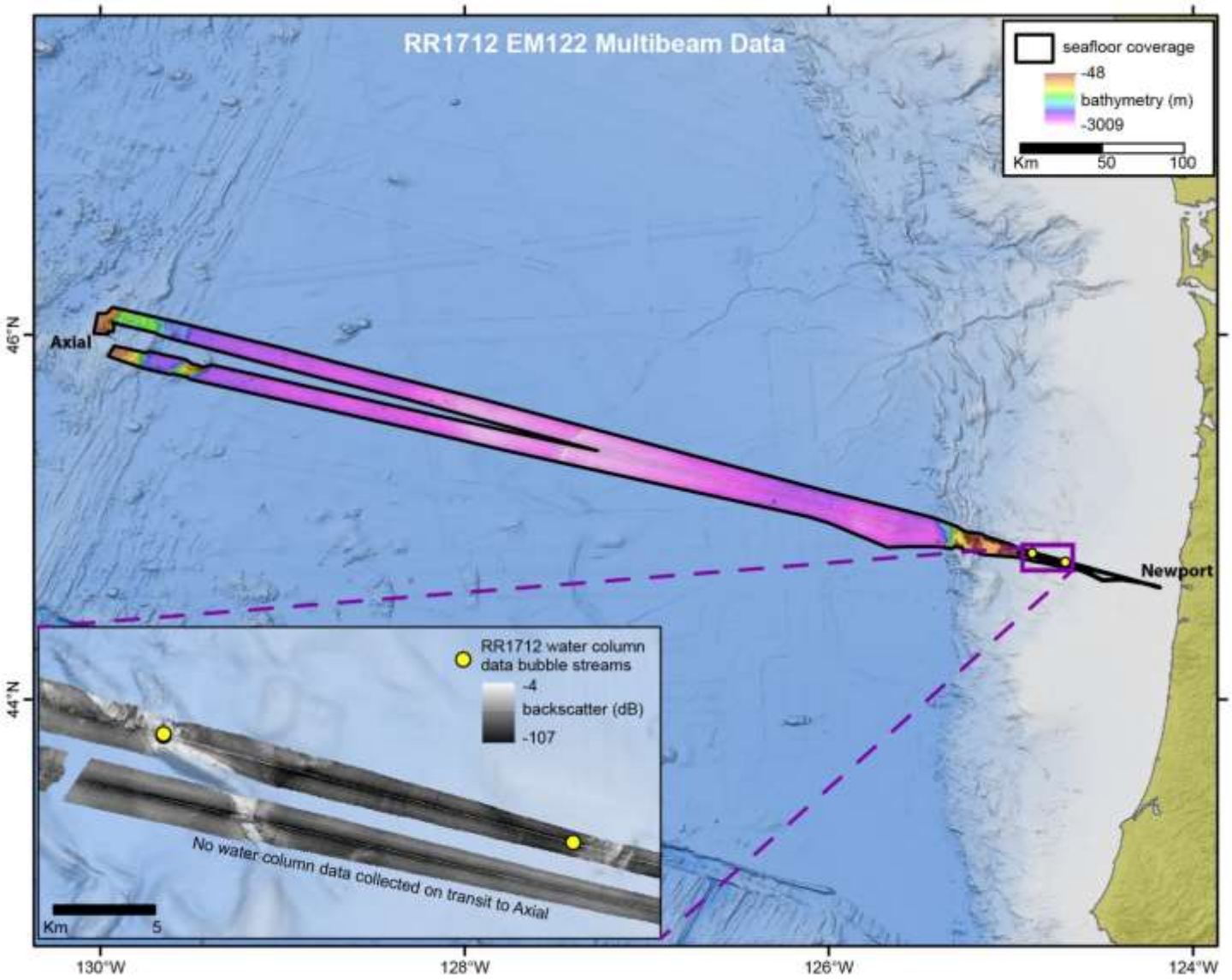


Figure 4.7.2-1 Map showing EM122 data collected.

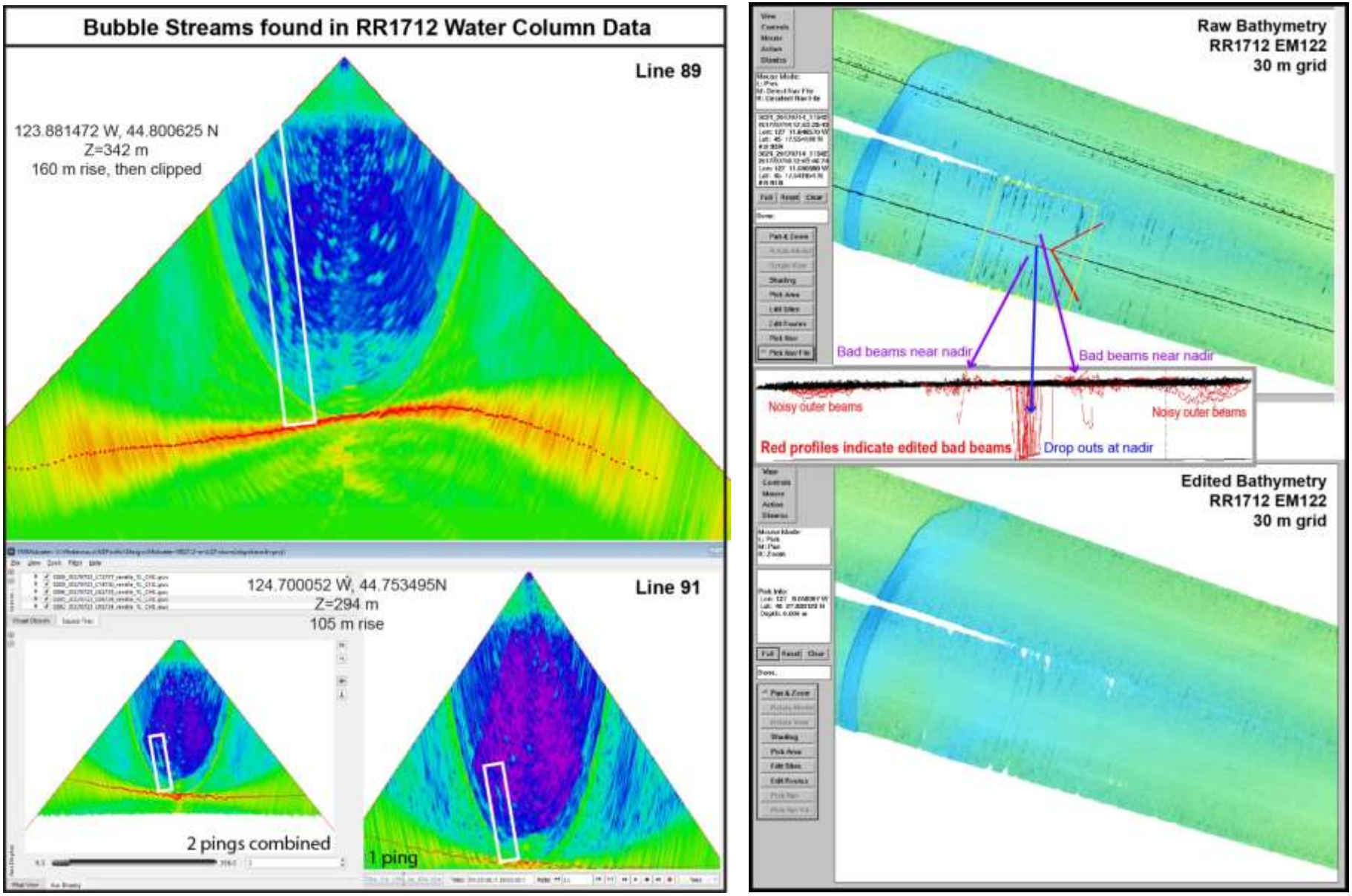


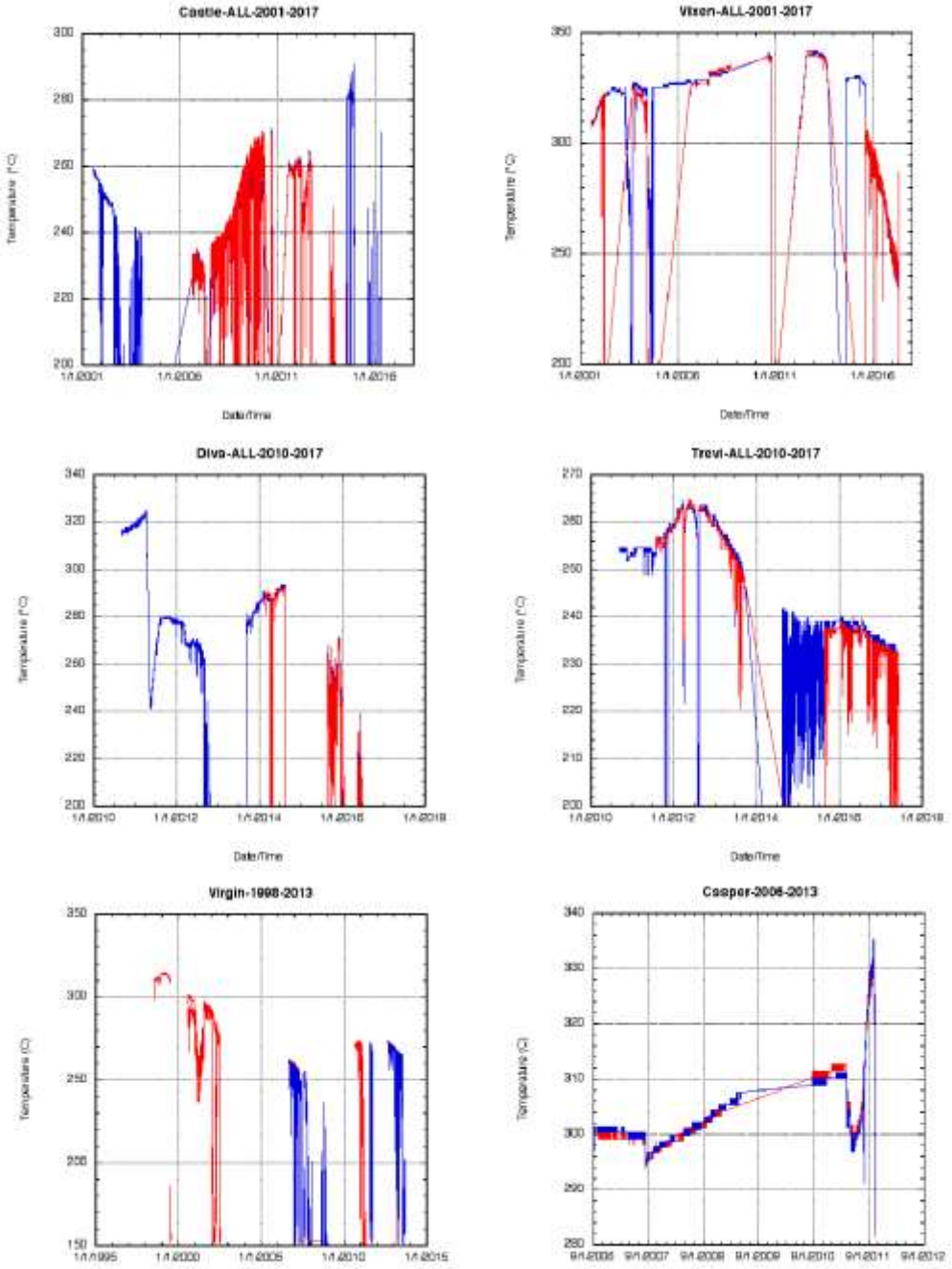
Figure 4.7.2-2 View of bubble streams detected near shore (left). (Right) Swaths showing noise and bad data in raw data (top) and data after editing (bottom).

4.8 Hydrothermal Vent Temperature Recorders

Bill Chadwick

We recovered HOBO-style high-temperature probes (aka MISO) at Castle, Diva, Trevi, and Vixen hydrothermal vents (all anhydrite chimneys). From these new data we have updated long-term plots of these temperature data at each vent. In each plot, there are trends in the maximum recorded temperature, but the excursions to lower temperature should be ignored, because they are largely due to the probes falling out of the vents. The two colors in parts of the plots are when probes with two independent sensors were used.

Fig. 4.8-1 Graphs of high-temperature recorders for various deployment years.



Observations:

• The Castle and Vixen records are both 2001-2017. Castle shows rising temperature leading up to the 2011 eruption, and perhaps the 2015 eruption, but the record is pretty incomplete since 2011 (it's difficult to keep the probe in the vent there). The Vixen record has a moderate rise in temperature from 2001-2013 and has been declining since then. There is an apparent decline from 2015-2017 but it could be due to the probe being on the edge of the fluid flow.

• The Diva and Trevi plots are both from 2010-2018. Diva was one of two probes showing a sudden temperature decrease during the 2011 eruption (the other was Casper; Vixen shows a small co-eruption decrease in 2015). Temperature at Diva rose before both the 2011 and 2015 eruptions and was lower afterward. At Trevi, temperature increased from 2011-2013 and has been declining since then.

• The current long-term plots from Virgin (1998-2013) and Casper vents (2006-2013) are included, even though there is no new data added. The temperature at Virgin vent had been declining since after the 1998 eruption, but the record is not very complete. Casper shows a co-eruption decrease in temperature in 2011, followed by an increase.

We currently have HOBO probes in the following vents: Virgin, Vixen, Castle, Diva, and Trevi.

Fig. 4.8-2 MISO 102-Left shows instrument at Diva before recovery in 2017 showing the tip of the wand not in the hot fluid. Right-image of probe at deployment in 2015. Jason was positioned in opposite headings between the 2 years.

Table 4.8-1 Temperature Recorders remaining at Axial Seamount.

Instrument	Location	type	Dive Deployed	Comments
MISO 153	Castle	HiTemp	J-965	Deployed 2017 in same place as one recovered.
HOBO 130	Diva	HiTemp	J-965	Replaced HOBO 102
HOBO 129	Virgin	HiTemp	J-966	In anhydrite flow
HOBO 151	Vixen	HiTemp	J-967	Deployed in place of Miso103
HOBO 104	Trevi	HiTemp	J-967	Deployed where took HFS and gas samples.
MTR 3040	Mkr113 Vent	LowTemp	J-965	Replaced MTR 3173
MTR 3197	Anemone	LowTemp	J-966	In lower temp flow; replaced 3043.
MTR 3048	Marker-33 V	LowTemp	J-967	Deployed at HFS sample site.
MTR 3201	Marker N3 V	LowTemp	J-967	Deployed at HFS sample site.
MTR 4127	Snow drift (NRZ)	LowTemp	J2-826	With Marker 261 where fluids and mat were sampled on 2015 lava
MTR 3312	Fuzzy tubeworm bush	LowTemp	J2-789	deployed 2014: 3m W of RSN cam
MTR 3185	Marshmallow	LowTemp	J2-789	deployed 2014: center of small lonely bush
MTR 3054	Medusa (Marker 68)	LowTemp	J2-789	deployed 2014: next to mkr anchor
MTR 4099	Anemone vent	LowTemp	J2-660	deployed 2012, placed where MTR 4096 was; Lost?
MTR 3004	Anemone vent	LowTemp	J2-726	deployed 2013; Lost?

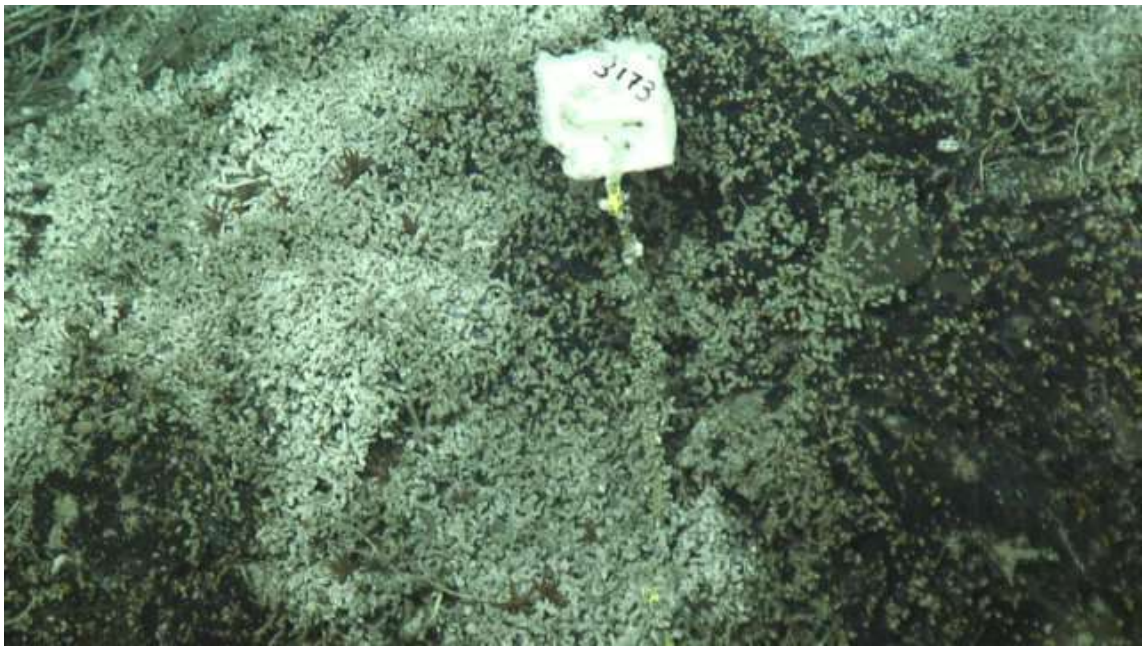


Fig 4.8-3 MTR 3173 at Mkr-113 vent before recovery on J2-965 after a 1-year deployment.

4.9 Outreach and Education

Bill Chadwick, Teresa Atwill, Andra Bobbitt

As in previous years, we maintained an on-line Cruise Blog for outreach and education at the following URL:

http://axial2017.blogspot.com

Figure 4.9-1 Teacher At Sea, Teresa Atwill, taking photos in the control van during the Jason.

Teresa Atwill (Lincoln County School District) was our teacher-at-sea this year and wrote all the entries on the cruise blog. The blog entries were posted daily (12 posts in total), from just prior to the cruise to just after we returned to port. The blogs describe the science teams and the research conducted onboard the ship, with background information to help readers better understand the geologic setting and significance of our research at Axial Seamount. Images and videos were embedded in the blogs to help illustrate the operations, the people, the submersible vehicles we were using, and life on board the *R/V Revelle*.

There were 2533 hits to the blog recorded, and the most popular blog entries were “Science Crew”, “The Thin Line”, “First Jason Dive”, “Before We Go”, “It’s Magical”, and “Text Messages and Transducers”. Since the cruise, the most popular blog post is the one about “STEM Careers”. Most hits to the blog are from the United States, Germany, Poland, and Australia with additional hits from other countries in smaller numbers.

After the cruise, Teresa Atwill created an additional web site linked to the one above that includes information for teachers on how to connect the research at Axial Seamount with classroom lessons about ocean and volcano research. The link to this site will be sent out to teachers through the Oregon Coast Stem Hub and other Northwest Stem Hub groups.

In addition, highlight videos from our five Jason ROV dives were created by Kjersten Hellis and are posted on the NOAA-PMEL-EOI You Tube channel, which is linked on the EOI web page:

https://www.pmel.noaa.gov/eoi/

...and the EOI Axial Seamount web page:

https://www.pmel.noaa.gov/eoi/axial_site.html

Direct links to the EOI YouTube channel for all our video clips is at this URL:

https://www.youtube.com/channel/UCwYal-KFaA52F5lF9IUd9oA

The URL for the 5 video clips from this year’s Axial cruise is:
https://www.youtube.com/playlist?list=PLgxHFq3fMoN-AgwjAtUjmfqtmOCznHH94

The URL for all the previous Axial Seamount video clips on the EOI You Tube channel is:
https://www.youtube.com/channel/UCwYal-KFaA52F5lF9IUd9oA/playlists?view=50&shelf_id=11&sort=dd

5.0 JASON Imagery and Video

Bill Chadwick

Automated H264 Continuous Video Recordings

Three 1080i camera streams (brow camera, pilot camera, science camera) were recorded to hard drive-based video files. Raw videos are MPEG Transport Stream (.ts) files compressed (output rate was 6000 kbps) using the H.264 codec. Image resolution is 1920x1080 pixels. These are playable using open source video players such as VLC. Filenames include camera name and start timestamp. Automated clip duration was set at 15 minutes. In addition to the video files, metadata broadcast in real-time on the Jason network was captured to subtitle files (.srt format), which can produce a line of text overlain on the video. These components were merged into a Matroska container file (.mkv). Components are provided in subdirectories.

This was the first cruise with a new set of Jason control vans and consequently there was a little bit of a learning curve about the new video recording systems. The following problems occurred related to the continuous recording of video in H264 format, which led to missing video data on the Jason data hard disk delivered to us at the end of the cruise. However, once these missing data were identified, the Jason video was reprocessed at WHOI and most of the missing files were recovered and delivered to us (several months) after the cruise.

Dive	
J2-965	Initially 4+ hours of H264 video was missing from the time interval 2017-07-16 20:06:30 to 2017-07-17 00:12:09, but these data were recovered after reprocessing.
J2-966	Three days of the H264 video recordings (7/18, 7/19, and 7/22) were not processed at sea from .ts to .mkv files, and the files from 7/18 were not transferred and processed at all at sea. Consequently, these video files were missing from the data delivered at the end of the cruise. However, these data were recovered by reprocessing and were delivered after the cruise.
J2-967	H264 files were OK on the initial data hard disk.
J2-968	Same problem as for J2-966 – some .mkv files were not generated at sea, but the missing data were recovered during reprocessing after the cruise.
J2-969	Jason descent and first 6 minutes on the bottom were not recorded.

The following is a listing of the number of H264 files and the total file size

Dive	Number of H264 files	Total file size
J2-965	158	165.62 Gb
J2-966	693	807.28 Gb
J2-967	377	434.84 Gb
J2-968	79	89.86 Gb
J2-969	88	97.30 Gb
Totals	1395	1.595 Tb

High-Definition video highlights

Highlight video was recorded to hard disk at a higher quality format than the H264 recordings. The highlight recordings were compressed in real time using the ProRes422 family of codecs and are renamed after each dive so that they indicate lowering ID, start time, and stop time. A summary listing of the highlight video clips are included in the table below. The recordings include time code that is synchronized to the same time reference as the other logging computers in the Jason system.

Dive	Number of files	Total file size
J2-965	21	56.27 Gb
J2-966	25	51.85 Gb

J2-967	19	34.97 Gb
J2-968	18	35.64 Gb
J2-969	28	53.20 Gb
Totals	111	231.93 Gb

HD video frame grabs

Frame grabs were captured during the Jason dives by the video loggers from two of the many cameras on Jason simultaneously. The choice of the two camera is selectable, but usually included the Science Camera and another. These are saved as camA and camB*.tif files (1920 x 1080 pixels) that are ~3 Mb in size. File names include date and time.

Dive	Number of frame grabs	Total file size
J2-965	710	2.47 Gb
J2-966	1413	4.45 Gb
J2-967	813	2.65 Gb
J2-968	905	3.01 Gb
J2-969	1500	4.62 Gb
Totals	5341	17.20 Gb

Super Scorpio digital still camera

A Super Scorpio digital still camera was mounted on the same pan & tilt on Jason as the Science Camera. The images are saved as .jpg files (4672 x 2628 pixels) that are 4-6 Mb in size. The exposure and image quality are quite good when we took the time to stop and frame a picture for this camera, but the camera controls were not easy to use, so we did not utilize this camera very much.

Dive	Number of DSC images	Total file size
J2-965	7	37.8 Mb
J2-966	102	384.7 Mb
J2-967	47	205.9 Mb
J2-968	38	162.3 Mb
J2-969	108	446.6 Mb
Totals	302	1.24 Gb

Table 5-1 Video highlights.

New Clip Name	Dive ID	Original Clip ID	Log Start Time	Log End Time	Camera Source	Logger Comment
J2-965_20170716163110-20170716163116.mov	J2-965	SC1ATK22.mov	NA	16:31:17:00	Pilot	Throwaway
J2-965_20170716195147-20170716195625.mov	J2-965	SC1ATK23.mov	19:52:03:00	19:56:25:08	Science	360 view of the top of El Guapo.
J2-965_20170716195914-20170716202903.mov	J2-965	SC1ATK24.mov	19:59:19:00	20:29:01:29	Science	Fluid sample from the top of El Guapo.
J2-965_20170716202951-20170716203425.mov	J2-965	SC1ATK25.mov	20:29:52:29	20:34:25:06	Science	Gas tight bottle-5 sample from the top of El Guapo.
J2-965_20170716205009-20170716205101.mov	J2-965	SC1ATK27.mov				Chimney grab sample from the top of El Guapo.
	J2-965		21.32:10:00	21:33:30:11	Science	Gas tight bottle sample 15 at Diva. Larger fish in frame.
J2-965_20170716213159-20170716213329.mov	J2-965	SC1ATK29.mov				
J2-965_20170716220319-20170716220624.mov	J2-965	SC1ATK30.mov	22:03:21:00	22:06:24:20	Science	MISO retrieval and deployment at Diva.
J2-965_20170716220651-20170716221149.mov	J2-965	SC1ATK31.mov	22:06:51:00	22:11:49:00	Science	Fly over of Escargot with view of pig instrumentation on flat top.
J2-965_20170716221631-20170716221748.mov	J2-965	SC1ATK32.mov	22:16:32:00	22:17:48:15	Science	Temperature measurement at Tiny Towers.
J2-965_20170716222123-20170716222447.mov	J2-965	SC1ATK33.mov	22:21:24:00	22:24:48:09	Science	Blue mats and HSF-17 sample at Tiny Towers.
J2-965_20170716234859-20170716235029.mov	J2-965	SC1ATK34.mov	23:49:00:00	23:50:30:00	Science	Good view of tube worms
J2-965_20170716235222-20170716235412.mov	J2-965	SC1ATK35.mov	23:52:22:00	23:54:13:07	Science	Looking at a tube worm colony up close
J2-965_20170716235507-20170716235609.mov	J2-965	SC1ATK36.mov	23:55:10:00	23:56:09:23	Science	Trying to get a better view of the colony
J2-965_20170716235941-20170717000129.mov	J2-965	SC1ATK37.mov	23:59:40:00	00:01:29:15	Science	Noticing some peach colored microbe mats and red tube worms
J2-965_20170717000437-20170717000641.mov	J2-965	SC1ATK38.mov	00:04:36:00	00:06:41:10	Science	Getting temperature reading for HFS-20
J2-965_20170717001139-20170717001300.mov	J2-965	SC1ATK39.mov	00:11:40:00	00:13:00:21	Science	Preparing to take HFS-20; close up on tube worm colony
J2-965_20170717002928-20170717003059.mov	J2-965	SC1ATK40.mov	00:29:28:00	00:31:00:07	Science	Started with a good view of some tube worm tops; can see anemone later
J2-965_20170717013537-20170717013806.mov	J2-965	SC1ATK41.mov	01:35:37:00	01:38:05:28	Science	Close up view of clams and one sad, pathetic tubeworm

New Clip Name	Dive ID	Original Clip ID	Log Start Time	Log End Time	Camera Source	Logger Comment
J2-965_20170717014428-20170717014522.mov	J2-965	SC1ATK42.mov	01:44:28:00	01:45:23:03	Science	Interesting tube coming out of clam
J2-965_20170717015138-20170717015305.mov	J2-965	SC1ATK43.mov	01:50:59:00	01:53:05:28	Science	Recording of collapsed area where we want to sample from next time; may be more active
J2-965_20170717030311-20170717030457.mov	J2-965	SC1ATK44.mov	03:02:00 AM	03:04:00 AM	Science	Jason being pulled from water
J2-966_20170717111446-20170717111709.mov	J2-966	SC1ATK45.mov	11:14:45:00	11:17:08:21	Science	Jason being deployed for the 5 day pressure dive
J2-966_20170717123417-20170717123656.mov	J2-966	SC1ATK46.mov	12:34:17:00	12:36:57:11	Science	Coming in on AX308 for pressure measurement
J2-966_20170717182642-20170717182739.mov	J2-966	SC1ATK47.mov	18:27:20:00	18:27:40:08	Science	Coming in on AX101 for pressure measurement at caldera center
J2-966_20170717212754-20170717213051.mov	J2-966	SC1ATK48.mov	09:27:55 PM	21:30:51:29	Science	AX302 BPR swap in order to deploy Mini BPR #5 and MPR measurement.
J2-966_20170717233629-20170717233721.mov	J2-966	SC1ATK49.mov	23:36:28:00	23:37:22:09	Science	Ropey lava's and a cool crab
J2-966_20170718011431-20170718012049.mov	J2-966	SC1ATK50.mov	01:14:31:00	01:20:49:24	Science	Collapse zone at the border of 2011 flows, approach to Smiley Marker. Longer because I wanted to capture the approach
J2-966_20170718040751-20170718041026.mov	J2-966	SC1ATK51.mov	04:08:01:00	04:10:26:23	Science	Coming in on AX310 for pressure measurement next to the poi cable
J2-966_20170718070647-20170718070813.mov	J2-966	SC1ATK52.mov	07:06:49:00	07:08:13:00	Science	AX104 pressure measurement with MPR.
J2-966_20170718141059-20170718141416.mov	J2-966	SC1ATK53.mov	14:11:00:00	14:14:16:13	Science	View of fissure that opened during 1998 eruption as we approach AX-105
J2-966_20170718203122-20170718203139.mov	J2-966	SC1ATK54.mov				
J2-966_20170718203326-20170718203327.mov	J2-966	SC1ATK55.mov				
J2-966_20170718210139-20170718210511.mov	J2-966	SC1ATK56.mov	21:01:41:00	21:05:11:00	Science	AX104 pressure measurement and sculpin panorama.
J2-966_20170718225529-20170718225713.mov	J2-966	SC1ATK57.mov	22:55:28:00	22:57:13:22	Science	Beautiful view of different lava morphologies on the way to AX310
J2-966_20170718230006-20170718230335.mov	J2-966	SC1ATK58.mov	23:00:05:00	23:03:35:26	Science	Columns and collapse zones on approach to AX310. Looks like a Roman forum
J2-966_20170719102308-20170719102538.mov	J2-966	SC1ATK59.mov	10:23:09:00	10:25:38:16	Science	AX307 pressure measurement. Site of later mini BPR swap.
J2-966_20170719180132-	J2-966	SC1ATK60.mov	18:02:00:00	18:04:45:00	Science	view of Virgin Chimney before being

New Clip Name	Dive ID	Original Clip ID	Log Start Time	Log End Time	Camera Source	Logger Comment
20170719180433.mov						knocked down
J2-966_20170719180521-20170719180805.mov	J2-966	SC1ATK61.mov	18:05:00:00	18:08:05:29	Science	View of Virgin Chimney being toppled. Beautiful view with jellies drifting precariously past
J2-966_20170719185601-20170719185854.mov	J2-966	SC1ATK62.mov	18:56:00:00	18:58:54:24	Science	GTB-04 GT-9 red same taken at virgin vent
J2-966_20170719190332-20170719190738.mov	J2-966	SC1ATK63.mov	19:03:33:00	19:07:39:03	Science	First attempt at a second sample of Virgin using GTB-07.
J2-966_20170719191023-20170719191250.mov	J2-966	SC1ATK64.mov	19:10:24:00	10:12:50:14	Science	Second attempt at sampling of Virgin with GTB-07.
J2-966_20170719192345-20170719192736.mov	J2-966	SC1ATK65.mov	19:23:55:00	19:27:36:22	Science	View of Inferno prior to HOBO installation.
J2-966_20170719193404-20170719193553.mov	J2-966	SC1ATK66.mov	19:34:05:00	19:35:53:27	Science	View of Inferno prior to grab sample of chimney.
J2-966_20170719204504-20170719205118.mov	J2-966	SC1ATK67.mov	20:45:06:00	20:51:18:21	Science	Unfiltered piston sample #5 at Hell.
J2-966_20170719211519-20170719211840.mov	J2-966	SC1ATK68.mov	21:15:28:00	21:18:40:07	Science	MTR retrieval at Anemone. Number covered by bio growth.
J2-966_20170719225949-20170719230107.mov	J2-966	SC1ATK69.mov	22:59:00	23:01:00	Science	Pulling Jason from water
J2-967_20170720083311-20170720083334.mov	J2-967	SC1ATK70.mov	08:33:11:00	08:33:34:25	Science	Temperature measurement at Casper.
J2-967_20170720085304-20170720085543.mov	J2-967	SC1ATK71.mov	08:53:05:00	08:55:44:19	Science	Coming in hot for fluid sampling and HOBO retrieval on Vixen.
J2-967_20170720091457-20170720091603.mov	J2-967	SC1ATK72.mov	09:14:15:00	09:16:03:00	Science	Chalcopyrite on the end of the recovered MISO 103.
J2-967_20170720132358-20170720132548.mov	J2-967	SC1ATK73.mov	13:23:57:00	13:25:47:28	Science	Snowblower-like venting at Marker 33 vent
J2-967_20170720135110-20170720135320.mov	J2-967	SC1ATK74.mov	13:51:09:00	13:53:20:07	Science	Fluid sample HFS-06 at Marker 33 AKA the 'Slow Blower'
J2-967_20170720140706-20170720140956.mov	J2-967	SC1ATK75.mov	14:07:06:00	14:09:57:05	Science	Close-ups of some of the limpets and palmworms at Marker33
J2-967_20170720170352-20170720170910.mov	J2-967	SC1ATK76.mov	17:04:30:00	17:09:10:12	Science	positioning Jason and resting HOBO 104 next to Trevi vent
J2-967_20170720171609-20170720171914.mov	J2-967	SC1ATK77.mov	17:16:32:00	17:19:14:20	Science	Placing pump in Trevi vent to take HFS-11
J2-967_20170720185958-20170720190445.mov	J2-967	SC1ATK78.mov	18:59:59:00	19:04:45:22	Science	Blue mats surrounding Marker 135.
J2-967_20170720193346-	J2-967	SC1ATK79.mov	19:33:47:00	19:34:57:03	Science	Blue mat close up around Marker 135

New Clip Name	Dive ID	Original Clip ID	Log Start Time	Log End Time	Camera Source	Logger Comment
20170720193456.mov						sampling.
J2-967_20170720193648-20170720193815.mov	J2-967	SC1ATK80.mov	19:36:49:00	19:38:16:07	Science	More close up footage of blue mats.
J2-967_20170720194614-20170720194629.mov	J2-967	SC1ATK81.mov	19:46:20:00	19:46:30:00	Science	More blue mat footage.
J2-967_20170720194721-20170720194842.mov	J2-967	SC1ATK82.mov	19:47:22:00	19:48:42:23	Brow	Brow cam footage of blue mats.
J2-967_20170720200741-20170720201009.mov	J2-967	SC1ATK83.mov	20:07:43:00	20:10:09:22	Science	More blue mat footage as we begin our transit to Bag City.
J2-967_20170720234742-20170720234850.mov	J2-967	SC1ATK84.mov	23:47:42:00	23:48:50:18	Science	Coming into AX104 with a good view of big rat tail fish
J2-967_20170721111128-20170721111448.mov	J2-967	SC1ATK85.mov	11:11:28:00	11:14:48:26	Science	Entering a huge collapse in the previously unexplored areas near the south pillow mound
J2-967_20170721112024-20170721112457.mov	J2-967	SC1ATK86.mov	11:20:24:16	11:24:57:12	Science	Moving NE from 1998 collapse area up to some 2011 mounds
J2-967_20170721115538-20170721115808.mov	J2-967	SC1ATK87.mov	11:55:39 AM	11:58:09:09	Science	Now moving east of previous position to other unexplored 2011 flows. Video capture traverse over a 1998 collapse zone
J2-967_20170721131053-20170721131349.mov	J2-967	SC1ATK88.mov	13:10:55:00	13:13:50:01	Science	So many sea pickles. Jason on its way up
J2-968_20170721214411-20170721214541.mov	J2-968	SC1ATK89.mov	21:44:12:00	21:45:41:09	Science	Lava drips on overhang of 2015 flow.
J2-968_20170721214556-20170721214743.mov	J2-968	SC1ATK90.mov	21:06:02:00	21:47:43:28	Science	Leaving collapsed area with overhang.
J2-968_20170721215140-20170721215631.mov	J2-968	SC1ATK91.mov	21:51:44:00	21:56:31:25	Science	Chimlet and some black smoke leaving lower vent.
J2-968_20170721215806-20170721220434.mov	J2-968	SC1ATK92.mov	21:58:08:00	22:04:34:00	Science	Fly over of chimlet prior to sampling.
J2-968_20170721220716-20170721221140.mov	J2-968	SC1ATK93.mov	22:07:20:00	22:11:40:11	Science	Geology sample of chimlet.
J2-968_20170721230128-20170721230428.mov	J2-968	SC1ATK94.mov	23:01:28:00	23:04:28:07	Science	Very odd films around one of the Happy Hour vents. Temperatures much higher than expected
J2-968_20170722000355-20170722000811.mov	J2-968	SC1ATK95.mov	00:03:56:00	00:08:1:20	Science	'Sulfur paste' sample suctioned up with slurp holster at the Limoncello vent site
J2-968_20170722001823-20170722002139.mov	J2-968	SC1ATK96.mov	00:18:24:05	00:21:39:21	Science	Chimlets along pillow basalts with lots of black smoke.
J2-968_20170722002413-20170722002700.mov	J2-968	SC1ATK97.mov	00:24:14:12	00:27:01:13	Science	Geology sample of chimlets with lots of black smoke.

New Clip Name	Dive ID	Original Clip ID	Log Start Time	Log End Time	Camera Source	Logger Comment
J2-968_20170722003943-20170722004108.mov	J2-968	SC1ATK98.mov	00:39:42:00	00:41:08:17	Science	Kahlua vent sample HFS-12. Palm worms already established! On a 2 year flow!
J2-968_20170722004608-20170722004632.mov	J2-968	SC1ATK99.mov	00:46:01:00	00:46:32:29	Science	Zoom in on Kahlua
J2-968_20170722005337-20170722005430.mov	J2-968	SC1ATK100.mov	00:53:30:00	00:54:30:22	Science	Really cool chimlet at Kahlua
J2-968_20170722005644-20170722005714.mov	J2-968	SC1ATK101.mov	00:56:50:40	00:57:14:27	Science	Same chimlet
J2-968_20170722005736-20170722005754.mov	J2-968	SC1ATK102.mov	00:57:35:00	00:57:55:03	Science	Trial one of chimlet pan
J2-968_20170722005820-20170722005842.mov	J2-968	SC1ATK103.mov	00:58:20:00	00:58:55:00	Science	Try 2 of pan up chimlet
J2-968_20170722005902-20170722010219.mov	J2-968	SC1ATK104.mov	00:58:59:00	01:02:20:02	Science	Best chimlet pan yet! Really cool looking biota everywhere at the base of the chimlet
J2-968_20170722011552-20170722011854.mov	J2-968	SC1ATK105.mov	01:15:52:00	01:18:55:06	Science	Charcoal colored smoker with lots of bags and anhydrite(?) ← Now called Sambuca vent
J2-968_20170722013458-20170722013818.mov	J2-968	SC1ATK106.mov	01:34:59:00	01:38:18:08	Science	Close-up on some of the smoker's at Sambuca
J2-969_20170722123220-20170722123705.mov	J2-969	SC1ATK107.mov	12:32:14:00	12:37:05:00	Science	View of a depression in the northeast caldera, full recording of our sampling of Geo-02
J2-969_20170722124116-20170722124352.mov	J2-969	SC1ATK108.mov	12:41:15:00	12:43:52:14	Science	Collapse of very glassy, jumbled 2015 lava's
J2-969_20170722124805-20170722125137.mov	J2-969	SC1ATK109.mov	12:48:04:00	12:51:36:25	Science	Mingling of caldera wall and 2015 flows, and video of GEO-03 sampling
J2-969_20170722125947-20170722130131.mov	J2-969	SC1ATK110.mov	12:59:45:00	13:01:32:01	Science	Little octopus!
J2-969_20170722131333-20170722131439.mov	J2-969	SC1ATK111.mov	13:13:32:00	13:14:40:14	Science	Caldera wall as we move up towards WP6. Good views of talus.
J2-969_20170722132106-20170722132540.mov	J2-969	SC1ATK112.mov	13:21:06:00	13:25:41:08	Science	Pillow cross sections as we continue up wall. Awesome look at older lavas. Full video goes all the way up the wall, great view!
J2-969_20170722132853-20170722133054.mov	J2-969	SC1ATK113.mov	13:28:54:00	13:30:55:05	Science	Fissures within the graben in the northeast
J2-969_20170722134755-20170722134916.mov	J2-969	SC1ATK114.mov	13:47:50:00	13:49:16:27	Science	Covering the fissures as we move gradually north along the graben towards WP7
J2-969_20170722140241-20170722140425.mov	J2-969	SC1ATK115.mov	14:02:01:00	14:04:26:14	Science	Fissure with odd vesicular lavas. Jumbled flow

New Clip Name	Dive ID	Original Clip ID	Log Start Time	Log End Time	Camera Source	Logger Comment
J2-969_20170722150139-20170722150358.mov	J2-969	SC1ATK116.mov	15:01:49:0	15:03:59:16	Science	Following small narrow fissure that meets up with larger one. Amazing landscape
J2-969_20170722150809-20170722151115.mov	J2-969	SC1ATK117.mov	15:08:14:00	15:11:15:11	Science	Passing over immense fissure, cannot see the bottom of it
J2-969_20170722151408-20170722151706.mov	J2-969	SC1ATK118.mov	15:14:16:00	15:17:06:14	Science	Reaching end of a fissure, stopped and collected sample Geo-05 of pillow w/ drips
J2-969_20170722153004-20170722153049.mov	J2-969	SC1ATK119.mov	15:30:05:00	15:30:49:13	Science	Passing over large sheet flow with a raked morphology. Went in or out of fissure
J2-969_20170722153311-20170722153700.mov	J2-969	SC1ATK120.mov	15:33:37:00	15:37:01:07	Science	Collecting Geo-07 of 2015 pillows. Abundant Large rat tail fish in background
J2-969_20170722153944-20170722154111.mov	J2-969	SC1ATK121.mov	15:39:51:00	15:41:12:01	Science	Jumbled fissure with large deep cavernous hole. Difficult to get sense of scale
J2-969_20170722154830-20170722155138.mov	J2-969	SC1ATK122.mov	15:49:10:00	15:51:38:08	Science	Sampling Geo-08 a 2015 pillow. Next to Kipuka. Pillow collapsed!
J2-969_20170722155840-20170722160154.mov	J2-969	SC1ATK123.mov	15:58:47:00	16:01:54:16	Science	View of 2015 flows appearing to come out of fissure with sediment atop in various places, meeting with deep fissure showing old pillows and with sediment.
J2-969_20170722161456-20170722161557.mov	J2-969	SC1ATK124.mov	16:13:30:00	16:15:57:19	Science	following eruptive fissure, jumbled masses of collapsed pillows
J2-969_20170722162740-20170722163139.mov	J2-969	SC1ATK125.mov	16:27:50:00	16:31:40:13	Science	Attempted collection of pillow w/ sediment. Was too crumbly and glassy.
J2-969_20170722163431-20170722163719.mov	J2-969	SC1ATK126.mov	16:34:45:00	16:37:20:05	Science	Collecting Geo-10 from sheet flow
J2-969_20170722163911-20170722163938.mov	J2-969	SC1ATK127.mov	16:39:23:00	16:39:38:02	Science	Passing over lineated sheet flow with large fish grazing on sediment
J2-969_20170722164409-20170722164856.mov	J2-969	SC1ATK128.mov	16:44:16:00	16:48:56:18	Science	Small lava pillar under pillow, collected for Geo-11. 5 or 6 dead sea pickles adjacent
J2-969_20170722165349-20170722165537.mov	J2-969	SC1ATK129.mov	16:53:00:00	16:55:37:11	Science	Contact on western side of graben facing north.
J2-969_20170722172058-20170722172329.mov	J2-969	SC1ATK130.mov	17:21:00:00	17:23:29:16	Science	Traveling east back to fissure ~100 m northeast of WP11. Older collapsed pillow lava in rift zone
J2-969_20170722172642-20170722172816.mov	J2-969	SC1ATK131.mov	17:26:47:00	17:28:16:18	Science	Contact of old with the 2015 lava flows.
J2-969_20170722174121-20170722174205.mov	J2-969	SC1ATK132.mov	17:41:10:00	17:42:10:00	Science	Lineated sheet flow to jumbled
J2-969_20170722175200-	J2-969	SC1ATK133.mov	17:52:05:00	17:53:43:24	Science	Lineated sheet flows – platy

New Clip Name	Dive ID	Original Clip ID	Log Start Time	Log End Time	Camera Source	Logger Comment
20170722175343.mov						
J2-969_20170722180744-20170722181013.mov	J2-969	SC1ATK134.mov	18:08:06:00	18:10:13:14	Science	Collapsed pillows and sheet flow. Looks like ancient Roman architecture

6.0 JASON

6.1 Dive Statistics

Jason RR1712 Lowering Statistics					
Lowering	**Start Time**	**End Time**	**Duration days hh:mm:ss**	**Max Depth**	**Note**
J2-964	7/14/2017 22:24	7/16/2017 01:09	2 attempts	146.22	Aborted
J2-965	7/16/2017 15:34	7/17/2017 03:05	11:30:46	1520.32	Fluid
J2-966	7/17/2017 10:54	7/19/2017 23:02	2 12:08:21	1716.42	Pressure
J2-967	7/20/2017 05:43	7/21/2017 13:20	1 07:36:32	1723.23	Pressure
J2-968	7/21/2017 18:34	7/22/2017 03:42	09:07:37	1770.56	NRZ
J2-969	7/22/2017 11:03	7/22/2017 19:24	08:21:27	1535.38	East Rim

Fig. 6.1-1 Jason's control van displays.

6.2 Dive Summaries

Dive J2-965 International District and Mkr113 Vent Fluid Sampling

Main goals: Fluid sampling at International District Vent field and at Mkr113 Vent

Samples: 28 total; 20 fluid, 6 gas, 2 geology (sulfides)

Tasks Accomplished:
1) International District
- Castle vent: 1 GTHFS, 2 HFS pistons, recovered MISO141, deployed MISO-153
- Deployed Tephra Sampler H near base of Castle chimney with marker, Mkr-278
- Ambient HFS DNA sample while transiting through Int'l District vent field
- El Guapo (top): 1 HFS GT & GTB, 3 HFS pistons, 2 chimney pieces
- Diva vent: recovered MISO102, deployed HOBO 130, 3 GTB, 2 HFS pistons
- Tiny Towers: HFS 2 pistons and 1 bag.

2) Transit to Mkr113 Vent
- HFS DNA sample while transiting between Int'l District and Mkr-113 Vent.

3) Mkr113 Vent (Marker 62)
- Fluid Sampling: 5 HFS Bag samples; 1 HFS DNA sample
- Deployed Mkr-272 (replaced missing Mkr-62)
- Recovered MTR-3173 and deployed MTR-3040

Dive J2-966 Pressure Dive #1

Main goals: Make pressure measurements at array of seafloor benchmarks. We will make 3 transects of the array. We will collect fluid samples near the end.

Samples: 18 total; 2 geology (sulfides), 4 gas, 12 fluid.

Tasks Accomplished:
1) Make pressure measurements at seafloor benchmarks.
Measurement order: AX-308 -> AX-106-> AX-307->AX-101->Ax-302->AX-309->AX-303->AX-310->AX-104 ->AX-105->AX-104->AX-310->AX-303->AX-309->AX-302->AX-101->AX-307->AX-308->AX-106

Benchmark	Pressure measurements	Recover	Deploy
AX-308	2	MBPR-8 (pass 2)	None
AX-106 (Ashes)	3	MBPR-9 (pass 2)	None
AX-307	2	MBPR-7 (pass 2)	MBPR-10 (pass 1)
AX-101 (Center)	2	None	Tephra-C (pass 1)
AX-302 (Trevi)	2	MBPR-6 (pass 1)	MBPR-5, Tephra-D (pass 1)
AX-309	2	None	None
AX-303 (Mkr33 Vent)	2	MBPR-12 (pass 1)	MBPR-2 (pass 1)
AX-310 (International Dist)	2	None	None
AX-104 (Bag City)	2	None	None
AX-105 (South Pillow Mound)	1	None	None

2) ASHES Fluid Sampling after last measurement at AX-106.

- Virgin: 3 HFS pistons, 2 GTB
- Inferno: 2 geology (sulfides); 3 HFS; 1 GTB
- Hell: 2 HFS pistons; 1 GTHFS
- Anemone: 2 HFS bags, 1 HFS DNA

There were several Jason power issues during this dive. During the first measurement at AX-310 there was a power failure. Lost thruster power on several sites, including twice at AX-307 resulting in 3 attempts at the pressure measurement. Dive ended before all pressure measurements completed.

Dive J2-967 Pressure Dive #2

Main goals: Finish abbreviated third transect to make pressure measurements at array of seafloor benchmarks and collect fluid samples at Casper, Vixen, Mkr-33 Vent, Trevi, Mkr-N3 Vent and Bag City.
General path: Casper/Vixen -> AX-104 (Bag City) -> AX-303 (Mkr-33 Vent) -> AX-302 (Trevi) -> AX-104 (Bag City) -> AX-105 (South Pillow Mound)

Samples: 28 total;

Tasks Accomplished:
1) Casper: 1 HFS piston; 1 GTHFS; recovered MISO-103; deployed HOBO-151.
2) Vixen: 2 HFS pistons; 1 GTHFS
3) Transit to benchmarks AX-104 (Bag City vent). Make pressure measurement. No fluid sampling on this visit (will see if there is time on next visit).
4) AX-303 (Mkr33 vent) pressure measurement.
5) Mkr-33 Vent: 3 HFS bags, 1 HFS DNA. Recovered MTR-3052 and deployed MTR-3048.
6) Transit to benchmark AX-302 (Trevi): 1 HFS DNA during transit.
7) AX-302 (Trevi) pressure measurement.
8) Trevi Vent: Recovered HOBO-101, 3 HFS pistons, 2 GTBs, deployed HOBO-104.
9) Transit to Mkr N3 vent. Mkr-N3 Vent: 1 HFS bag, 1 HFS piston, 1 HFS DNA, 1 GTB. Recovered MTR-4128 and deployed MTR-3201.
10) Transit to AX-104 (Bag City vent): 1 HFS DNA sample.
11) AX-104 Pressure measurement. Deployed Mkr-276.
12) Bag City: 3 HFS bags, 1 HFS DNA.
13) Transit to AX-105 (South Pillow Mound). Pressure measurement. Recovered MBPR-13 and deployed MBPR-4.
14) Geology exploration of South Pillow Mound lava flows. Took 4 geology samples (Three 1998 lavas and one 2011 lava).

Dive J2-968 North Rift Zone Mini-Smoker Vents

Main goals: Explore top of 2015 lava flow with lava lake drain-out where MBARI ROV dive found mini-smoker vents active in August 2016.

Samples: 17 total; 11 fluid, 4 gas, 2 geology (sulfide & sulfur)

Tasks accomplished:
1) Explored new lava flow starting just north of where MBARI discovered small, black smokers in 2016. Observed areas of clear venting, 'bag' creatures and black smoke coming from cracks between lobates.

2) Sampled high-temperature venting area: sulfide chimney (GEO-01) with black smoke, fluids (3 HFS pistons and 1 bag) and gas (1 GTHFS and 1 GTB) at site named Prosecco. Tmax at black smoker was 317°C.
3) Sampled diffuse venting area at Prosecco: 2 HFS bags and 1 HFS DNA samples. Deployed Mkr-264 at site.
4) Explored stained region of the flow to the west and discovered erupted sulfur deposits. Named site Limoncello and took suction sample of sulfur (GEO-11). Area contained numerous sulfur excretions.
5) Moved to the east and discovered site with numerous skinny, short, venting, black chimneys. Named site Kahlua. Collected 2 HFS pistons, one GTHFS samples at the site. Deployed Mkr-241 at the site.
6) Explored further to the west toward mapped collapse feature but only found a depression with no active venting.
7) Moved back to the east toward active venting and discovered another area of small, venting chimneys. Venting was very black,chimney looked charred with sulfide worms surrounded by bag creatures. Called site Sambuca. Took 2 HFS bags and one GTB samples at the site.

Dive J2-969 Axial East Rim and Flow graben

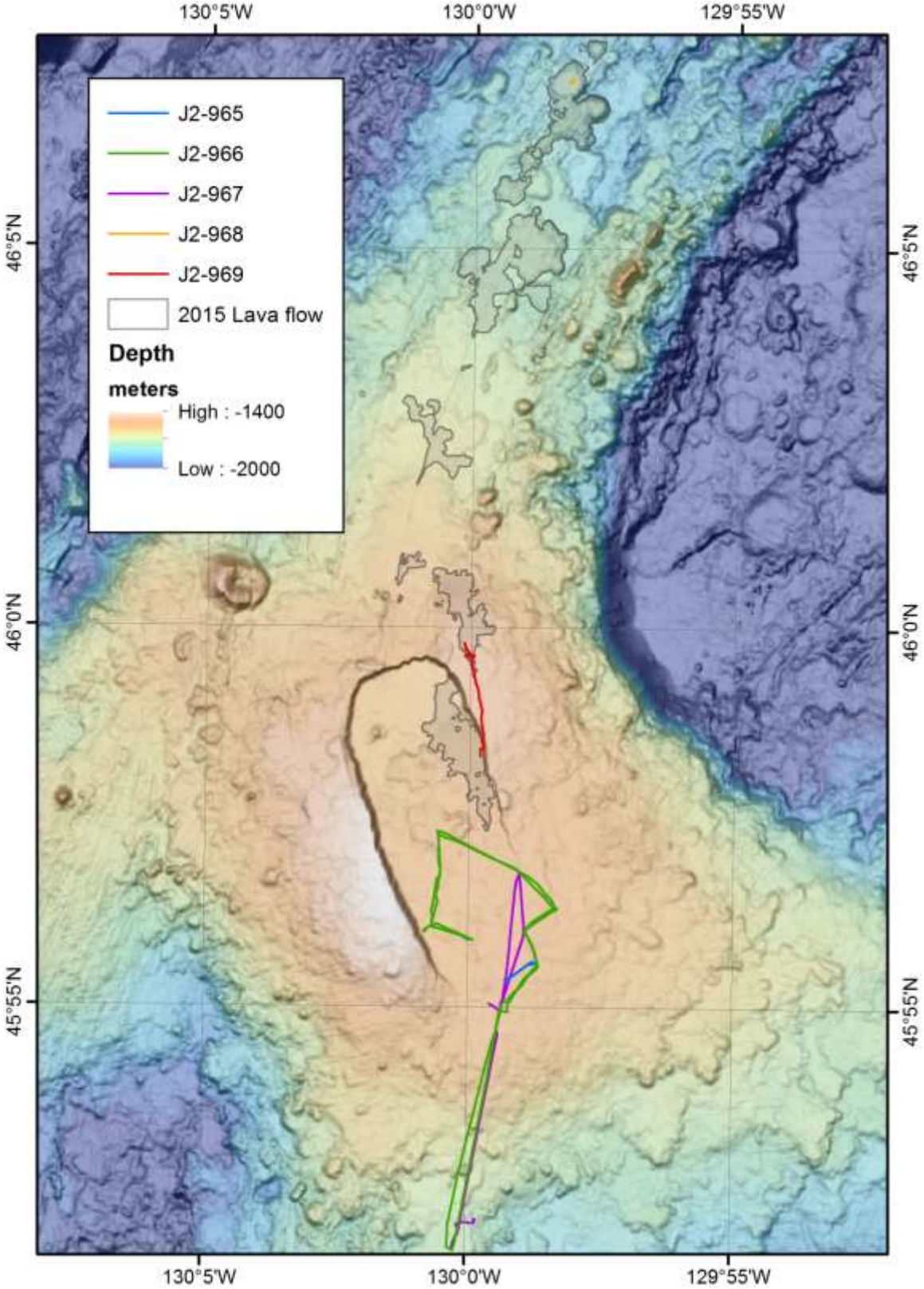
Main goals: Explore starting on caldera floor near 2015 eruptive vents (1529 m), climb up caldera wall ~65 m to rim (1463 m), explore graben to north for ~ 2 km, sample rocks where 2015 lava is present.

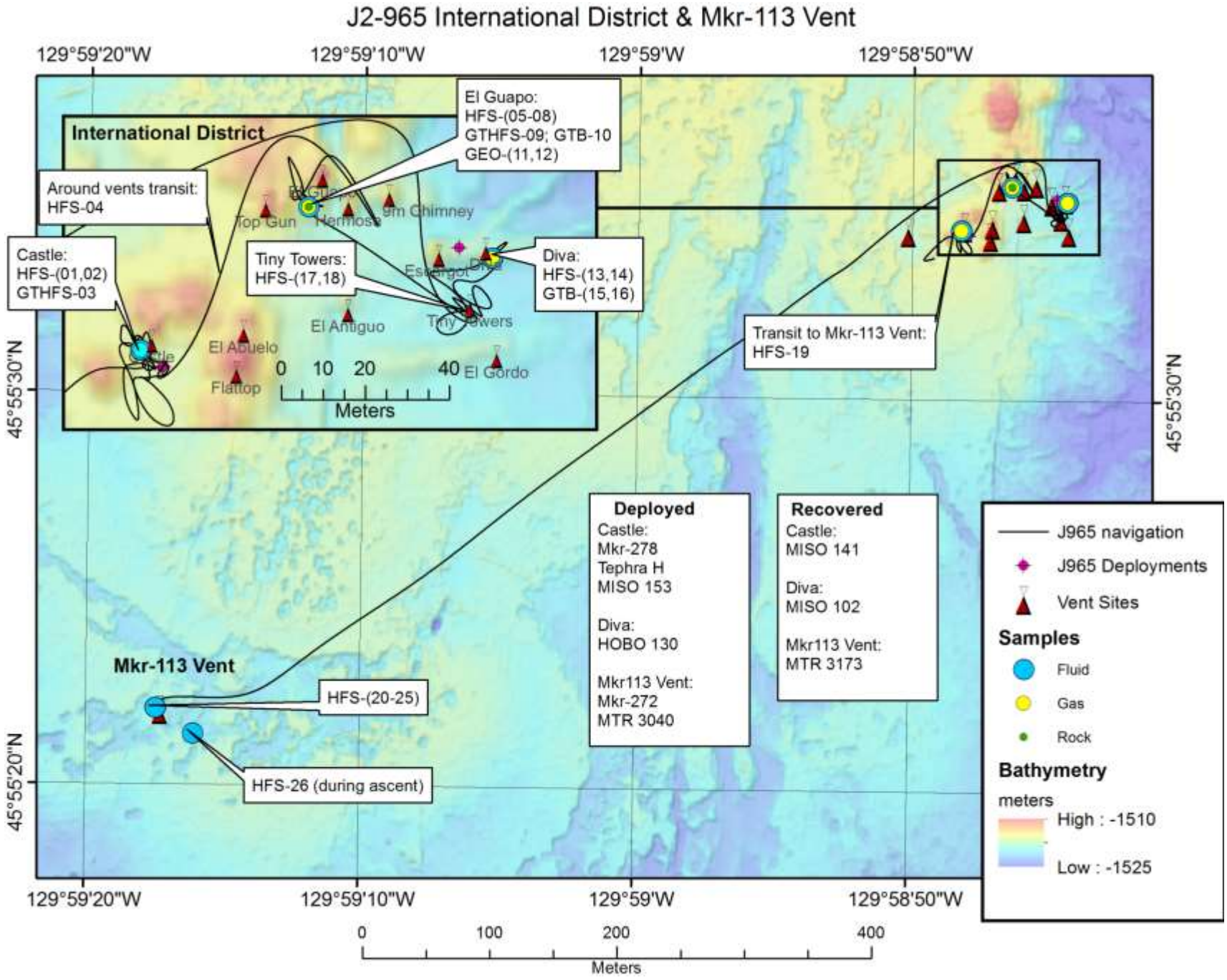
Samples: 14 total rock samples.

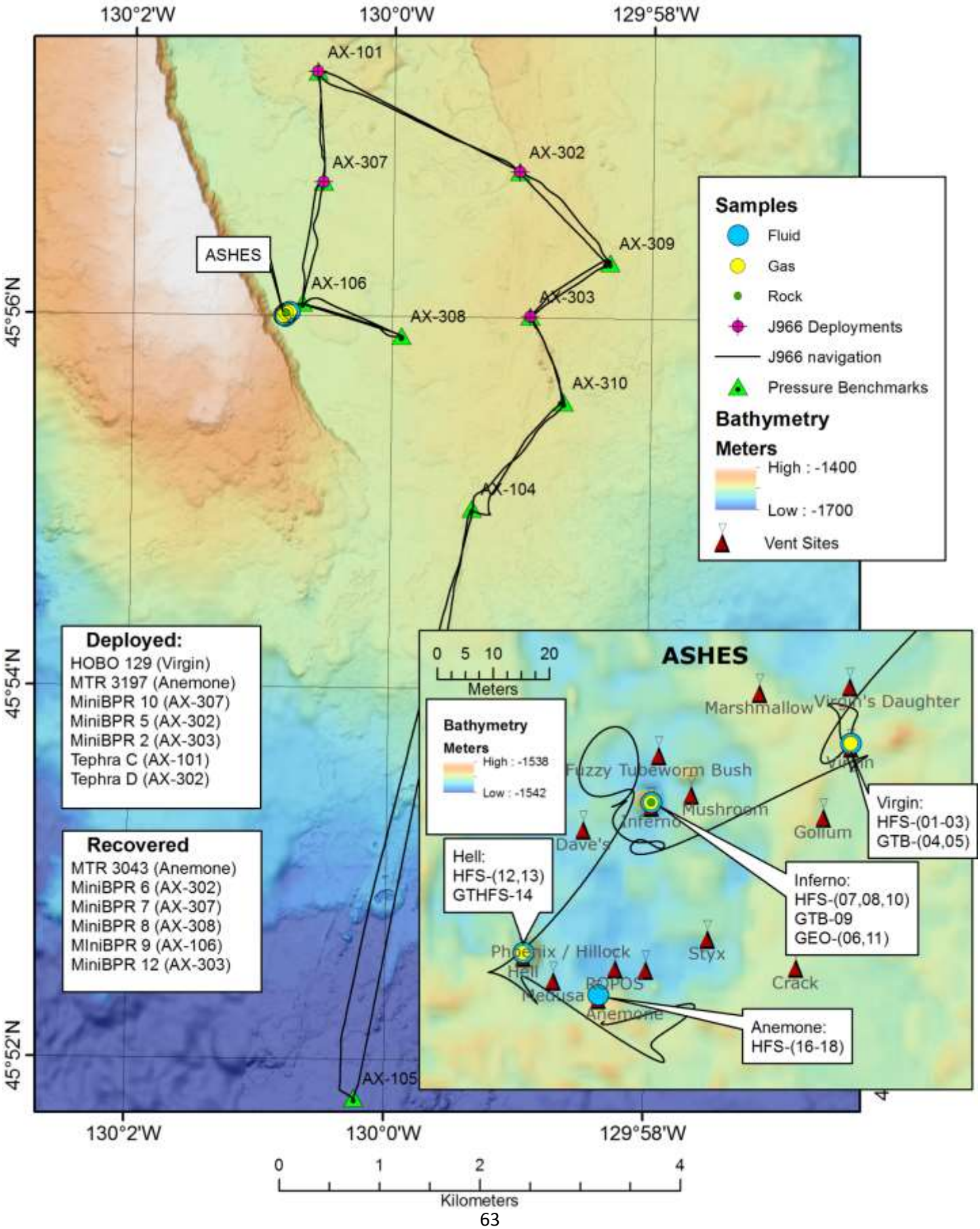
TASKS:
1) Sampled pieces of 2015 crust on the caldera floor near the eruptive fissure. (2 geology samples).
2) Took a geology sample at the contact between the 2015 flow and the talus of the east caldera wall.
3) Explored edge of flow along caldera wall to the north. Took a second sample at contact between 2015 flow and talus.
4) Climbed caldera wall to east rim at the 2015 graben.
5) Drove north in a zig-zag pattern along rim across fissures within the graben.
6) Deployed Tephra-F and Mkr-281 in a small depression in older flow on the east rim.
7) Continued to explore to the north within the graben in a zig-zag. Crossed many fissures and fractures.
8) Encountered new lavas between waypoints 8 & 9, coming up in the fissure and through ash sediment. Took a geology sample of the new lava (GEO-05).
9) Continued to explore new lavas while heading north along the rim. Took 9 more samples of 2015 lavas from various different areas.

6.3 Jason Dive Maps

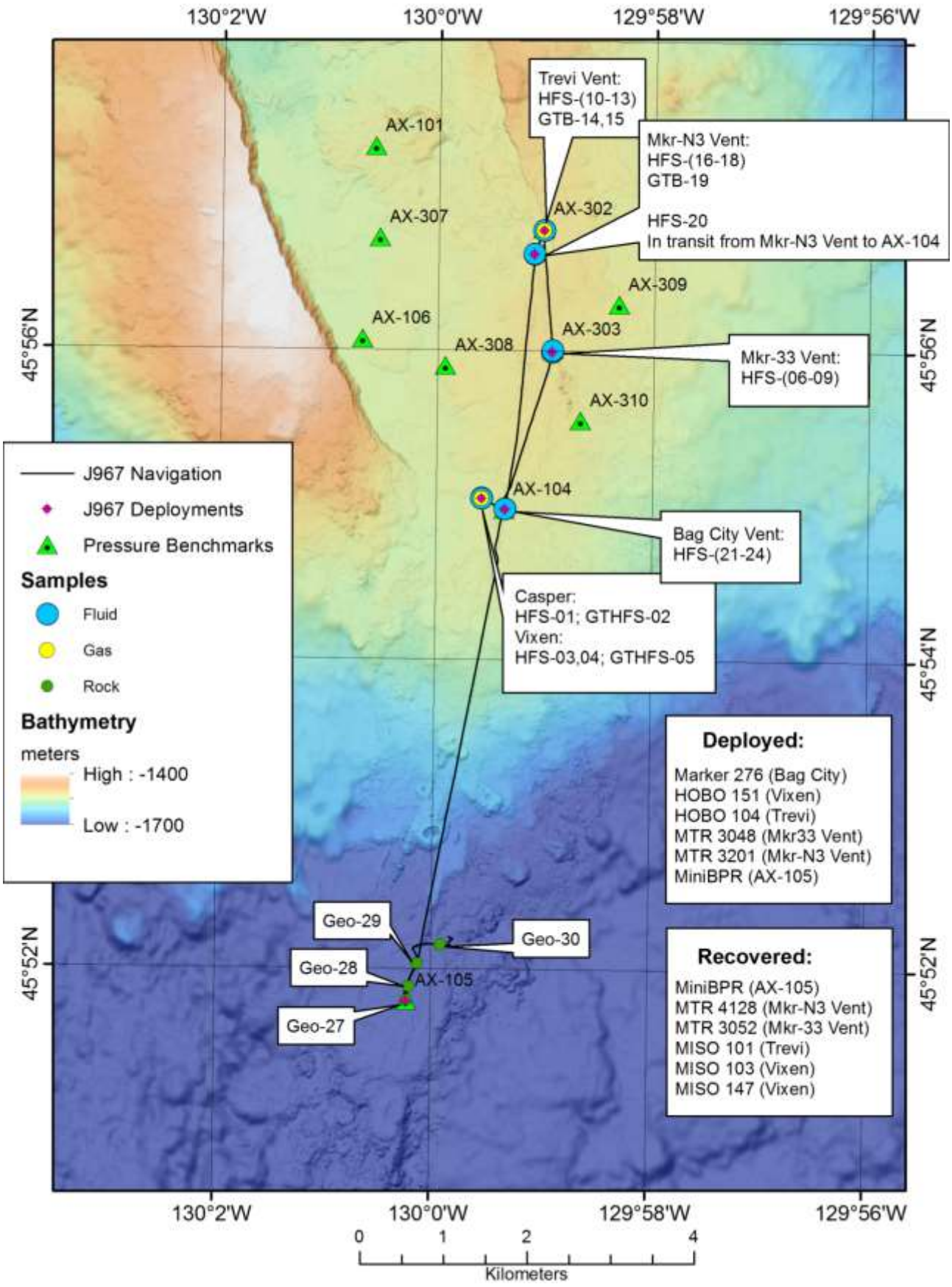
The map below shows all the 2017 Jason dives relative to the 2015 lava flows:

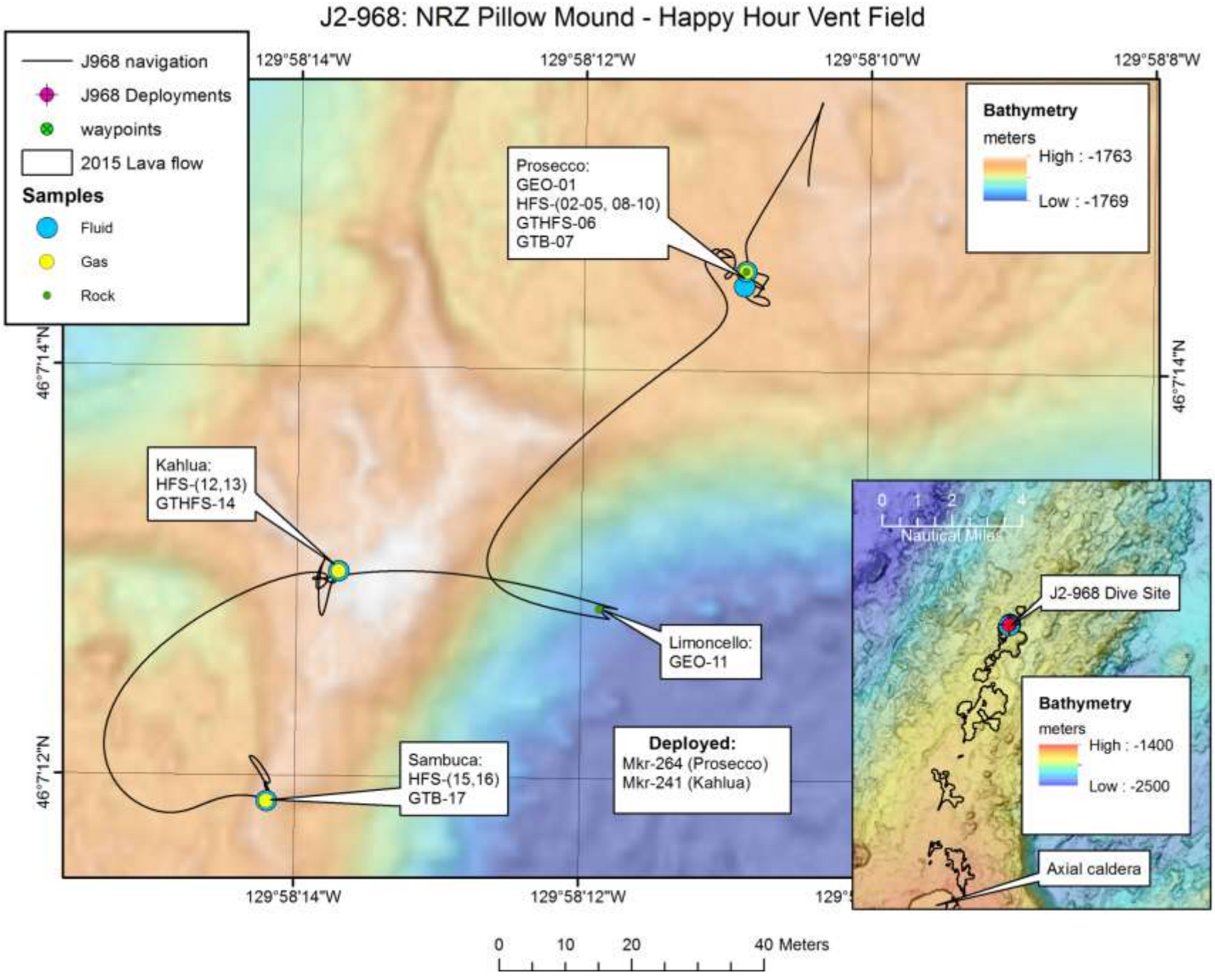


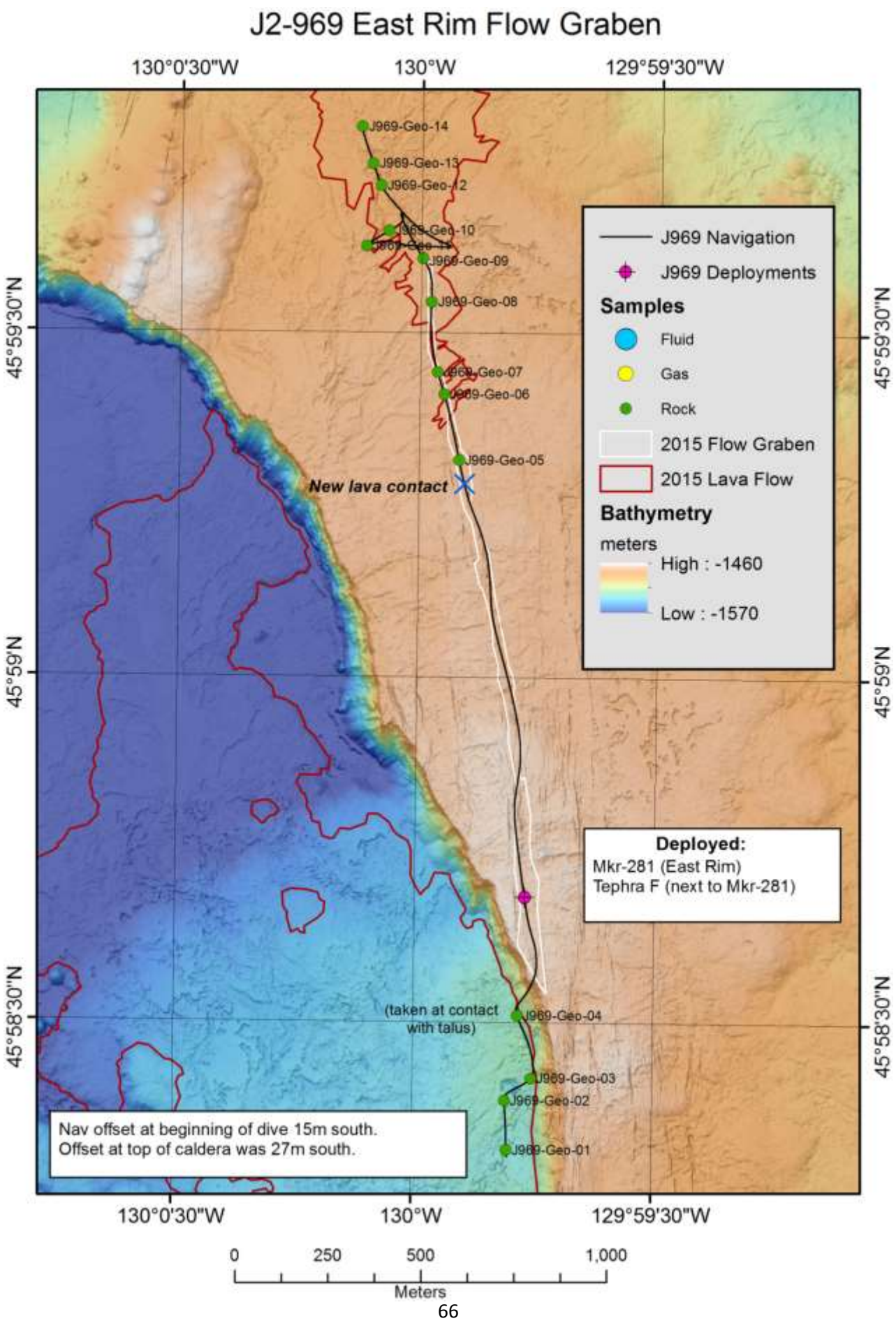

J2-965 International District & Mkr-113 Vent
129°59'20"W
129°59'10"W
129°59'W
129°58'50"W
45°55'30"N
45°55'20"N
International District
El Guapo:
HFS-(05-08)
GTHFS-09; GTB-10
GEO-(11,12)
Around vents transit:
HFS-04
Castle:
HFS-(01,02)
GTHFS-03
Tiny Towers:
HFS-(17,18)
Diva:
HFS-(13,14)
GTB-(15,16)
Transit to Mkr-113 Vent:
HFS-19
Top Gun
Hermosa
9m Chimney
El Antiguo
El Abuelo
Flattop
El Gordo
0 10 20 40
Meters
Mkr-113 Vent
HFS-(20-25)
HFS-26 (during ascent)
Deployed
Castle:
Mkr-278
Tephra H
MISO 153
Diva:
HOBO 130
Mkr113 Vent:
Mkr-272
MTR 3040
Recovered
Castle:
MISO 141
Diva:
MISO 102
Mkr113 Vent:
MTR 3173
J965 navigation
J965 Deployments
Vent Sites
Samples
Fluid
Gas
Rock
Bathymetry
meters
High : -1510
Low : -1525
0 100 200 400
Meters


J2-966 First Pressure Dive | ASHES Fluid Sampling
130°2'W
130°0'W
129°58'W
45°56'N
45°54'N
45°52'N
AX-101
AX-307
AX-302
AX-309
ASHES
AX-106
AX-303
AX-308
AX-310
AX-104
AX-105
Samples
Fluid
Gas
Rock
J966 Deployments
J966 navigation
Pressure Benchmarks
Bathymetry
Meters
High : -1400
Low : -1700
Vent Sites
Deployed:
HOBO 129 (Virgin)
MTR 3197 (Anemone)
MiniBPR 10 (AX-307)
MiniBPR 5 (AX-302)
MiniBPR 2 (AX-303)
Tephra C (AX-101)
Tephra D (AX-302)
Recovered
MTR 3043 (Anemone)
MiniBPR 6 (AX-302)
MiniBPR 7 (AX-307)
MiniBPR 8 (AX-308)
MIniBPR 9 (AX-106)
MiniBPR 12 (AX-303)
ASHES
0 5 10 20
Meters
Bathymetry
Meters
High : -1538
Low : -1542
Marshmallow
Virgin's Daughter
Fuzzy Tubeworm Bush
Mushroom
Inferno
Dave's
Gollum
Virgin:
HFS-(01-03)
GTB-(04,05)
Hell:
HFS-(12,13)
GTHFS-14
Inferno:
HFS-(07,08,10)
GTB-09
GEO-(06,11)
Phoenix / Hillock
Hell
Styx
ROPOS
Medusa
Anemone
Crack
Anemone:
HFS-(16-18)
0 1 2 4
Kilometers

J2-967 Second Pressure Dive




J2-968: NRZ Pillow Mound - Happy Hour Vent Field
J968 navigation
J968 Deployments
waypoints
2015 Lava flow
Samples
Fluid
Gas
Rock
129°58'14"W
129°58'12"W
129°58'10"W
129°58'8"W
46°7'14"N
46°7'12"N
Bathymetry
meters
High : -1763
Low : -1769
Prosecco:
GEO-01
HFS-(02-05, 08-10)
GTHFS-06
GTB-07
Kahlua:
HFS-(12,13)
GTHFS-14
Limoncello:
GEO-11
Sambuca:
HFS-(15,16)
GTB-17
Deployed:
Mkr-264 (Prosecco)
Mkr-241 (Kahlua)
0 10 20 40 Meters
0 1 2 4
Nautical Miles
J2-968 Dive Site
Bathymetry
meters
High : -1400
Low : -2500
Axial caldera


J2-969 East Rim Flow Graben
130°0'30"W
130°W
129°59'30"W
45°59'30"N
45°59'N
45°58'30"N
J969-Geo-14
J969-Geo-13
J969-Geo-12
J969-Geo-10
J969-Geo-09
J969-Geo-08
J969-Geo-07
J969-Geo-06
J969-Geo-05
New lava contact
J969-Geo-04
(taken at contact with talus)
J969-Geo-03
J969-Geo-02
J969-Geo-01
J969 Navigation
J969 Deployments
Samples
Fluid
Gas
Rock
2015 Flow Graben
2015 Lava Flow
Bathymetry
meters
High : -1460
Low : -1570
Deployed:
Mkr-281 (East Rim)
Tephra F (next to Mkr-281)
Nav offset at beginning of dive 15m south.
Offset at top of caldera was 27m south.
0
250
500
1,000
Meters

6.4 Jason Navigation

Navigation positions for 2017 Jason dives were better than the observed offsets from the 2015 expedition. The pressure benchmarks locations are ideal to use as baseline positions from year to year. Table 6.4-1 lists offsets from Jason RENAV positions for each benchmark visit. A few additional offsets noted by the data loggers are listed for International District sites. For some pressure measurement a range of distances and bearings is listed due to the wandering of position fixes while in place. (See Fig. 6.4-1 for a map illustrating the phenomena). The offsets were generally less than 10 meters and in most cases within 5 meters of the benchmark which is within visual range detection by Jason's pilots and cameras. Jason RENAV in 2017 did not incorporate DVL nav and smoothed USBL only.

Offsets between Jason navigation and the MBARI AUV 2017 1-meter grid bathymetry data were also noted by data loggers on dive J2-969. The offsets here were substantial, 23 and 20 meters. MBARI AUV grids are processed to internally align but have been known to have offsets from coarser, ship bathymetry. Knowing this, Susan Merle matched large vent chimneys previously navigated over the years to the new bathymetry. Prior the 2017 expedition, the MBARI grids were shifted to align with these vent locations for both ASHES and International District. The ASHES grid (axauvd1m) was shifted 13.2 X and -5.3 Y (meters). International District was shifted 10.5X -5.6Y meters (axauvc1m). For sampling in those areas, the shifted grids were used as Jason underlay maps during the dive and the offsets listed in Table 6.4-1 were from these grids. Unshifted MBARI grids would have had even greater observed offsets at both of these locations.

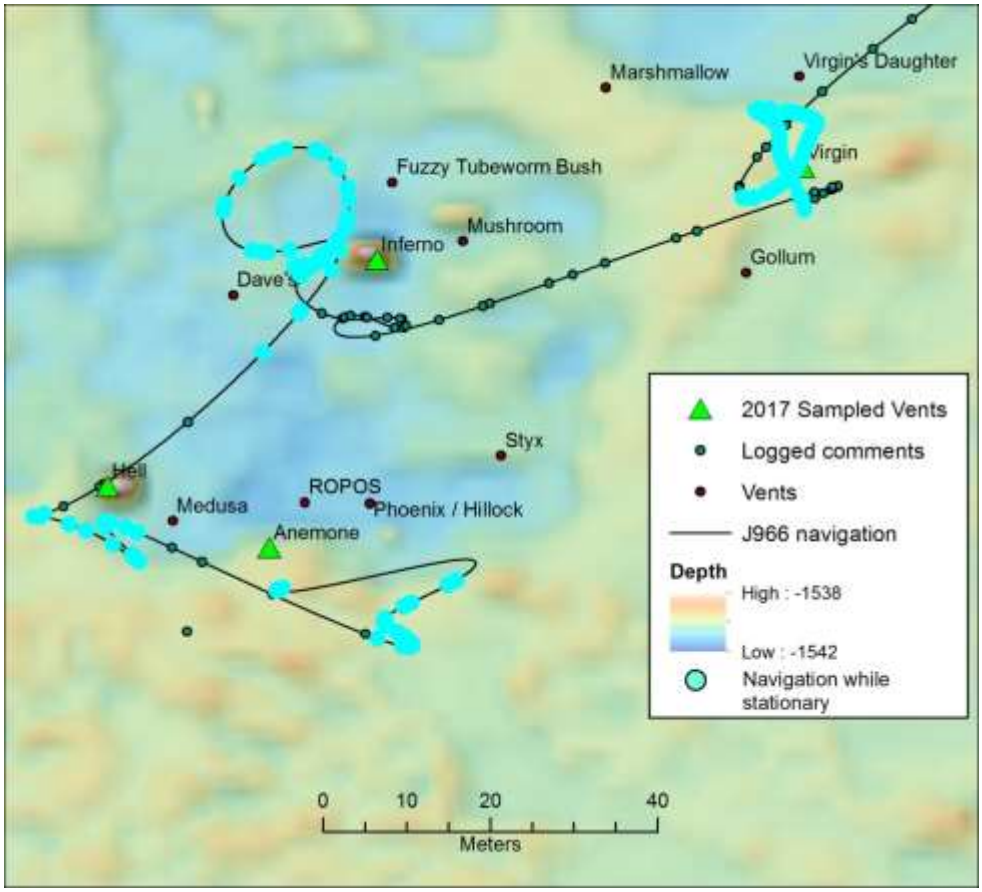


Figure 6.4-1 Map of Jason RENAV for dive J2-966. Logged comments are highlighted in bright blue during periods where Jason was actually stationary while sampling. During a dive, the navigation positions while stationary are a scattering of points on the navigation screens. Loggers estimate a single position from the scatter and record the position as a 'cursor' fix in the logged comments. Bathymetry grid was shifted to match known vents sites (axauvd1m) at ASHES.

Table 6.4-1 Navigations offsets observed at Pressure benchmarks from processed (RENAV) navigation after the expedition. 2015 offsets were the reported discrepancies from the data logger. Other 2017 offsets listed at the end of the table were data logger comments during the dive.

Benchmark	Dive	Offset (m)	bearing from benchmark	2015 Offsets/bearings	
AX-308	J966	5.5-10	158-120		
AX-308	J966	3-9.5	127-104		
AX-106	J966	4.7-7.9	121-127		
AX-106	J966	4-6.5	122-170		
AX-106	J966	2.5-10.2	260-131		
AX-101	J966	5.3	272		
AX-101	J966	4.5	45		
AX-307	J966	4.3	268		
AX-307	J966	4.8	303		
AX-302	J966	4.7	68		
AX-302	J966	3.3	183-112	5	340
AX-302	J967	1.2-4			
AX-309	J966	13	25		
AX-309	J966	2.5	22	14-20	340
AX-303	J966	3.5-4	143-127		
AX-303	J966	3.1-4	93-74		
AX-303	J967	8.1-9	175-29		
AX-310	J966	4.6-9	106-167		
AX-310	J966	7.0-9	67	8	310
AX-104	J966	8	79		
AX-104	J966	8.5	90		
AX-104	J967	4.9-6.0	100		
AX-105	J966	4.4	321		
AX-105	J967	2	183	12	280

Other logger offset notes:

Castle	J965	14	SW
Mkr-153/9m Chimney	J965	12	SW
El Guapo	J965	7.5	33

Six new markers were deployed in 2017, Fig. 6.4-2. Each dive carried 2 markers in the basket to use as needed. Two markers replaced older markers that were either missing or unreadable (Mkr-62 and Mkr-65 respectively). Two other markers were located next to Tephra samplers to assist in their future recovery. Finally two markers were deployed in newly sampled (fluid, gas and sulfides) venting sites on the 2015 lava pillow mound at the North Rift Zone. Table 6.4-2 lists the newly deployed markers and an updated listing of all markers presumed to still be at Axial Seamount.

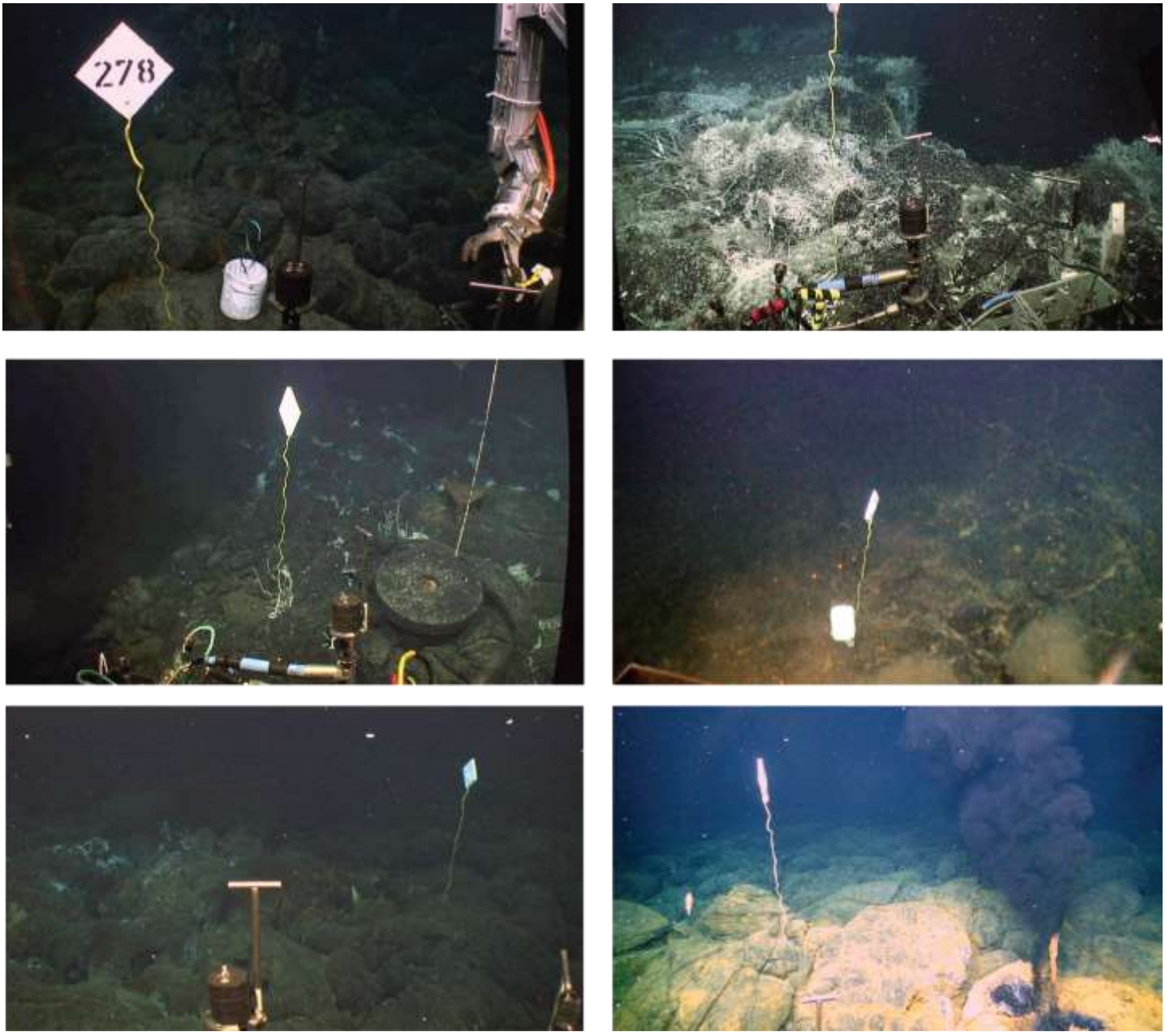


Fig. 6.4-2 New markers deployed in 2017; top to bottom, left to right: Mkr-278 at Castle Vent base, International District; Mkr-272 at Mkr-113 Vent; Mkr-276 at Bag City; Mkr-281 next to Tephra-F on East Rim; Mkr-264 at Prosecco; Mkr-241 at Kahlua.

Table 6.4-2 New markers and updated inventory of existing markers at Axial Seamount.

Deployed in 2017:

Marker	Latitude	Longitude	Z	Region	Location	Deployed	comments
Mkr-278	45.92616	-129.97996	1516	International District	Castle	J-965	Next to Tephra-H.
Mkr-281	45.97803	-129.99613	1464	East Rim	East Rim graben	J-969	Next to Tephra-F in 2015 graben.
Mkr-241	46.12028	-129.97050	1763.9	NRZ	Kahlua	J-968	NRZ pillow mound sampling site (2017)
Mkr-264	46.12068	-129.96967	1764.3	NRZ	Prosecco	J-968	NRZ pillow mound sampling site (2017)
Mkr-276	45.91619	-129.98936	1528.9	Pre-1982 flow (W of 1998 lava)	Bag City	J-967	Replacing old Mkr-65 which is blackened and unreadable.
Mkr-272	45.92276	-129.98815	1520	Pre-1982 flow (W of 1998 lava)	Mkr113 Vent	J-965	Replacing missing Mkr-62.

All Axial Markers:

Marker	Latitude	Longitude	Z	Region	Location	Deployed	comments
Smiley marker	45.93326	-129.98178	1517	1998LavaFlow	E of Marker33 vent site		Saw in 2011. It survived the 2011 eruption. Near east edge of 2011 lava flows.
Mkr44	45.92603	-129.98010	1520	1998LavaFlow	Village		Sampled on R856 22:45:34. (Added back in 2011-lost off list). Sample R1010 09:17:48.
Ghost TrainWheel	45.93208	-129.98407	1519	1998LavaFlow			Has 1998 date on railroad wheel. Probably old mooring-discovered on R1012-not deployed then. Looks like on edge of 2011 lava flow-not sure if it is still there.
Mkr135	45.94370	-129.98518	1522	2011 lava over 98	MkrN3	J730	Deployed at post-eruption diffuse MkrN3 site where MTRs were deployed/recovered in 2013. Cursor position. On top of large pillow vv#12253
Mkr170	45.92769	-129.98248	1519	2011LavaFlow	Boca	J5-583	
Mkr166	45.93316	-129.98228	1520	2011LavaFlow	Marker33 Vent		Deployed after 2011 flow. Seen 2013 & 2015.
Mkr66	45.93342	-129.98228	1516	2011LavaFlow	AX203 near Marker 33 Vent		Attached to metal tripod benchmark that was moved from near AX105 to near Marker33 vent in 2011. Seen 2015.

Marker	Latitude	Longitude	Z	Region	Location	Deployed	comments
Mkr136	45.94642	-129.98379	1522	2011LavaFlow	AX-302 Trevi benchmark	J730	Mrk63 is on old benchmark AX-202 also at this AX-302 site (metal triangle). VV#8714. Seen 2015.
Mkr63	45.94639	-129.98382	1520	2011LavaFlow	AX-202 Trevi benchmark		Attached to metal tripod benchmark that was moved from caldera center to near Trevi vent in 2011. Seen 2015.
Mkr21	45.93327	-130.01359	1547	ASHES	~5m SW of Styx		
Mkr129	45.93327	-130.01374	1542	ASHES	Anemone	J726	Using 2013 sampling/MTR3004 cursor lat/long. VV#1045
Mkr129	45.93325	-130.01379	1543	ASHES	Anemone	J2-726	Deployed after sampling and leaving a MTR in 2013. Couldn't find 2012 MTR. Check position after 2013 cruise using Vent location.
Mkr47	45.93345	-130.01349	1542	ASHES	between Gollum-Dave's		Seen 2015 J2-824.
Mkr117	45.93331	-130.01334	1546	ASHES	Crack		Marker seen in 1998 (R466)
Mkr121	45.93355	-130.01325	1542	ASHES	Gollum	J2-521	Seen 2015.
Mkr64	45.93356	-130.01330	1545	ASHES	Gollum	J2-293	Seen 2015.
Tripod21	45.93357	-130.01329	1547	ASHES	Gollum		
Mkr27	45.93332	-130.01391	1546	ASHES	Hell		Deployed 1986 by PiscesIV. Using 2007 vent position.
Mrk2	45.93332	-130.01391	1546	ASHES	Hell		Deployed 1986 by PiscesIV on seafloor. Using 2007 vent position.
MrkL	45.93332	-130.01391	1546	ASHES	Hell	R466	Small square foam markers (eyeball) deployed 1998 in hole left by SUAVE sampling. Using 2007 vent position.
Mkr19	45.93349	-130.01367	1547	ASHES	Inferno		1998 unreadable due to bio-coating; marker deployed 1996. Spotted 2010 (bucket lid).
MkrI	45.93373	-130.01341	1546	ASHES	Marshmallow	R471	Spotted 2010-1m from vent. Visible J2-293 ('07). Named White Vent originally (R471).
Mkr68	45.93328	-130.01389	1542	ASHES	Medusa-2010	J2-521	Visible 2013 J2-726.
Mkr1	45.93363	-130.01358	1547	ASHES	Mushroom		Deployed 1986 by PiscesIV. Using 2007 vent position.
Mkr31	45.93363	-130.01358	1547	ASHES	Mushroom		Deployed 1986 by PiscesIV. Using 2007 vent position.
Mkr28	45.93328	-130.01362	1547	ASHES	Phoenix		Deployed 1986 by PiscesIV on seafloor. Originally referred to as Hillock Vent. Using 2007 vent position.

Marker	Latitude	Longitude	Z	Region	Location	Deployed	comments
Mkr32	45.93328	-130.01362	1547	ASHES	Phoenix		Deployed 1986 by PiscesIV on side of vent. Originally referred to as Hillock Vent. Using 2007 vent position.
Mkr54	45.93327	-130.01383	1547	ASHES	ROPOS	J2-293	Deployed 2007 (J2-293) on west edge of ROPOS vent (white diamond)
MkrD	45.93336	-130.01372	1546	ASHES	SE Phoenix	R468	visible J2-293 ('07); nav poor when viewed marker and bucket lid (better when sampling)
observatory platform	45.93362	-130.01389	1545	ASHES	West of Inferno	J2-580	
AX-106	45.93445	-130.01160	1542	ASHES	AX-106	J2-522	Cement benchmark AX-106 is ~150 m ENE of ASHES
Mkr60	45.95512	-130.00989	1534	CalderaCenter	AX-101	R623	Marker at Caldera Center near AX-101
Mkr61	45.95503	-130.00989	1534	CalderaCenter	AX-101	R623	Marker at Caldera Center near AX-101
Mkr128	45.91745	-129.99303	1534	Coquille	Casper	J730	Used Casper position from HOBO 102 deployment. Not a cursor position. VV# 10939
Mkr122	45.91717	-129.99290	1534	Coquille	Diffuse vent area	J2-520	Seen 2015.
Mkr57	45.91733	-129.99295	1537	Coquille	Vixen	J2-289	Deployed 2007. (J2-289) Old mkr57 deployed on R857(04). 2010 repositioned by ~.5m 2007 position over 10m off.
Mkr141	45.87992	-129.80294	1917	Dependable	Trusty	J731	Cursor position. Near sampling hole but too hot to place marker anchor in the sampling hole. VV# 15290.
Mkr142	45.88002	-129.80281	1919	Dependable	Weak & Rusty	J731	East side of Dependable. Marker deployed just above the vent sampled; just below and left of a first flange witnessed. Logged nav position (not cursor). VV# 14880.
Mkr155	45.94609	-129.98365	1520	E of 1998 & 2011 lava flows (E of Magnesia site)	Spanish Steps	J2-525	Deployed at new vent (later named Spanish Steps) near Trevi (J2-525)
Mkr156	45.94628	-129.98371	1520	E of 1998 & 2011 lava flows (E of Magnesia site)	Trevi	J2-525	Deployed at Trevi (J2-525)
Mkr-281	45.97803	-129.99613	1464	East Rim	East Rim graben	J-969	Next to Tephra-F in 2015 graben.
Mkr153	45.92650	-129.97920	1517	International District	9m Chimney		Seen 2015.
Mkr-278	45.92616	-129.97996	1516	International District	Castle	J-965	Next to Tephra H deployed in 2017. At Castle base out of venting area. Heading=327.

Marker	Latitude	Longitude	Z	Region	Location	Deployed	comments
Mkr150	45.92642	-129.97898	1520	International District	Diva		Seen 2015.
Mkr151	45.92619	-129.97894	1520	International District	El Gordo		
MkrN	45.92608	-129.97979	1522	International District	Flattop		Not seen 2010. Probably gone.
MkrN5	45.92615	-129.98014	1522	International District	Flattop		Didn't see marker in 2007/2010. Gone?
Mkr152	45.92655	-129.97937	1517	International District	Hermosa		
Mkr169	45.92651	-129.97940	1519	International District	Hermosa		
Mkr126	45.92580	-129.97787	1531	International District	AX-310	J730	Using cursor position for location. AX-310 site. VV#7452
Mkr-246	45.97808	-130.01242	1570	NE Caldera		J822	At J822-geo-24 sample site near WP5.
Mkr-241	46.12028	-129.97050	1763.9	NRZ	Kahlua	J-968	NRZ pillow mound sampling site (2017)
Mkr-264	46.12068	-129.96967	1764.3	NRZ	Prosecco	J-968	NRZ pillow mound sampling site (2017)
Mkr240	45.98298	-130.01111	1579	NRZ		J822	At J822-geo-25 sample site between WP6-WP7 (ROV weight management)
Mkr242	45.98298	-130.01111	1579	NRZ		J822	At J822-geo-25 sample site between WP6-WP7 (ROV weight management)
Mkr260	45.98298	-130.01111	1579	NRZ		J822	At J822-geo-25 sample site between WP6-WP7 (ROV weight management)
Mkr-275	45.97808	-130.01242	1570	NRZ		J822	At J822-geo-24 sample site near WP5.
Mkr294	46.07469	-129.99505	1716	NRZ		J826	RAS location on NRZ. Sampled on J820 and J826.
Mkr-K	46.11133	-129.97217	1752	NRZ		R1863	Marks venting area on top of the North Rift Zone 2015 lava flow
Mkr-UW	46.11476	-129.96307	1756	NRZ		R1863	Marks venting area on top of the North Rift Zone 2015 lava flow
Mkr261	46.08035	-129.99235	1727	NRZ	Snowdrift	J826	NRZ Snowdrift. Thick eruptive (orange-white) mat on way to WP5 in 2015 on new lava. Area of big collapse. Sampled in cracks with intense flow. MTR 4127 deployed at site.
Mkr-276	45.91619	-129.98936	1528.9	Pre-1982 flow (W of 1998 lava)	Bag City	J-967	Replacing old Mkr-65 which is blackened and unreadable.
Mkr-272	45.92276	-129.98815	1520	Pre-1982 flow (W of 1998 lava)	Mkr113 Vent	J-965	Replacing missing Mkr-62.

Marker	Latitude	Longitude	Z	Region	Location	Deployed	comments
Mkr143	45.94806	-129.98465	1522	Red Mat Bridges		J732	Anchor chain put in red mat surrounded by orange mat near edge of large collapse feature. (Not the sample site which was a nearby pillar). Position from cursor.
Mkr130	45.93846	-129.97209	1527	RSN PN	AX-309	J730	At RSN Primary Node site and AX-309. Cursor position. VV#7712. Seen 2015.
AX-105	45.86317	-130.00375	1723	SouthPillowMound	AX-105		Cement benchmark AX-105 at S. Pillow Mound site
Mkr127	45.94533	-130.00913	1545	West of Magnesia	AX-307	J730	Cursor position at AX-307 and Mkr127. Seen 2015.

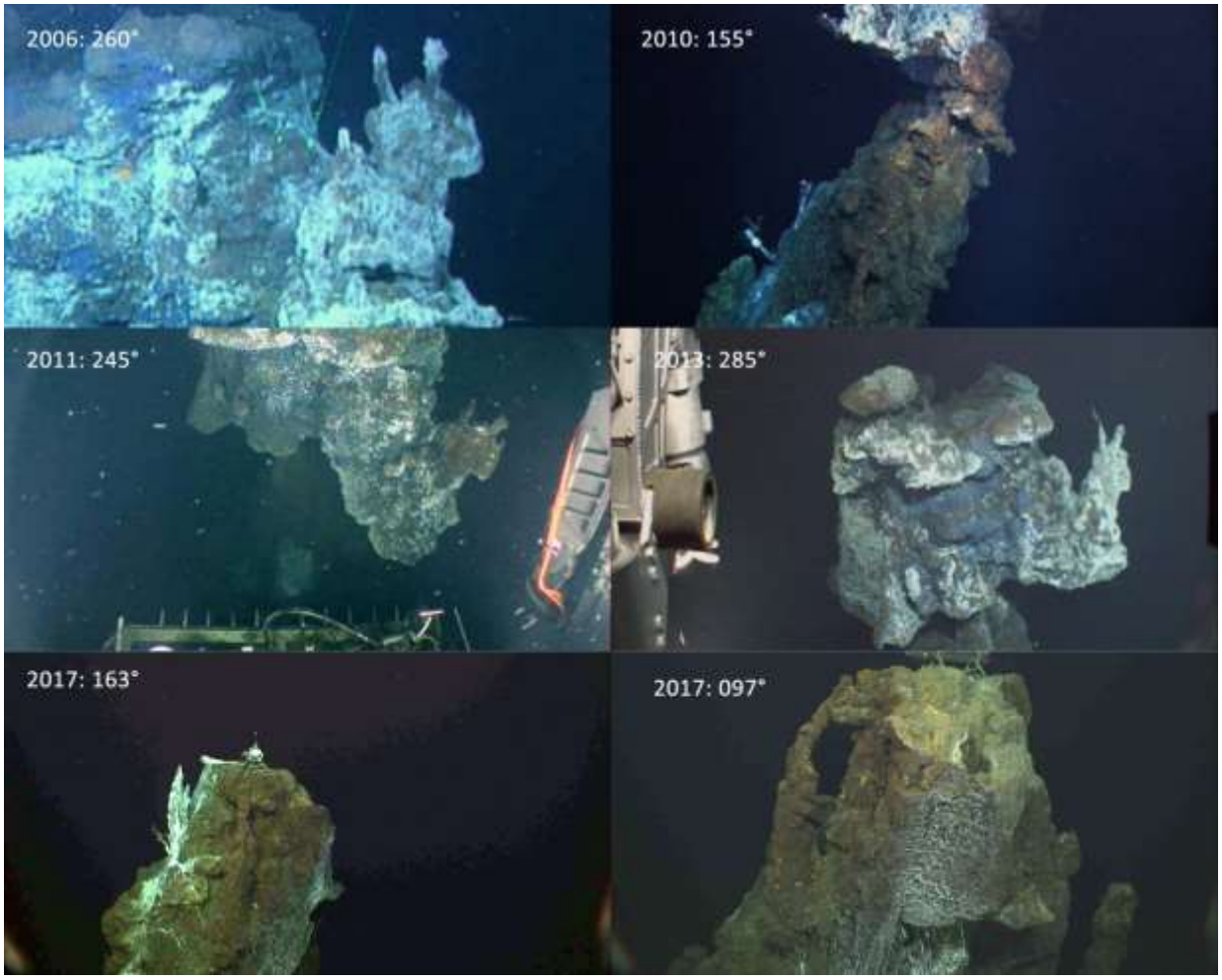
New high-temperature hydrothermal venting on one of the thick 2015 lava flows on the distal north rift zone was first discovered by the 2016 MBARI Western Flyer expedition (http://www.mbari.org/at-sea/expeditions/northern-2016-expedition/). ROV Don Ricketts discovered miniature black smokers on Dive 879 while traversing over the thickest part of one of the 2015 flows, which is over 60 meters thick. On this Axial 2017expedition 15 samples were collected at four different locations in this new hydrothermal field, 3 sites of which were actively venting high-temperature fluids from narrow, bottle-like, chimneys. The entire site was named the Happy Hour Vent Field.

Table 6.4-3 Happy Hour venting sites identified on the 2015 NRZ pillow mound flow.

Venting Site	Latitude	Longitude	Depth	Marker	Comments
Prosecco	46.12068	-129.96967	1764	Mkr-264	Multiple black chimneys on new flow; 317°C. Flow observed in lobate cracks (not sampled).
Kahlua	46.12028	-129.97050	1764	Mkr-241	Thin chimlets with black smoke. Tmax=247°C.
Limoncello	46.12023	-129.96995	1770		Extruded sulfur not active venting.
Sambuca	46.11997	-129.97060	1764		Chimlets with Tmax=37°C and smoking black holes with Tmax=321°C

An unfortunate discovery on this expedition was the destruction of the signature element of the Escargot chimney in the International District.

Figure 6.4-3 Images of Escargot with the year and the ROV heading. The 2010 & 2017 image with similar headings show the top portion of the chimney has been eliminated.



6.5 Jason Samples

Jason samples were collected on each dive and numbered sequentially as collected. Samples are named by dive, type and their collection number: Dive-type-Number, J965-GEO-01 for example. The type in the name indicates the primary purpose of the sample and the description will indicate if there were subsamples of different types (such as rock collected that had biology on it). The time and date are GMT, not local times. Position information was evaluated after the dive to determine the best position within the cluster of fixes (sometimes over 10 meters) while stationary. See the navigation section, 6.4, to read about these issues regarding Jason USBL and post-processing. The VV field is the Virtual Van record ID at the time the sample was being collected. Sample metadata is submitted to SESAR (System for Earth Sample Registration) at www.geosamples.org.

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J965-HFS-01	J2-965	2017/07/16	18:35:42	45.92620	-129.98003	51.9	2.3	1513.8	**J965-HFS-01** Unfiltered piston #1 t Castle Vent. Start 18:35. Stop 18:38. Tmax=255.2; Tavg=254; Vol=420ml; T2=75. Did not see any flow out sample pump.	Castle	180	Butterfield
J965-HFS-02	J2-965	2017/07/16	18:40:41	45.92620	-129.98003	51.9	2.3	1513.8	**J965-HFS-02**. Unfiltered Titanium Piston #2. Start 18:40. Stop 18:45. Tmax=253. Tavg=253. T2=25 Vol=375. Did not see flow out exhaust. Same location as sample -01.	Castle	194	Butterfield
J965-GTHFS-03	J2-965	2017/07/16	18:49:40	45.92620	-129.98003	51.9	2.3	1513.8	**J965-GTHFS-03** Gastight hydraulic function 5. Fired. GT-10 Orange Blue. Pump is shut off. Sample looked good. Same place as previous two samples. Tmax=256 T2=64.	Castle	219	Butterfield
J965-HFS-04	J2-965	2017/07/16	19:26:58	45.92620	-129.98003	19.9	3.9	1511.6	**J965-HFS-04** DNA filter #10. Start 19:26. Stop 19:53. T1=2.2 Volume=3000ml. Taken while in transit at International District (El Abuelo; El Guapo; 9m Chimney; Hermosa). End position 45.92653/-129.97956. For Carol Stepien.	Int'l District transit	335	Stepien
J965-HFS-05	J2-965	2017/07/16	19:55:07	45.92620	-129.98003	256.3	14.8	1501.0	**J965-HFS-05** Unfiltered Bag #16. Start 19:55. Stop 19:58. T1=2.2 Vol=500ml. Ambient near El Guapo. Bag #16. Good exhaust.	El Guapo	428	Butterfield

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J965-HFS-06	J2-965	2017/07/16	20:04:42	45.92620	-129.98003	245.6	15.1	1501.1	**J965-HFS-06** Unfiltered Piston #3 Start 20:04. Stop 20:08.Tmax=340.8 Tavg=328 T2=100 vol=400. Good exhaust. Seeing sulfide worms limpets and palm worms. Top of El Guapo.	El Guapo	461	Butterfield
J965-HFS-07	J2-965	2017/07/16	20:09:21	45.92620	-129.98003	245.5	15.1	1501.1	**J965-HFS-07** Unfiltered Piston #4 Start 20:09. Stop 20:13. Tmax=341.9 Tavg=341 T2=100 vol=500. Same exact location. FAILED SAMPLE 32ml total.	El Guapo	473	Butterfield
J965-HFS-08	J2-965	2017/07/16	20:13:52	45.92651	-129.97952	245.3	13.7	1501.2	**J965-HFS-08** Filtered Piston #7 Start20:15. Stop 20:16:53. Tmax=341.5 Tavg=341.2 T2=70. Volume=425. Same place.	El Guapo	486	Butterfield
J965-GTHFS-09	J2-965	2017/07/16	20:18:56	45.92651	-129.97952	245.0	14.0	1501.2	**J965-GTHFS-09** Fired. GT #12 (Green-Yellow). (Tmax for HFS at same site is 341.5degC and Tmax with Jason probe is 339.55degC.)	El Guapo	501	Baumberger
J965-GTB-10	J2-965	2017/07/16	20:32:50	45.92651	-129.97952	245.4	13.3	1501.3	**J965-GTB-10** Sample triggered using a two armed approach. At same location as previous HFS/GTHFS samples. (Tmax for HFS at same site is 341.5degC and Tmax with Jason probe is 339.55degC.)	El Guapo	538	Baumberger
J965-Geo-11	J2-965	2017/07/16	20:50:09	45.92651	-129.97952	244.2	13.9	1501.3	**J965-GEO-11** Sample of chimney wall at top of El Guapo near HFS and gas samples. Placed in aft-port quadrant of milk crate.	El Guapo	584	James Holden
J965-Geo-12	J2-965	2017/07/16	20:51:59	45.92651	-129.97952	244.4	13.2	1501.4	**J965-GEO-12** Additional piece of chimney from El Guapo top. Can see chalcopyrite on sample. Placed in stbd biobox.	El Guapo	591	James Holden

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J965-HFS-13	J2-965	2017/07/16	21:14:19	45.92641	-129.97896	60.0	0.8	1518.1	**J965-HFS-13** at Diva. Unfiltered Titanium piston #5. Start 21:14. Stop 21:16. Tmax=173 Tavg=163 T2=60 Vol=375ml. Chimney knocked down before sampling.	Diva	661	Butterfield
J965-HFS-14	J2-965	2017/07/16	21:20:35	45.92641	-129.97896	59.9	0.8	1518.1	**J965-HFS-14** Filtered Piston #8. Start 21:20. Stop 21:23.Tmax=221 Tavg=213 T2=56 Vol=325. Good exhaust. Same place at Diva.	Diva	679	Butterfield
J965-GTB-15	J2-965	2017/07/16	21:35:19	45.92641	-129.97896	63.1	0.8	1518.3	**J965-GTB-15** (GT-16 Orange) Fired.Tmax=229degC. Same place at Diva.	Diva	720	Baumberger
J965-GTB-16	J2-965	2017/07/16	21:48:19	45.92641	-129.97896	63.0	0.8	1518.4	**J965-GTB-16** (GT-17 White). Fired. Placed in vent at slightly different spot than GTB-15 in same orifice. Nozzle was clean after firing; flow rate seems high. Tmax with Jason probe=273.96degC. At Diva.	Diva	758	Baumberger
J965-HFS-17	J2-965	2017/07/16	22:21:52	45.92628	-129.97903	213.3	1.3	1520.2	**J965-HFS-17** Filtered Piston #9 at Tiny Towers (blue mat present).	Tiny Towers	870	Butterfield
J965-HFS-17	J2-965	2017/07/16	22:22:03	45.92628	-129.97903	213.3	1.3	1520.2	**J965-HFS-17** Filtered Piston #9 at Tiny Towers (blue mat present). Start 22:22. Stop 22:25. Tmax=173.7 Tavg=173.4 T2=65 Vol=475.	Tiny Towers	871	Butterfield
J965-HFS-18	J2-965	2017/07/16	22:27:15	45.92628	-129.97903	213.4	1.3	1520.3	**J965-HFS-18** Unfiltered Bag #17 Start 22:27. Stop 22:30. . Tmax=173.6 Tavg=173.5 T2=60 Vol=375. Same position as last samples at Tiny Towers.	Tiny Towers	891	Butterfield

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J965-HFS-19	J2-965	2017/07/16	22:54:22	45.92628	-129.97903	233.1	112.9	1403.9	**J965-HFS-19** DNA filter #11. Start. 22:54 at Diva transit to Mkr-113 Vent site. Stop 23:27. T1= 2.2degC. At about 1400 m. DNA sample for Carol Stepien.	Transit	915	Stepien
J965-HFS-20	J2-965	2017/07/17	00:12:54	45.92276	-129.98815	12.4	3.3	1519.7	**J965-HFS-20** Unfiltered Bag #18. At Mkr-113 Vent in 15.5degC. Start 00:12. Stop 00:16. Tmax=16.4 Tavg=15.9 T2=9 vol=500. In tubeworm patch near the recovered MTR with good diffuse flow.	Mkr-113 Vent	1027	Butterfield
J965-HFS-21	J2-965	2017/07/17	00:17:35	45.92276	-129.98815	12.2	3.3	1519.7	**J965-HFS-21** Unfiltered Bag #19 Unfiltered. Start 00:17. Stop 00:20. Tmax=16.8 Tavg=16.0 T2=8.5 vol=500. Good exhaust. Same location as HFS-20.	Mkr-113 Vent	1045	Butterfield
J965-HFS-22	J2-965	2017/07/17	00:22:31	45.92276	-129.98815	12.2	3.3	1519.7	**J965-HFS-22** DNA filter #13 Start 00:22. Stop 00:50. Tmax=16.9 Tavg=15.6 T2=9.1. Vol=3501ml. For Julie Huber. Same location at Mkr-113 Vent.	Mkr-113 Vent	1060	Julie Huber
J965-HFS-23	J2-965	2017/07/17	00:52:34	45.92276	-129.98815	11.5	3.2	1519.8	**J965-HFS-23** Filtered Bag #21. Start 00:52. Stop 00:54. Tmax=16.1 Tavg=15.6 T2=8.9. Vol=352ml. Same location.	Mkr-113 Vent	1137	Butterfield
J965-HFS-24	J2-965	2017/07/17	00:57:09	45.92276	-129.98815	11.7	3.2	1519.8	**J965-HFS-24** Filtered Bag #22 Start 00:57. Stop 00:59. Tmax=16.4 Tavg=16.2 T2=9.2. Vol=352ml. Same location.	Mkr-113 Vent	1151	Butterfield
J965-HFS-25	J2-965	2017/07/17	01:45:09	45.92276	-129.98815	75.5	0.8	1519.9	**J965-HFS-25** Unfiltered bag #20. Start 01:44. Stop 01:47. Tmax=2.0 Tavg=2.0 T2=2.2 Vol=400ml. In vicinity of Mkr-113 Vent in a clam patch.	Mkr-113 Vent	1279	Butterfield

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J965-HFS-26	J2-965	2017/07/17	01:57:48	45.92258	-129.98777	216.9	105.3	1416.3	**J965-HFS-26** DNA Filter #14 on the ascent. This will take ~25 minutes. Z=1427 Alt=100. (Finished at 0224. Tmax=3.7 Tavg=2.9 Vol=3500ml.)	Ascent	1313	Stepien
J966-HFS-01	J2-966	2017/07/19	18:27:54	45.93366	-130.01322	195.6	1.2	1540.5	**J966-HFS-01** Unfiltered Piston #1 Start 18:27. Stop 18:29. Virgin Vent. Tmax=209.5 Tavg=202 T2=78 Vol=300ml. Got up to 223degC. Good exhaust. Down to 217deg so slightly mixed.	Virgin Vent	6749	Butterfield
J966-HFS-02	J2-966	2017/07/19	18:31:39	45.93366	-130.01322	195.6	1.2	1540.5	**J966-HFS-02** Filtered Piston #9 Start 18:31. Stop 18:34. Tmax=232.2 Tavg=228 T2=70 vol=325ml. Exact same location.	Virgin Vent	6761	Butterfield
J966-HFS-03	J2-966	2017/07/19	18:35:45	45.93366	-130.01322	195.5	1.2	1540.4	**J966-HFS-03** Unfiltered Piston #2 Start18:35. Stop 18:37. Tmax=237.4 Tavg=231 T2=64 vol=325ml. Same exact location.	Virgin Vent	6772	Butterfield
J966-GTB-04	J2-966	2017/07/19	18:57:40	45.93366	-130.01322	194.3	1.2	1540.3	**J966-GTB-04** GTB Red GT-9. Sample triggered using a two handed approach. Bottle moved significantly while triggered. Same location as HFS samples.	Virgin Vent	6839	Baumberger
J966-GTB-05	J2-966	2017/07/19	19:12:08	45.93366	-130.01322	147.6	0.8	1540.1	**J966-GTB-05** Greed/Red GT-7. Triggered using a two-armed approach. Same location at different heading at Virgin-positioned in good flow.	Virgin Vent	6876	Baumberger
J966-Geo-06	J2-966	2017/07/19	19:44:58	45.93356	-130.01367	271.8	3.7	1537.6	**J966-GEO-06**. Piece of chimney on side of Inferno Vent encased in diffuse flow. Covered in a biological mat. Small piece. Placed in port-side biobox.	Inferno Vent	6968	James Holden

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J966-HFS-07	J2-966	2017/07/19	20:06:34	45.93356	-130.01367	258.0	4.5	1537.1	**J966-HFS-07** Unfiltered Piston #3. Start 20:06. Stop 20:09. Tmax= 305.7 Tavg=305.2 T2=98.0 Vol=500. From Inferno Vent where structural vent removed prior to sampling flow.	Inferno Vent	7024	Butterfield
J966-HFS-08	J2-966	2017/07/19	20:10:41	45.93356	-130.01367	258.1	4.5	1537.1	**J966-HFS-08** Unfiltered Piston #4. Start 20:10. Stop 20:13. Tmax=305.9 Tavg=305.3 T2=65.0 Vol=500. Same vent at Inferno.	Inferno Vent	7039	Butterfield
J966-GTB-09	J2-966	2017/07/19	20:16:35	45.93356	-130.01367	258.6	4.6	1537.0	**J966-GTB-09** Fired. GT-12 Green-Yellow at Inferno in same vent as HFS samples. Temperature was stable at 305.7degC. Jason temperature probe was 305degC max.	Inferno Vent	7058	Baumberger
J966-HFS-10	J2-966	2017/07/19	20:19:35	45.93356	-130.01367	258.9	4.6	1537.0	**J966-HFS-10** Filtered Piston #8. Start 20:19. Stop 20:21. Tmax=306.6 Tavg=305.9 T2=70 Vol=400. Same location as previous HFS/GTB.	Inferno Vent	7068	Butterfield
J966-Geo-11	J2-966	2017/07/19	20:37:40	45.93356	-130.01367	258.8	4.6	1536.9	**J966-GEO-11** A small sample of the Inferno chimney was placed in the port-side biobox. Sample crumbled and consisted primarily of tubeworms taken from same area as fluid samples.	Inferno Vent	7117	James Holden
J966-HFS-12	J2-966	2017/07/19	20:53:25	45.93332	-130.01396	184.9	4.2	1537.1	**J966-HFS-12** Unfiltered piston #5 Start 20:56. Stop 20:59. Tmax=293.3 Tavg=287.8 T2=90 Vol=500. Hell Vent top where active structural part of chimney removed prior to sampling.	Hell Vent	7159	Butterfield

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J966-HFS-13	J2-966	2017/07/19	21:00:37	45.93332	-130.01396	185.8	4.2	1537.1	**J966-HFS-13** Filtered Piston #7. Start 21:00. Stop 21:04. Tmax=298.2 Tavg=297.1 T2=95 Vol=500. Same location as previous sample.	Hell Vent	7180	Butterfield
J966-GTHFS-14	J2-966	2017/07/19	21:05:59	45.93332	-130.01396	186.2	4.2	1537.1	**J966-GTHFS-14** GT-11 (Nude). Triggered. Tmax=297degC. Same location at Hell.	Hell Vent	7195	Baumberger
J966-HFS-15	J2-966	2017/07/19	21:22:26	45.93325	-130.01379	239.5	0.8	1539.4	**J966-HFS-15** Unfiltered Bag #16. Start 21:22. Stop 21:35. Tmax=28.0 Tavg=25.4 T2=13.0 Vol=500ml. Anemone Vent positioned into a lower vent site (first area was only 4degC).	Anemone Vent	7245	Butterfield
J966-HFS-16	J2-966	2017/07/19	21:26:44	45.93325	-130.01379	239.5	0.8	1539.4	**J966-HFS-16** Unfiltered Bag #17 Start21:26. Stop 21:29. Tmax=28.7 Tavg-26.2 T2=13 Vol=500ml. Same location as previous sample.	Anemone Vent	7260	Butterfield
J966-HFS-17	J2-966	2017/07/19	21:33:54	45.93325	-130.01379	240.0	0.8	1539.3	**J966-HFS-17** DNA filter Sample #13. Start 21:33. Stop 21:50. Tmax=22.8 Tavg=16.9 t2=11 Vol=2156. Same location.	Anemone Vent	7280	Julie Huber
J967-HFS-01	J2-967	2017/07/20	08:44:19	45.91742	-129.99299	303.0	0.8	1531.5	**J967-HFS-01** Unfiltered Piston #1. Start 08:44. Stop 08:46. Tmax=296.5 Tavg=295.9 T2=70 Vol=400. Casper Vent directly in the high-temperature flow.	Casper Vent	7431	Butterfield
J967-GTHFS-02	J2-967	2017/07/20	08:48:15	45.91742	-129.99299	303.0	0.8	1531.4	**J967-GTHFS-02** Sample triggered. Temp=296.4degC. GT-10 (orange-blue) taken in same place as HFS-01.	Casper Vent	7444	Baumberger
J967-HFS-03	J2-967	2017/07/20	09:02:10	45.91736	-129.99300	275.0	0.9	1530.9	**J967-HFS-03** Unfiltered Piston #2. Start 09:02. Stop 09:05. Tmax=322.8 Tavg=322.2 T2=95 Vol=400. Vixen Vent. Good exhaust.	Vixen Vent	7486	Butterfield

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J967-HFS-04	J2-967	2017/07/20	09:07:22	45.91736	-129.99300	275.0	0.9	1530.9	**J967-HFS-04** Starting filtered piston #9. Start 09:07. Stop 09:09. Tmax=323.5 Tavg=323.3 T2=101 Vol=375. Same location at Vixen.	Vixen Vent	7503	Butterfield
J967-GTHFS-05	J2-967	2017/07/20	09:10:21	45.91736	-129.99300	275.1	0.9	1530.9	**J967-GTHFS-05**. Triggered. GT-16 (orange). Tmax=323. Same location at Vixen.	Vixen Vent	7515	Baumberger
J967-HFS-06	J2-967	2017/07/20	13:50:53	45.93317	-129.98233	189.0	0.8	1513.3	**J967-HFS-06** Start 13:51. Stop 13:55. Unfiltered Bag #16. Tmax=25.4 Tavg=24.9 T2-10.4 Vol=500ml. In "snow-blower" hole at Mkr-33 Vent site. Good exhaust. Floc coming out of vent.	Mkr-33 Vent	8145	Butterfield
J967-HFS-07	J2-967	2017/07/20	13:56:06	45.93317	-129.98233	189.1	0.8	1513.3	**J967-HFS-07** Start 13:56. Stop 13:59. Unfiltered bag #17. Tmax=25.0 Tavg=24.5 T2=10.5 Vol=500ml. Same location at Mkr-33 Vent.	Mkr-33 Vent	8161	Butterfield
J967-HFS-08	J2-967	2017/07/20	14:02:32	45.93317	-129.98233	189.1	0.8	1513.4	**J967-HFS-08**. DNA filter #13 Start 14:02. Stop 14:25. Tmax= 28.0 Tavg=27.1 T2=12 Vol=3000. Same location at Mkr-33 Vent.	Mkr-33 Vent	8183	Julie Huber
J967-HFS-09	J2-967	2017/07/20	14:29:57	45.93317	-129.98233	188.6	0.8	1513.6	**J967-HFS-09** Filtered bag #21. Start 14:30. Stop 14:34. Tmax=28.4 Tavg=27.7 T2=12.5 Vol=500ml. Same location at Mkr-33 Vent.	Mkr-33 Vent	8258	Butterfield
J967-HFS-10	J2-967	2017/07/20	14:47:52	45.93335	-129.98225	354.9	4.0	1510.1	**J967-HFS-10** DNA filter #14 for Carol Stepien. Sample during transit from Mkr-33 to Trevi. Start 14:48. Stop 15:27. Tmax=2.2 Tavg=2.1 T2=2.2 Volume=5000ml.	Trevi Vent	8306	Stepien

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J967-HFS-11	J2-967	2017/07/20	17:21:25	45.94629	-129.98375	283.6	1.0	1518.1	**J967-HFS-11** Start 17:21. Stop 17:24. Unfiltered Piston #3. Tmax=231 Tavg=230.3 T2=66 vol=400ml. Good exhaust. Same location at Trevi.	Trevi Vent	8698	Butterfield
J967-HFS-12	J2-967	2017/07/20	17:24:58	45.94629	-129.98375	283.2	1.1	1518.1	**J967-HFS-12** Unfiltered Piston #4. Start 17:25. Stop 17:28. Tmax=230.3 Tavg=219 T2=68 vol=475. Not seeing exhaust. Same location at Trevi.	Trevi Vent	8710	Butterfield
J967-HFS-13	J2-967	2017/07/20	17:29:40	45.94629	-129.98375	283.4	1.0	1518.1	**J967-HFS-13** Filtered Piston #8 Start 17:30. Stop 17:32. Tmax=231 Tavg=230.7 T2=77 vol=400ml. Same location. Good exhaust.	Trevi Vent	8726	Butterfield
J967-GTB-14	J2-967	2017/07/20	17:51:47	45.94629	-129.98375	282.4	0.8	1518.2	**J967-GTB-14** Fired. Black GTB #5. Trevi Vent in the same place as the 230deg HFS samples. Had to bend the wand tip before firing.	Trevi Vent	8790	Baumberger
J967-GTB-15	J2-967	2017/07/20	17:58:48	45.94629	-129.98375	284.4	114.0	1518.2	**J967-GTB-15** White GT-17 Fired at Trevi. Good placement.	Trevi Vent	8809	Baumberger
J967-HFS-16	J2-967	2017/07/20	19:19:03	45.94370	-129.98520	336.3	0.8	1520.4	**J967-HFS-16** Unfiltered Bag Sample #18 Start 19:19. Stop 19:21. Tmax=24.4 Tavg=24.2 T2=12 Vol=400. At location where MTR was recovered at Mkr-N3 Vent.	Mkr-N3 Vent	9030	Butterfield
J967-HFS-17	J2-967	2017/07/20	19:24:23	45.94370	-129.98520	336.4	0.8	1520.4	**J967-HFS-17** Filtered Piston #7 Start 19:23. Stop 19:27. Tmax=24.5 Tavg=24.4 T2=12 Vol=550. Same location at Mkr-N3 Vent.	Mkr-N3 Vent	9044	Butterfield
J967-HFS-18	J2-967	2017/07/20	19:27:51	45.94370	-129.98520	336.3	0.8	1520.4	**J967-HFS-18** DNA Filter #15 Start 19:28. Stop 19:49. Tmax=24.6 Tavg=24.3 T2=12 Vol=3000 mL. Same location at Mkr-N3 Vent.	Mkr-N3 Vent	9056	Julie Huber

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J967-GTB-19	J2-967	2017/07/20	19:58:31	45.94370	-129.98520	336.3	0.8	1520.2	**J967-GTB-19** Fired. GTB-2 Green. Same location at Mkr-N3 Vent.	Mkr-N3 Vent	9138	Baumberger
J967-HFS-20	J2-967	2017/07/20	20:08:15	45.94376	-129.98521	339.4	1.4	1519.7	**J967-HFS-20** We are running another DNA sample as we transit from Mkr135 at Mkr-N3 Vent to AX104 (Bag City). Stop 20:45 Tmax=2.9 T2=2.2 Vol=5000	Transit	9168	Stepien
J967-HFS-21	J2-967	2017/07/21	00:47:27	45.91626	-129.98937	200.4	0.9	1528.8	**J967-HFS-21** Unfiltered bag #19. In high-diffuse flow and tubeworm bush with Jason temp of 13.4. Start 00:47. Stop 00:51. Tmax=13.6 Tavg=13.4 Vol=502ml T2=7.3. Bag City.	Bag City Vent	9793	Butterfield
J967-HFS-22	J2-967	2017/07/21	00:51:15	45.91626	-129.98937	200.4	0.9	1528.8	**J967-HFS-22** Unfiltered Bag #20 Start 00:51. Stop 00:55. Tmax=13.1 Tavg=12.8 T2=7.4 Vol=494ml. Had to start pump manually. Same location at Bag City.	Bag City Vent	9804	Butterfield
J967-HFS-23	J2-967	2017/07/21	00:55:44	45.91626	-129.98937	200.3	1.0	1528.8	**J967-HFS-23** Filtered Bag #22. Start00:56. Stop 00:59. Tmax=13.1 Tavg=12.8 Vol=495ml T2=6.4. Same location at Bag City.	Bag City Vent	9820	Butterfield
J967-HFS-24	J2-967	2017/07/21	01:00:32	45.91626	-129.98937	200.4	0.9	1528.8	**J967-HFS-24** DNA filter #10. Start 01:00. Stop 01:22. Vol=3000ml Tmax=13.3 Tavg=12.6 T2=6.8. Same location at Bag City.	Bag City Vent	9832	Julie Huber

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J967-Geo-27	J2-967	2017/07/21	09:38:34	45.86324	-130.00368	56.4	1.2	1717.3	**J967-GEO-27**. Piece of intact pillow from 1998 flow just past where new lava flowed out of the fissure. Small bud below a tube spanning two pillows. Some glass shattered off rock while sampling. Put into milk crate. (Sample number out of order as recorded after dive). South Pillow Mounds. (Teaching specimen)	South Pillow Mounds	10066	Scott Nooner
J967-Geo-28.	J2-967	2017/07/21	10:19:04	45.86470	-130.00339	7.4	1.0	1716.8	**J967-GEO-28**. Grabbed piece of freshly crushed bud from striated pillow. Can see upper glass layer. Pillow adjacent to flatter-smaller intact lavas. 1998 lava flow. (Sample number out of order as recorded after dive). South Pillow Mounds. (Teaching specimen)	South Pillow Mounds	10150	Scott Nooner
J967-Geo-25	J2-967	2017/07/21	11:01:34	45.86720	-130.00211	89.9	1.0	1708.8	**J967-GEO-25**. Here in the 2011 lava flow. In a little mound surrounded by 1998 flow. Sampled a 2011 pillow toe. Put in stbd milkcrate.	South Pillow Mounds	10235	Clague / Rubin
J967-Geo-26	J2-967	2017/07/21	12:00:33	45.86922	-129.99852	88.5	1.2	1723.2	**J967-GEO-26** Large pillow toe from 2011 flow surrounded by 1998 flow. Put in stbd biobox.	South Pillow Mounds	10426	Clague / Rubin
J968-Geo-01	J2-968	2017/07/21	22:07:10	46.12069	-129.96967	357.9	1.2	1765.0	**J968-GEO-01**. Little black chimney at the top of a mound. Some bag creatures nearby. Same location visited by MBARI in 2016.	Prosecco	10606	Kashyap / Holden / Butterfield

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J968-HFS-02	J2-968	2017/07/21	22:16:55	46.12069	-129.96967	357.7	1.1	1765.0	**J968-HFS-02** Unfiltered piston #9. Start 22:18. Stop 22:20. Tmax=317.9 Tavg=317.6 T2=40 Vol=500ml. From hole created by taking sample geo-01. Snails, sulfide worms and some bacterial mat.	Prosecco	10638	Butterfield
J968-HFS-03	J2-968	2017/07/21	22:20:55	46.12069	-129.96967	357.7	1.1	1765.0	**J968-HFS-03** Unfiltered piston #8. Start 22:21. Stop 22:24. Tmax=317.6 Tavg=316 T2=40 Vol=500ml. Same location.	Prosecco	10654	Butterfield
J968-HFS-04	J2-968	2017/07/21	22:25:55	46.12069	-129.96967	357.9	1.2	1764.9	**J968-HFS-04** Unfiltered bag #17. Start 22:26. Stop 22:28. Tmax=317.5 Tavg=316.6 T2=40 Vol=300. Good exhaust. Same location.	Prosecco	10672	Butterfield
J968-HFS-05	J2-968	2017/07/21	22:30:02	46.12069	-129.96967	358.0	1.2	1764.9	**J968-HFS-05** Unfiltered Piston #1. Start 22:30. Stop 22:33. Tmax=318.2 Tavg=317.7 T2=42 Vol=500C. Same location.	Prosecco	10686	Butterfield
J968-GTHFS-06	J2-968	2017/07/21	22:34:29	46.12069	-129.96967	358.1	1.2	1764.9	**J968-GTHFS-06** Fired at same location as HFS samples at chimney sample hole. Blue-orange GTHFS sample Temp=317.5.	Prosecco	10700	Baumberger
J968-GTB-07	J2-968	2017/07/21	22:40:51	46.12069	-129.96967	357.8	1.2	1764.9	**J968-GTB-07** (gas tight bottle) in the same orifice as the previous HFS samples. Firing. Red GTB-09 at same location. Jason temperature 314degC.	Prosecco	10717	Baumberger
J968-HFS-08	J2-968	2017/07/21	23:06:56	46.12067	-129.96967	206.3	0.8	1764.6	**J968-HFS-08** Unfiltered bag #18. Start 23:07. Stop 23:10. Tmax=25.2 Tavg=21.2 T2=6 Vol=475. On other side of Prosecco vent mound from hi-temp HFS samples in diffuse flow between pillow lobes with white and orange mat. Slight change in position.	Prosecco	10796	Butterfield

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J968-HFS-09	J2-968	2017/07/21	23:10:56	46.12067	-129.96967	206.1	0.8	1764.5	**J968-HFS-09**. Unfiltered bag #19. Start 23:11. Stop 23:14. Tmax=26.2 Tavg=23.5 T2=6 Vol=475ml. Same location as HFS-08.	Prosecco	10809	Butterfield
J968-HFS-10	J2-968	2017/07/21	23:15:20	46.12067	-129.96967	206.1	0.8	1764.5	**J968-HFS-10**. DNA filter #13. Start 23:15. Stop 23:37. TMax=21.6 Tavg=19.4 T2=5 vol=2500ml. Same location in diffuse flow. (For Julie Huber) Saw gas bubbles from flow in back of vehicle on cameras.	Prosecco	10822	Julie Huber
J968-Geo-11	J2-968	2017/07/22	00:04:50	46.12023	-129.96995	103.0	0.8	1769.9	**J968-GEO-11** Suction of the sulfur deposits at the Liminocello site. Getting some other sediment as well. Small snails on frozen-molten sulfur. Shook sample hose and took second 2 more suctions of the site. Tilted hose up to ensure sample got into the chamber.	Liminocello	10988	Butterfield
J967-HFS-12	J2-968	2017/07/22	00:41:11	46.12028	-129.97046	299.1	1.5	1763.8	**J967-HFS-12** Unfiltered piston #4. Start 00:41. Stop 00:44. Tmax=246 Tavg=244.7 T2=28 Vol=500ml. Area with many chimneys and black smoke. Chimneys are small and thin. Palm worms already here. Sample site is where a chimney was removed for a sample but sample of chimney not successful.	Kahlua	11115	Butterfield
J967-HFS-13	J2-968	2017/07/22	00:44:36	46.12028	-129.97046	299.1	1.4	1763.8	**J967-HFS-13** Unfiltered piston #5. Start 00:45. Stop 00:47. Tmax=247.7 Tavg=245.3 T2=29 Vol=500ml. Same location as previous sample.	Kahlua	11128	Butterfield
J967-GTHFS-14	J2-968	2017/07/22	00:50:01	46.12028	-129.97046	299.1	1.5	1763.8	**J967-GTHFS-14** GT-7 Red-green in same orifice as previous samples here at Kahlua Site.	Kahlua	11144	Baumberger

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J968-HFS-15	J2-968	2017/07/22	01:28:59	46.11997	-129.97060	22.4	0.8	1764.4	**J968-HFS-15** Start. Filtered Bag #23. Start 01:29. Stop 01:32. Tmax=37.3 Tavg=37.0 T2=2 vol=400ml. Area of smoking chimlets and black-diffuse smoke from depressions with bag creatures. Good exhaust. Reset flush pump and Beast working better after.	Sambuca	11293	Butterfield
J968-HFS-16	J2-968	2017/07/22	01:36:42	46.11997	-129.97060	22.1	0.8	1764.4	**J968-HFS-16** Unfiltered Bag #20. Start 01:37. Stop 01:39. Tmax=35 Tavg=34 T2=4 vol=400ml. Same exact location as HFS-15 after reset flush pump and worked better for this sample.	Sambuca	11330	Butterfield
J968-GTB-17	J2-968	2017/07/22	01:55:41	46.11997	-129.97060	345.1	1.0	1764.4	**J968-GTB-17** Fired Nude GT-11 at Sambuca's tallest chimlet near the previous sample site. Jason temp probe T=312degC.	Sambuca	11402	Baumberger
J969-Geo-01	J2-969	2017/07/22	12:20:17	45.97191	-129.99667	334.0	3.1	1527.6	**J969-GEO-01** Crust near the 2015 eruptive fissure. Lobe (pillow-like) flow with collapse off to the side. Piece of upper crust with glassy surface. Placed in forward port side bin 5.	Axial caldera	11505	Clague / Rubin
J969-Geo-02	J2-969	2017/07/22	12:34:23	45.97311	-129.99675	50.5	0.8	1526.7	**J969-GEO-02**. Grabbing a piece of jumbled lobate from the edge of the collapse. Small fist-sized piece of thin glassy crust. Grabbed several pieces; shiny and fragile. In front-stbd center rock box.	Axial caldera	11568	Clague / Rubin
J969-Geo-03	J2-969	2017/07/22	12:50:30	45.97365	-129.99585	68.3	1.0	1524.3	**J969-GEO-03** Piece of smooth pillow lobate. Small glassy lobate. Smooth exterior. Taken at the contact between 2015 lavas and the talus of the eastern caldera wall. Into bin 3.	Axial caldera	11634	Clague / Rubin

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J969-Geo-04	J2-969	2017/07/22	13:10:04	45.97516	-129.99635	344.1	1.6	1525.3	**J969-GEO-04**. Piece of jumbled 2015 lava right at the contact with the talus. Thin glass crust. Platy.	Axial caldera	11720	Clague / Rubin
J969-Geo-05	J2-969	2017/07/22	15:16:33	45.98859	-129.99859	332.8	1.7	1471.7	**J969-GEO-05** Piece of skin of newly erupted lava pillow on a fissure. Took a second piece. Forward-port quadrant of stbd rock box.	Axial East Rim	12264	Clague / Rubin
J969-Geo-06	J2-969	2017/07/22	15:28:27	45.99017	-129.99914	351.0	0.9	1472.4	**J969-GEO-06** Piece of fresh skin on east side of where lava overflowed fissure on east side. Piece from overflow near top of fissure. Very glassy and covered with sediment. In the stbd rock box front-stbd quadrant. Took 3 pieces.	Axial East Rim	12316	Clague / Rubin
J969-Geo-07	J2-969	2017/07/22	15:35:02	45.99071	-129.99938	29.8	1.3	1472.9	**J969-GEO-07** Piece of new flow crust a little more than halfway to waypoint #10 from #9. Crust over-topping the fissure on its east side. Fissure has heavy ash sediment on top. Aft-port section of center rock box.	Axial East Rim	12349	Clague / Rubin
J969-Geo-08	J2-969	2017/07/22	15:51:13	45.99241	-129.99960	3.2	0.8	1473.9	**J969-GEO-08** Piece of this newly collapsed skin (when Jason was setting up) of the flow on top of the older sediment covered substrate-small Kipuka. Area with more significant extrusion of lava on top of ash sediment. Aft-stbd compartment of center rock box.	Axial East Rim	12422	Clague / Rubin

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J969-Geo-09	J2-969	2017/07/22	16:05:23	45.99346	-129.99992	263.9	0.8	1477.1	**J969-GEO-09** Piece of collapsed pillow crust from western wall of eruptive fissure. New flow with less sediment than eastern side of fissure. Just west of waypoint 11. Great pointy-lava drips. One piece in port rock box and second piece aft of center rock box. (Display specimen)	Axial East Rim	12493	Clague / Chadwick
J969-Geo-10	J2-969	2017/07/22	16:35:44	45.99412	-130.00111	327.2	0.8	1482.7	**J969-GEO-10** Piece of lineated sheet flow to the west of the fissure. Aft-stbd quadrant of stbd rock box.	Axial East Rim	12607	Clague / Rubin
J969-Geo-11	J2-969	2017/07/22	16:48:00	45.99375	-130.00189	266.6	1.2	1480.1	**J969-GEO-11** Tiny lava "pillar". Under a ledge. Skinny ~ 1 foot tall pillar-looking piece. Area with new lava and sediment. Placed in dive weight box. (Display specimen).	Axial East Rim	12655	Clague / Chadwick
J969-Geo-12	J2-969	2017/07/22	17:49:20	45.99521	-130.00140	339.4	0.8	1483.7	**J969-GEO-12** Piece of crust in the sheet flow at the fissure within the eruptive fissure (western edge visible in sonar). In the weight box with Geo-11 (pillar sample). Sheet flow collapsed as Jason pulled away.	Axial East Rim	12918	Clague / Rubin
J969-Geo-13	J2-969	2017/07/22	17:57:04	45.99575	-130.00169	300.9	1.1	1480.5	**J969-GEO-13** Piece of pillar top in collapse area after large area of sheet flow in the 2015 lava flow. Near western edge of eruptive fissure. Several pieces collected while parked on top of pillar. Pillar collapsing while sampling. Aft-port quadrant of stbd rock box.	Axial East Rim	12952	Clague / Rubin

Sample ID	dive	Date	Time	Latitude	Longitude	Gyro	Alt.	Depth	Description	Location	VV	PI
J969-Geo-14	J2-969	2017/07/22	18:14:18	45.99663	-130.00208	58.6	0.8	1483.2	**J969-GEO-14** Piece of crust from bottom of the wall on edge of the collapse area. Near or in the eruptive fissure. Some sediment. Placed in stbd swing arm biobox.	Axial East Rim	13012	Clague / Rubin

6.6 Jason Dive Logs

This version of the cruise report does include the dive logs (an additional 109 pages). The complete version which includes logs is available online at the Marine Geoscience Data System (MGDS):

www.marine-geo.org.

Additionally both the complete and this short version are available on the NOAA PMEL Earth-Ocean Interactions website at:

https://www.pmel.noaa.gov/eoi/axial_site.html.