Brothers Volcano
March 6-26, 2018
R/V Thomas Thompson, ROV Jason

TN350 Cruise Report

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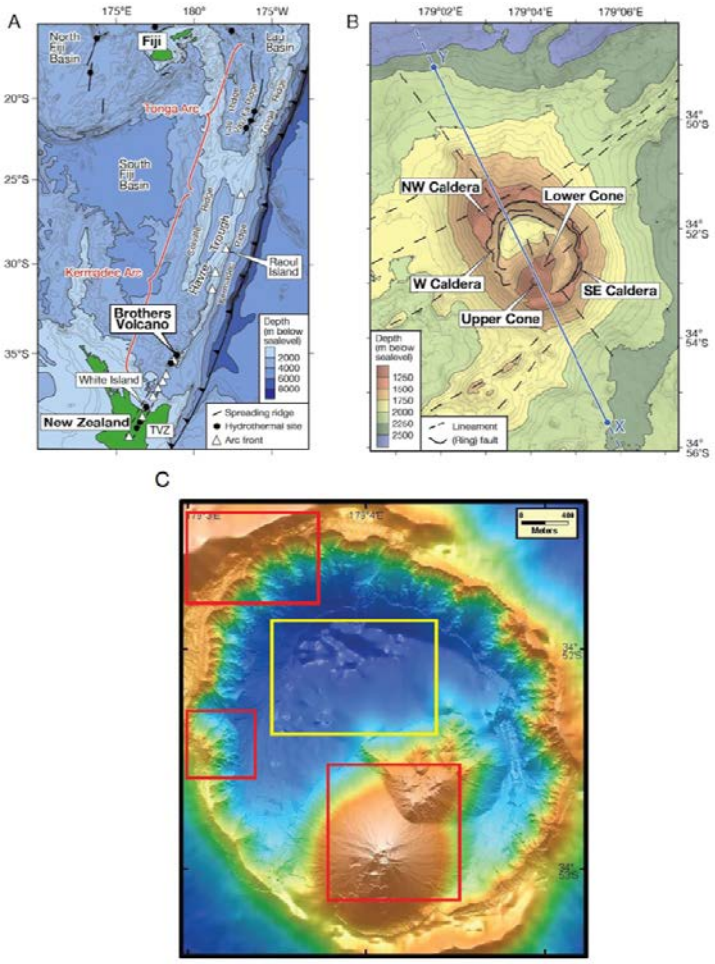
Collaborators: **Cornel de Ronde** and **Fabio Caratori Tontini** (GNS Science)

*Chief Scientist



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Summary of Activities and Sample Collection

We departed Auckland on 6 March 2018 on the R/V *Thomas Thompson* with the remotely operated vehicle (ROV) *Jason* onboard, and arrived on site at Brothers volcano one day later on 7 March. There were a total of five *Jason* deployments (Dives #1037-1041) with nine days lost to weather or technical issues. Thirteen thermal blanket and thirty-one thermal probe measurements provided a comprehensive dataset of heat flux at Brothers volcano from the NW Caldera rim, along the caldera floor, and up the flanks of the Upper and Lower Cone sites. Fourteen Major water samples and fourteen Isobaric Gas-Tight (IGT) samples were taken for geochemical analysis of the fluids. Water samples were taken at almost every site where mineralized samples were collected. A total of thirty rocks and/or mineral (usually chimney) samples were collected and described. All high-temperature chimney samples were sub-sampled and the microbial DNA extracted. In addition to *Jason*-related operations, during weather days we conducted three different magnetometer surveys and four CTDO (conductivity-temperature-depth-optical) deployments. The newly surveyed uppermost part of the Upper Caldera wall was sampled and mapped using the Reson multibeam sonar.

Additional Activities. In addition to the day-to-day operations, science meetings were conducted on a daily basis. During transits, scientific presentations were given by Cornel de Ronde, Lucy Stewart, Gilberto Flores, and Alex Diehl, and were open to all the crew and scientific party. We also maintained a website of the cruise at the newly upgraded *Dive and Discover* site (divediscover.whoi.edu). Data can be obtained from the *Jason* Virtual Van (http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn350/index.html).

Acknowledgements

The success of this cruise reflects the efforts of many people on shore and at sea. First and foremost, Susan Humphris wishes to sincerely thank Anna-Louise Reysenbach for stepping in on short notice as Chief Scientist and assuming responsibility for successfully meeting the science objectives, despite the challenges encountered along the way!

Preparations for the cruise were complicated by the delay in completion of the refit of the R/V *Thomas Thompso*n. We wish to thank the University of Washington Marine Operations Office staff, and in particular, Doug Russell, for their tireless efforts to get the ship to Auckland for our cruise.

Much of the success of the cruise itself relied on the teamwork of the entire shipboard party. the scientists, the *Jason* team, and the crew. We thank Captain Eric Haroldson and the officers and crew of the R/V *Thomas Thompson*, and Ben Tradd and the *Jason* team, for their dedication to completing the scientific objectives of the cruise. We gratefully acknowledge the efforts of the shipboard technicians, Patrick A'Hearn and Steve Jalickee, for their tireless assistance. Much of the science at sea could not have been done without the logistics and equipment support from collaborators at GNS, New Zealand. We also thank the New Zealand government for providing us the access permit to do the research.

This work was funded by the US National Science Foundation and through the support of GNS by the New Zealand government.

Cruise Objectives

Volcanic arcs are the surface expression of magmatic systems that result from the subduction of mostly oceanic lithosphere at convergent plate boundaries. Arcs with a submarine component include intraoceanic arcs and island arcs that span almost 22,000 km on Earth's surface, with the vast majority located in the Pacific region. It is estimated that all intraoceanic arcs combined may contribute hydrothermal emissions equal to ~10% of that from mid-ocean ridges (MORs)

The Kermadec segment of the Kermadec-Tonga intraoceanic volcanic arc has at least thirty-two prominent volcanoes of which 80% are hydrothermally active, making it one of the most active arcs in the world. Hydrothermal activity associated with these arc volcanoes is often magmatically-dominated, in contrast to mid-ocean ridge vent systems, which are dominated by seawater circulation through basaltic oceanic crust. This magmatic hydrothermal signature, coupled with the shallow depths of these volcanoes and high volatile contents, heavily influences the chemistry of the fluids and the mineralization that results from these fluids, and likely has important consequences for the biota associated with these systems. Given the high metal contents and very acidic fluids, these hydrothermal systems are also thought to be important analogs of many porphyry copper and epithermal gold rich deposits mined on land today.

The cruise focused on testing several hypotheses relating to the geometry of hydrothermal circulation at Brothers, the heat and chemical fluxes, and the role of low pH, magmatic volatile-rich hydrothermal fluids on the formation of sulfides, rock alteration, microbial diversity and metabolic pathways in this hydrothermal system. An important secondary objective was to assess potential sites for drilling by the International Ocean Discovery Program (IODP) in May-July 2018 through which we hope to extend our seafloor observations and measurements into the subseafloor to ultimately address overarching questions regarding hydrothermal vent systems hosted in arc volcano settings.

The specific cruise goals were therefore to collect data and samples to:

- *Document the magnitude of conductive heat flux through the caldera floor*
- *Map and image the hydrothermal vent fields and areas around the proposed IODP drill sites*
- *Determine the volcanic stratigraphy at Brothers through detailed caldera floor-to-rim mapping and sampling*
- *Investigate the relation between vent fluid chemistry, mineralization, and the composition of the vent microbiology.*

Summary of ROV *Jason* Dives

<u>Dive 1037</u> (03/8/2018: ~6 hours bottom time)

Prior to the dive, it was evident that the power onboard the R/V *Thompson* was not clean, creating issues with the *Jason* van, including the wall air conditioners in the van. Once this issue was considered resolved, operations commenced. The elevator was deployed on a winch near the proposed IODP drill site on the rim of the NW Caldera.

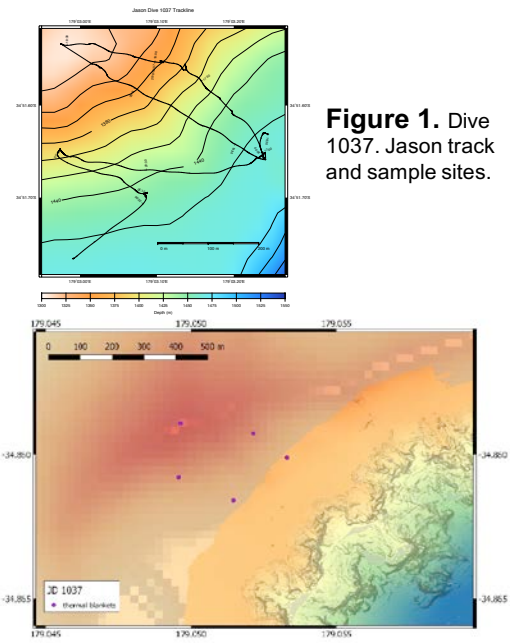


Figure 1. Dive 1037. Jason track and sample sites.

As part of Dive 1037, which was officially an engineering dive, we requested that some science objectives be accomplished; i.e., deployment of heat blankets, and detailed mapping of the recently discovered (January 2017) hydrothermally active area on the Upper Caldera walls, above the rim of the NW Caldera walls.

After initial deployment, a ground fault in the AVTRAK was detected, *Jason* was brought back onboard, the issue resolved, and then *Jason* was redeployed. Once on site, three blankets were collected from the elevator and deployed in the NW Caldera rim area. A further two blankets were then collected and deployed. It then became clear there were unpredictable power issues affecting the *Jason* winch operations, so the dive had to be aborted.

It was determined that the newly configured and overhauled R/V *Thompson* power supply was extremely unreliable and dirty, and could not support *Jason* operations. We returned to Auckland to rent a temporary generator for *Jason* operations.

<u>Dive 1038</u> (03/14-16: ~24 hours bottom time)

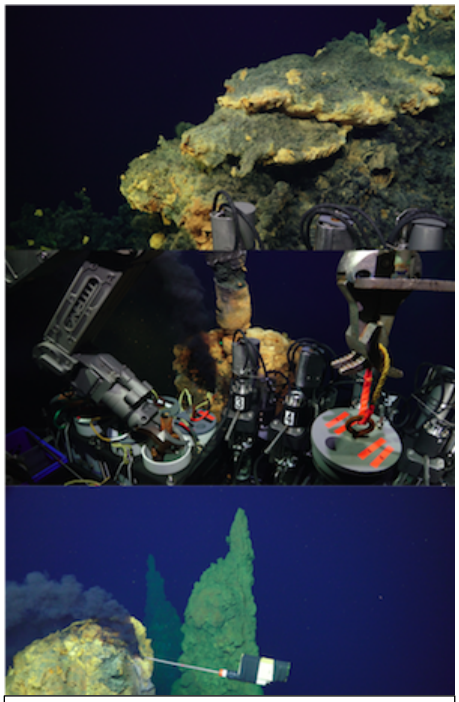
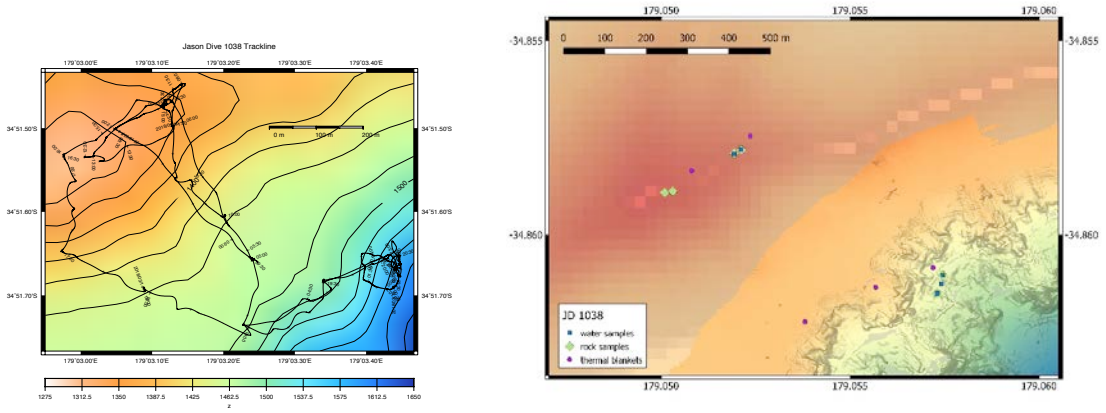


Figure 2. Dive 1038. Upper panel: Flange-like diffuse flow from Upper NW Caldera Rim. Middle: Chimneys at NW Caldera Wall. Lower: HOBO probe deployment at NW Caldera Wall area.

Jason was deployed on the rim above the NW Caldera area near the elevator site, and the blankets that had been deployed on Dive 1037 were retrieved and re-deployed at new sites in the Upper Caldera area and along the caldera rim separating the latter from the NW Caldera area. In between these activities, two diffuse venting flanges were sampled that were discharging fluids between ~42 and 55 ºC. High temperature water samples and chimney samples were also collected, and a HOBO probe was left in one of the vents. Thereafter, the Upper Caldera wall was explored, additional water and chimneys sampled, an additional HOBO probe deployed, and thermal blankets once more re-deployed in this area.

Seven chimney samples for microbiological analyses were recovered and deposited in bio boxes, and an additional three large chimney samples were obtained for geological studies. Four IGT fluid samples were obtained, and four additional fluid samples were collected with the Major water samplers. The heat flow blankets were again re-deployed, heat flow measurements were made with the heat flow probe. The five thermal blankets were retrieved at the end of the dive and transferred to the elevator for return to the surface. One of the HOBO probes was retrieved at the end of the dive.

Fig 3. Dive 1038. Dive track and sample sites



<u>Dive 1039</u> (03/15-16: ~27 hours bottom time)

The objectives of Dive 1039 were to: 1) document with video proposed IODP drill site WC-1A on the caldera floor; 2) transit to the NW Caldera wall to obtain more high-temperature fluids and chimneys from the vent sites perched on the wall; 3) investigate the stockwork zone previously discovered by the *Quest 4000* ROV in 2017; 4) deploy and then re-deploy heat flow blankets on the wall; and 5) retrieve the HOBO probe that was left behind during Dive 1038.

The elevator containing nine heat flow blankets was deployed using a winch near proposed IODP site WC-1A. A marker was deployed at the WC-1A proposed drill site. A thermal blanket was deployed at the same site. All the remaining thermal blankets were deployed along a transect between WC-1A and the northwest caldera wall and then at the southend of the northwest caldera site. The thermal blankets were redeployed midway through the dive to obtain a second set of stations. The HOBO probe that had been inserted in a chimney in the Upper NW Caldera Rim area was recovered. Four IGT and four Major water samples of very high quality were obtained, and a fluid temperature of 318°C for one of the high-temperature fluids was recorded. All eight biochamber pots were filled and several other rocks collected. Excellent video of many of the collection sites were obtained, and we were also able to video in detail the stockwork zone (three different zones were identified) — another first for the 20 years of research done at Brothers. Additionally, we identified a small colony of tubeworms, possibly *Arcovestia ivanovi*, and observed several unusual deep-sea invertebrates. At the end of the dive all nine of the thermal blankets were retrieved and placed into the elevator along with two of the Major water samplers.

Although all goals were accomplished, *Jason* returned to the surface early, primarily because the weather forecast predicted a very rapid, stormy weather change for the afternoon, with winds >20 knots and large swells. As *Jason* surfaced, the weather did indeed change rapidly.

The wind and swell came up very quickly within an hour. The elevator was released from the seafloor in time to be retrieved after the recovery of *Jason*. The elevator was tracked from the seafloor to about 90 m before it was spotted on the surface. What followed remains unclear, but it resulted in the loss of the elevator. A twenty-four hour search commenced that continued through the night until late afternoon the next day. All nine thermal blankets and their data, two Major water samplers and their contained fluids (all belonging to GNS), a MAPR (belonging to NOAA), and other electronics associated with the elevator, were lost.

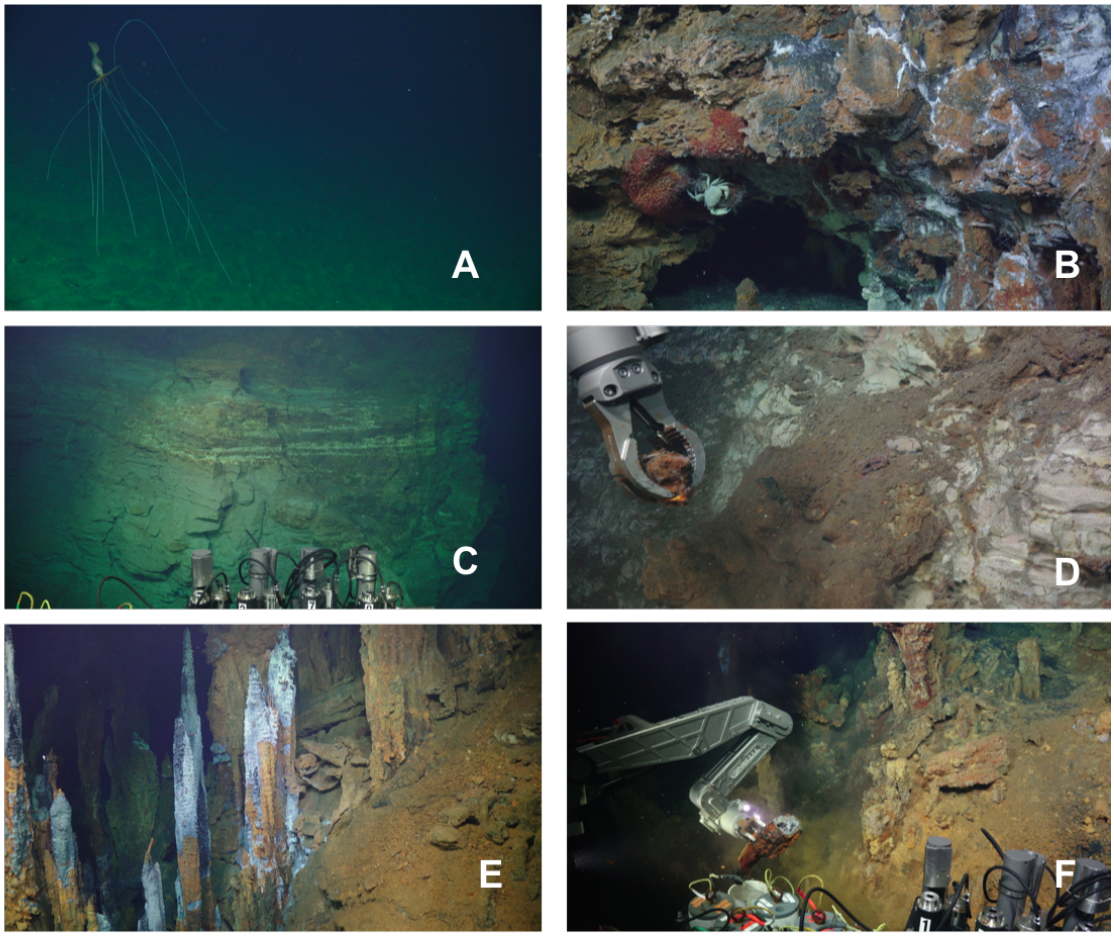


Fig 4. Dive 1039. A. caldera floor- Bigfin squid-- are a group of rarely seen cephalopods in the genus *Magnapinna* and family Magnapinnidae. B. Tubeworm colony, probably *Arcovestia ivanovi* . C and D. lower stock work zone. E and F sampling the chimneys on the NW caldera wall area.

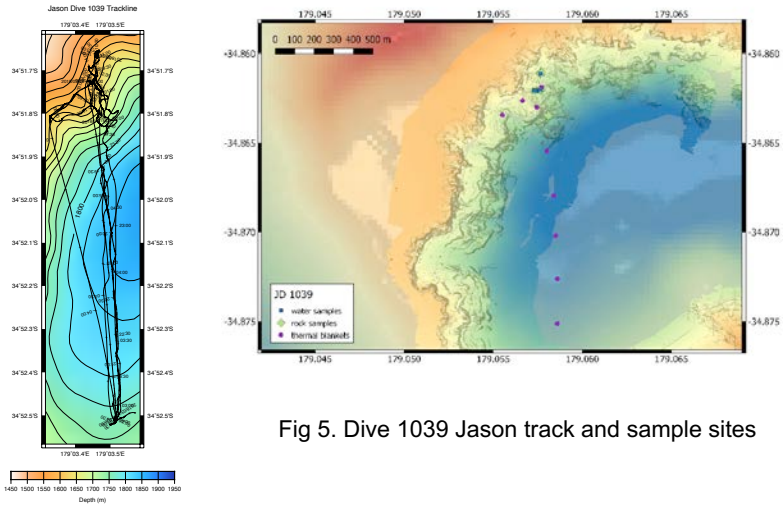


Fig 5. Dive 1039 Jason track and sample sites

<u>Dive 1040</u> (03/16-17: ~12.5 hours bottom time)

This dive accomplished all its primary objectives which were to: 1) conduct numerous heat probe measurements from proposed IODP site WC-1A then up, and over, the Upper Cone; 2) obtain four IGT, four major water samples, and corresponding rock and chimney samples; and 3) retrieve a thermal blanket that had been deployed in January 2017 from the pit crater to the Upper Cone. The dive was not extended because *Medea* (the tether management system for *Jason*) had an issue with its own tether.

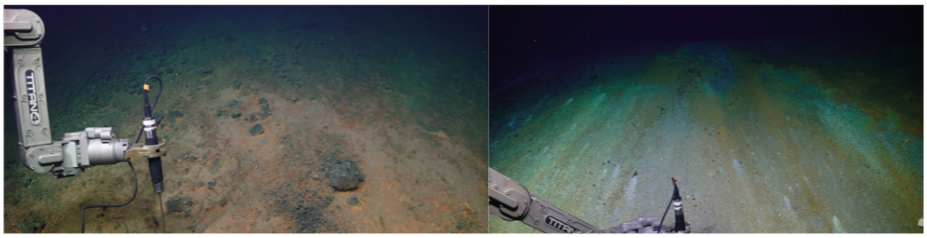


Fig. 6. Examples of heat probe measurements up the cone site.

Figure 6. Examples of heat probe measurements at the Cone site.

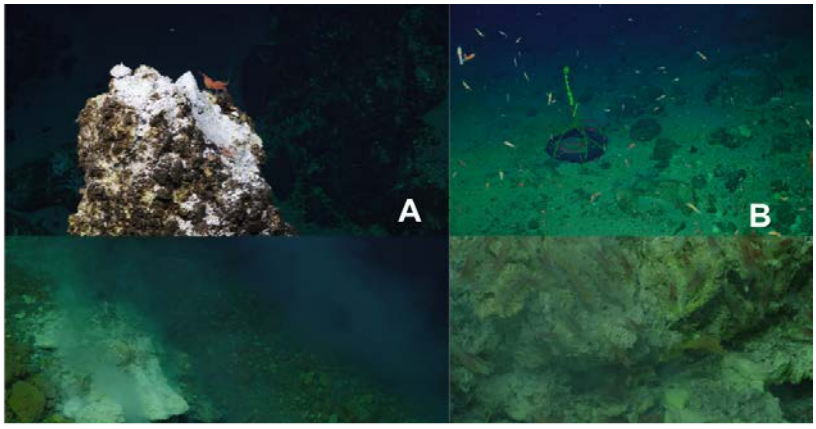


Fig 7. Upper cone site sampling. A. A unite deposits. B. retrieval of an therm a blanket that was deployed in 2017. C and D. Difuse flow sulfur flanges.

Figure 7. Dive 1040: Upper Cone sampling. A. Alunite deposits. B. Retrieval of thermal blanket deployed in 2017. C & D. Diffuse flow from sulfur flanges.

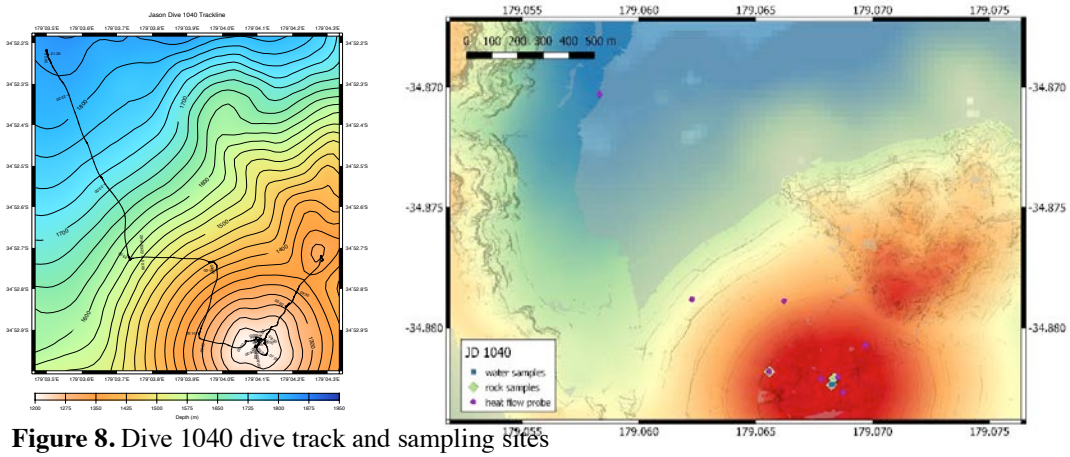


Figure 8. Dive 1040 dive track and sampling sites

<u>Dive 1041</u> (03/23-25" ~49 hours bottom time)

Dive 1041 took advantage of good weather conditions to obtain heat flow probe measurements at all the sites where data had not been retrieved due to loss of the heat flow blankets on the elevator. The dive started on the Lower Cone where a few water and rock samples were recovered. A marker was placed at the proposed IODP alternate drill site SEC-1A. We then headed to the NE Caldera wall to conduct a detailed survey of the rock units that make up this

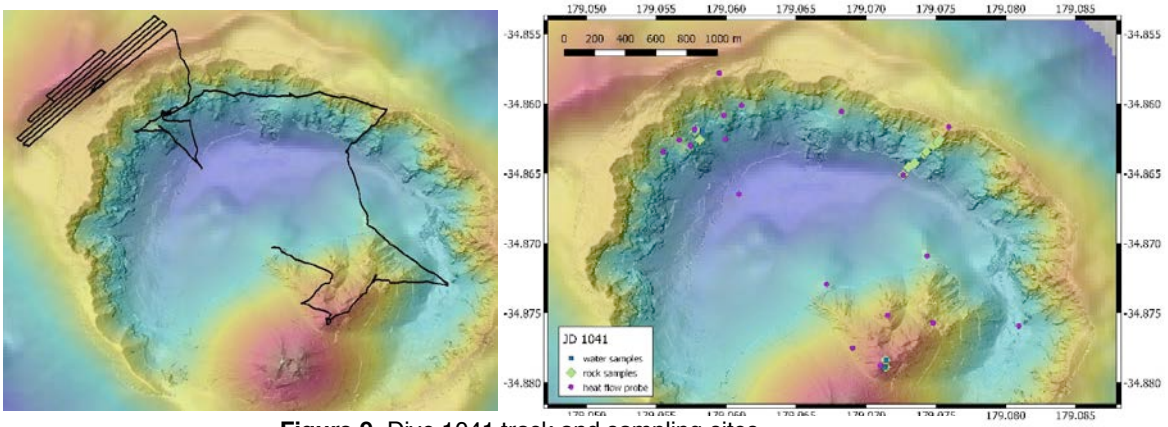


Figure 9. Dive 1041 track and sampling sites

part of the caldera wall. Thereafter, we returned to the rim above the NW Caldera area, where we obtained the additional heat flow probe measurements, and then collected more water samples and chimney samples down the NW Caldera slope. Finally, we attempted to complete the survey of the Upper Caldera wall with the Reson multibeam. However, we were able to accomplish only about half of the survey as we could not consistently get good fixes of the seafloor using the Doppler which affected trackline following.

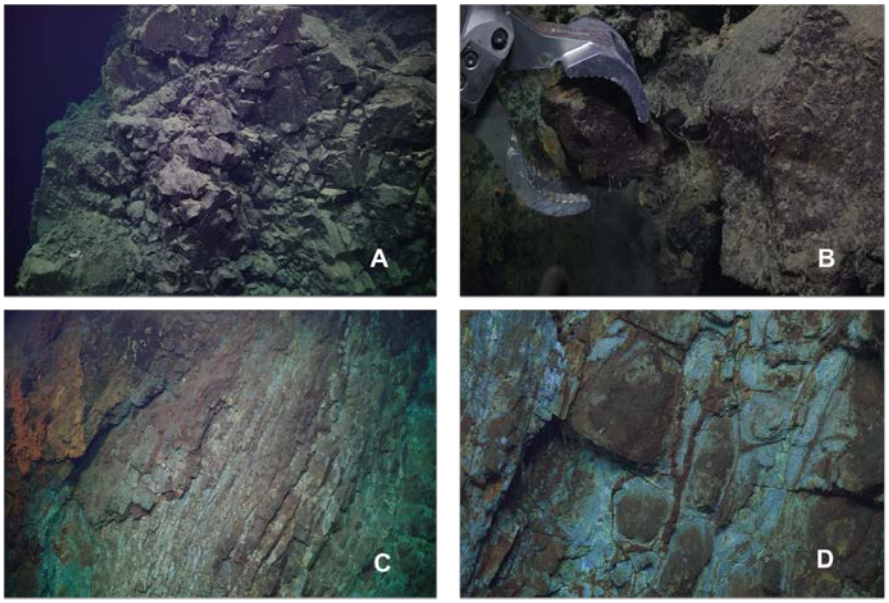


Fig 10. A and B. NE Caldera wall. C and D. Stockwork zone on the NW Caldera wall

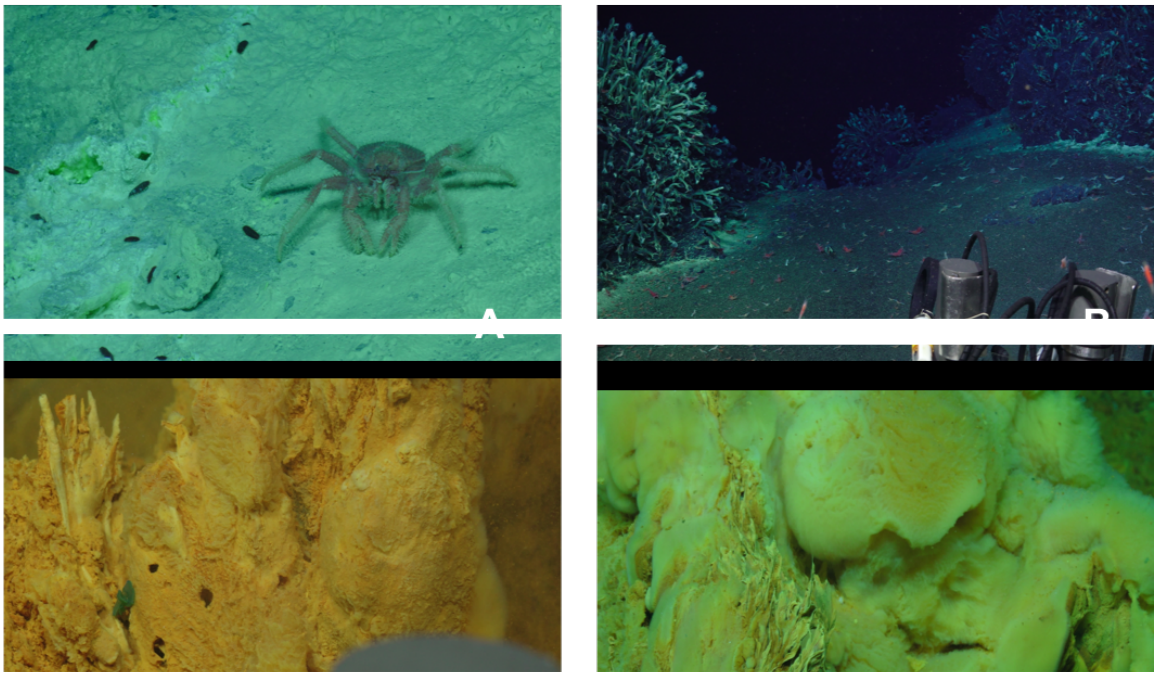


Fig 9. A and B. Lower cone site sulfur fumaroles and sediments with barnacles. C and D. Microbial mats on low temperature iron oxide deposits from the NW Caldera wall area

Figure 11. A and B. Lower Cone sulfur fumaroles and sediments with barnacles. C and D. Microbial mats on lower temperature iron oxyhydroxide deposits in the NW Caldera wall area.

Individual Team Shipboard Activities and Preliminary Observations

1. Underway Geophysical Surveys (Maurice Tivey and Fabio Caratori Tontini)

The R/V *Thompson* has a newly installed Kongsberg Simrad EM302 sonar - a high frequency (30 kHz) multibeam designed for optimum performance in water depths shallower than ~3000 m. Full beam swaths widths varied between 4,000 m and 10,000 m depending on the angle settings for the beams, generally 30 to 75°. The system has 432 beams and we utilized the high density equal distance mode for the distribution of the beams. Dual swath mode was turned off and pitch stabilization was turned on. The POS-MV provided yaw stabilization information. Sound speed information was obtained from an XBT measurement within the caldera.

Multibeam data were collected on all transits to and from the Brothers site and on several geophysical surveys during weather downtime for ROV *Jason* operations (see Table 1). In terms of processing, the raw *.all data were converted to MB-Systems format *.mb59 files using a script and then processed in the MB System software where ping editing was done and files saved as trackline swath grids.

Table 1. Shipboard multibeam surveys conducted during cruise TN350

Geophysics

Survey	Latitude (S)	Longitude (E)	Start time (UTC)	End time (UTC)
Transit to Brothers			06-Mar-2018 01:00	06-Mar-2018 19:30
1	34°54.3954’	178° 54.3954’	08-Mar-2018 21:18	
	36° 03.0858’	177° 48.4578’		9-Mar-2018 05:10
Transit to Auckland			09-Mar-2018 05:20	09-Mar-2018 20:00
Transit to Brothers			13-Mar-2018 10:59	14-Mar-2018 07:00
2	34° 36.002’	178° 45.805’	18-Mar-2018 07:38	
	34° 50.698’	179° 04.605’		19-Mar-2018 21:03
3	34° 51.368’	179° 04.402’	20-Mar-2018 05:50	
	34° 51.966’	179° 05.085’		21-Mar-2018 15:30
/TransitTransit To Auckland			25-Mar-2018 01:21	25-Mar-2018 23:00

A Marine Magnetics Seaspy marine magnetometer supplied by GNS Science was used to collect sea surface magnetic measurements during the cruise. The Seaspy magnetometer is an Overhauser nuclear precession type of sensor that collects total field data at a fast rate (typically during this cruise, 0.3 Hz sec rep rate) with a reported accuracy of 0.1 nT. The magnetometer was deployed by hand over the starboard side of the fantail. A 200-m-long magnetometer cable was used during for the first tow, but the cable suffered damage from spinning of the fish and was hopelessly twisted upon retrieval (although data acquisition was fine). A second, 100 m-long tow cable was used for subsequent tows. A coaxial conductor deck cable ran from the aft fantail through the hangar to the wet lab where a laptop was set up with Marine Magnetics BOB software for data acquisition. GPS navigation was taken from the ships CNAV3050 feed to the laptop. Time was manually set to GMT.

The magnetometer was used during the geophysics surveys but not during transits. The first geophysics survey was conducted at transit speeds of up to 13 kts. The subsequent tows were done at slower speeds (6 kts) due to weather conditions. A total of three geophysics surveys were completed during the cruise to fill in coverage of the GNS Science data compilation of the Kermadec arc region.

Underway marine gravity data was provided by a GNS Science-supplied gravimeter. The instrument is a Lacoste and Romberg S-80 marine gravimeter upgraded to a ZLS Ultrasys control system. Time is provided by the laptop clock, which was synchronized to the GPS signal taken from the ship. Data were recorded on a laptop at a 1 Hz data rate with hourly files.

2. Heat Flow Measurements (Maurice Tivey and Fabio Caratori Tontini)

A primary objective of the geophysical program was to obtain heat flux measurements across the caldera, including measurements at the various proposed IODP drill sites. The original plan for the heat flow measurements was to use thermal blankets (GNS Science provided nine) supplemented by heat flow probe measurements using the recently updated NDSF Heat Flow Probe (HFP).

Thermal blankets allow seafloor thermal gradient measurements to be made in areas of sparse sediment cover and bare rock outcrops where more conventional heat flow probes are unable to penetrate into the seafloor. Thermal blankets consist of an open cell foam material covered by a porous fabric in the shape of a disk approximately 0.5 m in diameter (Figure 12). The thermal blankets have a motorcycle inner tube filled with seawater and a ring of lead shot to provide the ballast weight and ability for the blanket to conform to the seafloor morphology in order to provide a good seal (Figure 13). Autonomous recording milli-degree precision thermistor sensors manufactured by Antares are located on the top and bottom of the blanket providing the basis for the thermal gradient measurement. The thermistor on the bottom of the blanket equilibrates with the underlying seafloor while the top thermistor equilibrates with the overlying seawater. A typical minimum time for equilibration is approximately 8 hours between separate measurement locations.

Figure 12. A stack of thermal blankets being prepared for deployment.

In order to provide a calibration of the thermal blankets measurements, we also planned to use the NDSF Heat Flow Probe, which is inserted into the seafloor by the ROV manipulator (Figures 14 and 15). This 60-cm-long probe has been upgraded from the original *Alvin* heat flow probe and consists of nine thermistors spaced 5 cm apart along the probe length. The first thermistor is located 11.5 cm from the tip with succeeding thermistors spaced 5 cm up the probe. The probe also incorporates a heater wire that can provide a known heat flow pulse in order to estimate *in situ* thermal conductivity. A typical measurement consists of inserting the probe into the seafloor and waiting between 8 to 10 minutes for the frictional heat of insertion to dissipate; then a heat pulse can be fired, followed by another 8 to 10 minute measurement period before retracting the probe. Thus, a total heat flow probe measurement takes approximately 20-25 minutes. The heat flow probe was installed and carried on all of the ROV *Jason* dives. The software was modified from the original Alvin heat flow program. The was some confusion about how to set the various settings on the heat flow GUI, which resulted in a couple of stations not properly firing a heat pulse of sufficient time. This is only a problem for the first few HFP stations.

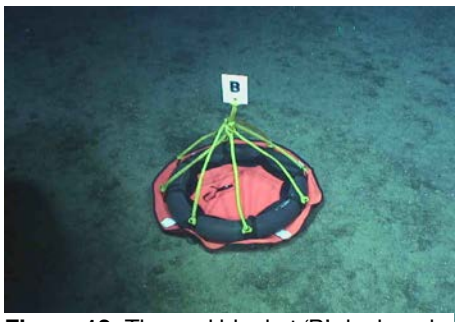


Figure 13. Thermal blanket 'B' deployed on sedimented seafloor.

Five thermal blankets were sent down on an elevator to be deployed on the first ROV *Jason* dive 1037 at the NW Caldera hydrothermal site. Problems with the ship's power meant that the ROV dive ended before we had a chance to recover, or move, the blankets to a new measurement location. On the following dive 1038, we were able to move the blankets to a second measurement location in the NW Caldera area (See Table 1 for deployment locations). At the end of Dive 1038, the blankets were returned to the surface by elevator for data download. For the next dive 1039, all nine thermal blankets were sent down on the elevator to the West Caldera site. The blankets were distributed across the caldera floor and up the caldera wall toward the NW Caldera site. The blankets were moved once during the dive to a second set of measurement locations. Due to incoming weather, the blankets were retrieved and shuttled to the elevator, which was subsequently lost at the surface. Hence, all the data collected during the dive 1039 were lost. This also meant that we no longer had any thermal blankets left with which to make measurements. We were then forced to maximize the use of the NDSF Heat Flow Probe (HFP), which provided a more than adequate substitute.

Two HFP measurements were made during *Jason* dive 1038 at two previous thermal blanket sites (for which we had data) as a calibration. Two further HFP measurements were made during *Jason* dive 1039. In addition, a total of eight HFP measurements were made during *Jason* dive 1040 and a further nineteen HFP measurements were made on *Jason* Dive 1041 for a total of thirty-one HFP stations (Table 2). In the end, we were able to obtain sufficient heat flow measurements using both the thermal blankets and HFP to provide a comprehensive coverage of the caldera.

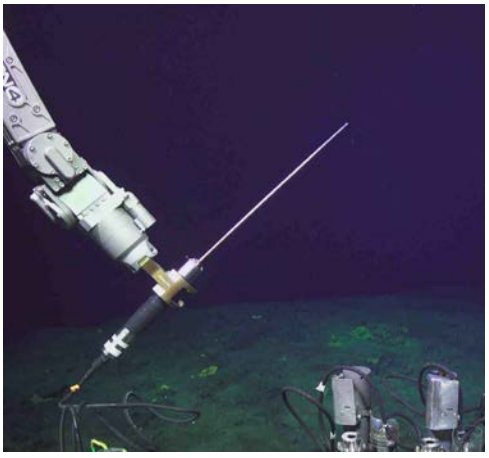


Figure 14. NDSF Heat Flow Probe, 60 cm long, in *Jason*'s manipulator.

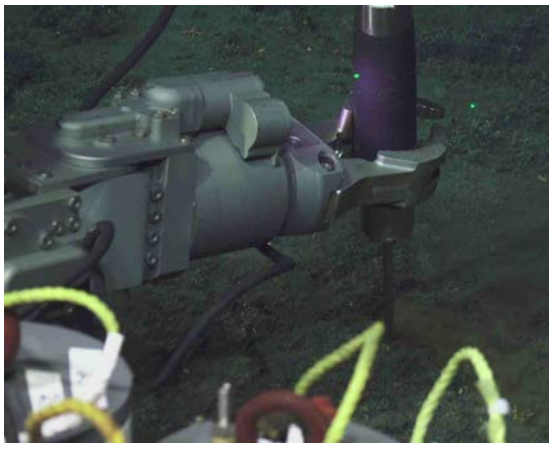


Figure 15. NDSF Heat Flow Probe inserted into sediment.

Table 2. Thermal Blanket stations

Thermal Blanket Station ID	Latitude (Deg. S)	Longitude (Deg. E)	Seafloor temperature (deg C)	Water temperature (deg C)	Heat Flow (W/m)	Quality
1038-TB-A1	-34.8601	179.0533	3.416	3.443	-0.318	L
1039-TB-A2	-34.8574	179.0523	5.313	3.832	17.478	M
1038-TB-B1	-34.8593	179.0522	5.868	3.673	25.905	H
1039-TB-B2	-34.8583	179.0508	3.83	3.805	0.295	L
1038-TB-C1	-34.8589	179.0496	8.359	3.911	52.495	M
1039-TB-C2	-34.8622	179.0538	3.38	3.318	0.732	L
1038-TB-D1	-34.8615	179.0557	3.609	3.589	0.236	L
1039-TB-D2	-34.8608	179.0487	3.455	3.31	1.711	L
1038-TB-E1	-34.8616	179.0514	3.434	3.431	0.035	L
1039-TB-E2	-34.8608	179.0572	6.925	3.431	41.236	H
2017-F4*	-34.8775	179.0716	6.196	4.235	23.14	M
2017-F5*	-34.882	179.0684	5.064	4.881	2.16	L
2017-F6*	-34.8821	179.0683	4.747	4.775	-0.33	L

* Thermal blanket F recovered during *Jason* dive 1040 but deployed during the 2017 *Sonne* 2017 ROV *Quest* cruise.

Table 3. Heat Flow Probe stations

Heat Flow Probe Stn ID	Date UTC	Time UTC	Lat deg S	Lat min	Lon deg E	Lon min	Virtual van	Depth (m)	Location
J2-1038-7-HF1	3/14/18	15:50	-34	-51.5336	179	2.9764	1355	1297	blkt C blkt E
J2-1038-8-HF2	3/14/18	18:05	-34	-51.6915	179	3.0891	1644	1449	NWC-1A
J2-1039-1-HF1	3/16/18	2:12	-34	-52.5074	179	3.5147	4065	1756	WC-1A
J2-1039-16-HF1	3/16/18	19:05	-34	-51.9259	179	3.4789	6629	1806	blkt D
J2-1040-1-HF1	3/21/18	21:41	-34	-52.2195	179	3.4988	7942	1829	
J2-1040-2-HF1	3/21/18	23:32	-34	-52.7284	179	3.7368	8160	1559	
J2-1040-3-HF1	3/22/18	0:33	-34	-52.7334	179	3.9725	8328	1414	
J2-1040-4-HF1	3/22/18	1:27	-34	-52.9090	179	3.9344	8469	1309	
J2-1040-5-HF1	3/22/18	2:17	-34	-52.9275	179	4.0672	8611	1197	
J2-1040-6-HF1	3/22/18	2:56	-34	-52.9234	179	4.1111	8707	1227	UC-1A
J2-1040-9-HF1	3/22/18	6:37	-34	-52.9608	179	4.1236	9332	1202	
J2-1040-11-HF1	3/22/18	9:00	-34	-52.8434	179	4.1820	9698	1279	
J2-1041-1-HF1	3/22/18	21:38	-34	-52.3767	179	4.0310	9932	1608	
J2-1041-2-HF1	3/22/18	23:06	-34	-52.5103	179	4.2935	10200	1427	
J2-1041-3-HF1	3/23/18	0:01	-34	-52.6497	179	4.1422	10340	1432	
J2-1041-5-HF1	3/23/18	1:57	-34	-52.7255	179	4.2609	10657	1304	LC-1A
J2-1041-8-HF1	3/23/18	5:38	-34	-52.5420	179	4.4875	11234	1455	
J2-1041-9-HF1	3/23/18	6:53	-34	-52.5550	179	4.8565	11446	1672	SEC-1A
J2-1041-10-HF1	3/23/18	8:45	-34	-52.2538	179	4.4626	11777	1604	

J2-1041-11-HF1	3/23/18	10:13	-34	-51.9066	179	4.3597	11923	1811	
J2-1041-19-HF1	3/23/18	14:10	-34	-51.7003	179	4.5553	12549	1462	
J2-1041-20-HF1	3/23/18	15:36	-34	-51.6322	179	4.0953	13728	1592	
J2-1041-21-HF1	3/23/18	16:51	-34	-51.6079	179	3.6664	12892	1611	
J2-1041-22-HF1	3/23/18	18:11	-34	-51.7070	179	3.4660	13097	1610	
J2-1041-23-HF1	3/23/18	18:55	-34	-51.7561	179	3.3987	13204	1569	
J2-1041-24-HF1	3/23/18	19:43	-34	-51.8069	179	3.3296	13321	1569	
J2-1041-25-HF1	3/23/18	20:59	-34	-51.7799	179	3.4461	13494	1573	
J2-1041-26-HF1	3/23/18	22:48	-34	-51.9885	179	3.6548	13760	1873	NWC-2A
J2-1041-27-HF1	3/23/18	23:50	-34	-51.7530	179	3.5964	13907	1750	
J2-1041-32-HF1	3/24/18	5:19	-34	-51.6499	179	3.5894	14628	1589	
J2-1041-33-HF1	3/24/18	6:19	-34	-51.4660	179	3.5694	14777	1454	

3. Thermal HOBO Probe Deployments (Maurice Tivey)

High temperature thermocouple loggers (also known as HOBOs) supplied by Dan Fornari (WHOI-MISO group) were deployed at two vent locations at the NW Caldera site to measure the long-term variation in vent temperature (Table 3). The probes were deployed at the same location as a suite of fluid and chimney samples was obtained. One HOBO probe was deployed on *Jason* Dive 1038 and recovered approximately 16 hours later on the same dive. A second HOBO probe was deployed on *Jason* dive 1038 and recovered on *Jason* dive 1039 approximately 36 hours later. Unfortunately, we were not able to deploy any other HOBO probes at the Cone sites because of scheduling issues with the dive plan, and the fact that any subsequent dives would not be revisiting any of the Cone vent sites.

Table 4. HOBO temperature probe deployments

15:05 Mar 14	04:05 Mar 15	Dive 1038: Deploy HOBO hi-T temperature probe white/red in vent: J2-1038-6-TC/RED/WHITE Event # 1249; depth: 1319 m lat: 34 51.475173' S lon: 179 3.116164' E IGT and Major water samplers deployed: temperature 279°C J2-1038-6-IGT3 J2-1038-6-IGT3 J2-1038-6-MAJ-WHITE
07:21 Mar 15	20:21 Mar 15	Dive 1038: Retrieve HOBO RED/WHITE

00:33 Mar 15	13:33 Mar 15	Dive 1038: Deploy hobo HiT temperature probe at same site J2-1038-13-HOBO-TC RED/BLACK Event # 2584; depth: 1582 m lat: 34 51.690341' S lon: 179 3.438628' E Chimney sample J2-1038-13-R7

		Chimney sample J2-1038-13-R8 IGT and major water samplers deployed at same site: J2-1038-13-IGT5: Temperature 303°C J2-1038-13-MAJ-YELLOW
13:57 Mar 16	02:57 Mar 17	Dive 1039; HOBO RED/BLACK retrieved onto *Jason* basket; depth 1582 m

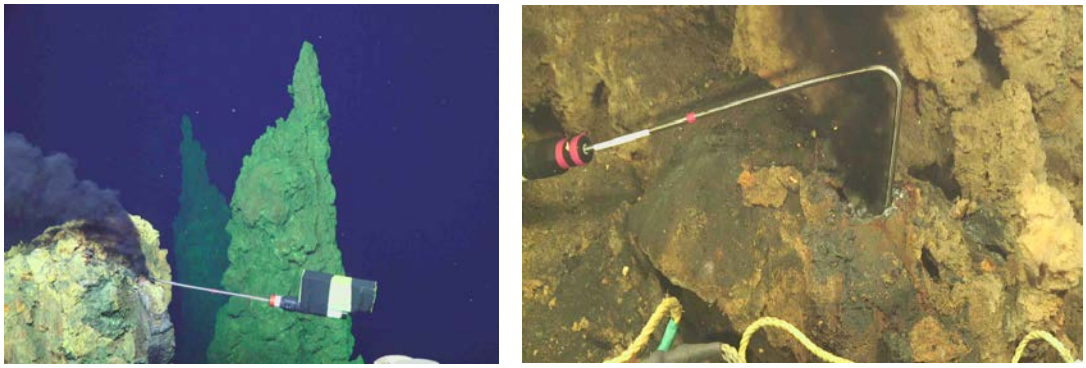


Figure 16. Deployment of HOBOs in high temperature hydrothermal vents.

4. Hydrothermal Vent Fluid Chemistry (Valerie Stucker, Sean Sylva, Alex Diehl)

A. *Gas-tight fluid samples*

Fluids were collected using titanium isobaric gas-tight (IGT) fluid samplers. In some cases, two gas-tight samples were collected at each edifice. The IGT samplers are equipped with thermocouples that allow for real-time temperature measurement during collection of fluids. Communication with the IGT samplers is achieved via an inductively coupled link (ICL) that allows RS-232 communication. Reported temperature for each IGT fluid sampler represents the maximum temperature recorded while the thermocouple/snorkel tip was inserted in the vent orifice prior to, during, or after sampling.

Fluid samples were processed within ten hours of vehicle recovery. Sub-samples were extracted from the IGT bottles for measurement of pH (25°C), dissolved gases, and major cation and anion analyses. The aliquot for trace metal analyses (~25 ml) was acidified with 0.025 ml of ultra-pure HNO_3. Small aliquots of fluid were archived for strontium isotope analysis. Aliquots were archived in evacuated glass containers for shore-based determination of the abundance of CO_2. Following complete removal of the fluid from the samplers, solid precipitates were removed from the bottle by rinsing with water. The water was then allowed to evaporate leaving the solid precipitates.

A Metrohm 780 pH meter was used for measuring pH (25°C). To minimize loss of acid volatiles, samples were not sparged with an inert gas during measurement. Attainment of stable pH values indicated that significant sulfide oxidation was not occurring during measurement, notwithstanding the absence of an inert gas overlying the sample. Dissolved H_2 and CH_4 concentrations were measured on board by gas chromatography (GC) following a headspace

extraction in a purpose-built inlet system. The GC was equipped with a 5Å molecular sieve column, nitrogen carrier gas, and a thermal conductivity detector for H_2 analysis and a PoraPlot-Q phase column, nitrogen carrier gas, and a flame ionization detector for CH_4 analysis.

Table 5. Summary of samples collected during cruise TN350

ROV Dive #	Latitude	Longitude	Depth [m]	Bathy	Heading	T_{max} [°C]	pH	Alk meq/l
J2-1038	34 51.475265	S179 3.115850 E	1319.48	1326.53	79.29	279.9	2.90	-0.9
J2-1038	34 51.475201	S179 3.116380 E	1319.51	1326.55	79.46	272.8	2.90	-1.0
J2-1038	34 51.690254	S179 3.438608 E	1582.54	1584.22	329.64	303.7	2.76	-1.4
J2-1038	34 51.663163	S179 3.446765 E	1581.75	1590.19	293.45	243.8	3.22	-0.6
J2-1039	34 51.718224	S179 3.539292 E	1599.51	1603.49	337.51	320.5	3.27	-0.6
J2-1039	34 51.718254	S179 3.539322 E	1599.47	1603.5	336.94	308.3	4.47	0.3
J2-1039	34 51.732618	S179 3.436398 E	1611.97	1614.65	292.35	95.7	3.18	-0.6
J2-1039	34 51.756684	S179 3.472938 E	1617.51	1620.5	318.69	301.9	3.30	-0.5
J2-1040	34 52.943336	S179 4.093397 E	1213.44	1215.22	311.33	172.9	2.23	-6.3
J2-1040	34 52.940756	S179 4.095599 E	1213.45	1215.09	323.00	199.9	1.57	-25.6
J2-1041	34 51.716946	S179 3.498592 E	1638.51	1822.7	99.54	262.4	3.04	-0.7
J2-1041	34 51.718687	S179 3.464497 E	1622.68	1628.68	325.99	212.3	3.15	-0.6
J2-1041	34 52.731541	S179 4.282243 E	1329.92	1332.12	274.02	80.8	4.53	-
J2-1041	34 52.702031	S179 4.286674 E	1315.72	1318	318.52	61.1	5.17	-

B. *Major fluid samples*

Two titanium syringe samplers (Major samplers) were used to collect fluids directly from actively venting sites during the *Jason* dives. The sample nozzle was placed into the discharging stream of the vent fluid. The observation of fluids being expelled from the hole above the nozzle entrance indicated that hot vent fluid was indeed passing up the nozzle. Temperature was obtained from the IGT sampling that immediately preceded the Major water sampling. Following equilibration, the hydraulic trigger on the ROV arm was used to open the Major samplers and draw in fluid. The venting hole on the sampler was again checked that it was discharging hydrothermal fluid once the trigger was released, to verify that the sampler nozzle was still in the fluid flow, and that hydrothermal fluid would be entering the Major sampler. The sampler was then returned to its storage location in a sliding drawer under the ROV.

Table 6. Splits taken from the titanium Major water samplers

Sample purpose	Volume (mL)	Container
Gas concentrations	10	Gas tight syringe
Alkalinity/acidity	20	Syringe
metals, trace and major	125	125 mL round bottle
Water isotopes	15	15 mL falcon tube
Silica/working bottle	30	60 mL pink vials
Nutrients	30	30 mL bottle
Anions	30	30 mL bottle
Sulfur/archive	125 mL	125 mL bottle
Dregs/particle analysis	5+ if present	50 mLTube

Preliminary shipboard chemistry results are presented below in Table 3. Upper Caldera samples had both higher and lower salinity when compared to seawater (i.e., 35‰), with both samples having a pH lower than 3. The NW Caldera site sampled many times previously had salinities near seawater, and ranged in pH from 7.6 down to 2.8. The highest measured sulfide content was in a sample with pH of 3.3. The Upper Cone had the lowest pH samples, ranging from 2.0 to 2.2.

These are not record low pH values, but nevertheless are still low. Salinity for these samples was near seawater values, while some sulfide was present in the samples.

Lower Cone samples were very gassy, and are likely to be dominated by CO_2 given previous sampling, with one very high alkalinity sample (5.76 meq/L) measured from a 60°C sample. This sample also had the highest sulfide concentration for the Lower Cone.

Table 7. Summary of samples and analyses from Major water samplers.

Sample ID	Date	Latitude	Longitude	Depth	Max T	pH	Alkalinity	Salinity	Sulfide
				m	°C		meq/L	‰	mg/L
NW Caldera upper rim									
J2-1038-6-MAJ-white	15/03/2018	34 51.476520 S	179 3.107844 E	1319	279	2.965	-0.96	41	42
J2-1038-15-MAJ-red	15/03/2018	34 51.549888 S	179 3.035784 E	1331		2.687	-1.91	27	135
NW caldera inside rim									
J2-1038-13-MAJ-yellow	15/03/2018	34 51.714360 S	179 3.387858 E	1582	303	2.824	-1.41	36	115.5
J2-1038-14-MAJ-green	15/03/2018	34 51.693120 S	179 3.429216 E	1575	8	7.618	2.4	34	0.019
J2-1039-14-MAJ-green	17/03/2018	34 51.732486 S	179 3.436374 E	1612	303	3.614	-0.24	35	32
J2-1039-15-MAJ-red	17/03/2018	34 51.730578 S	179 3.429894 E	1605		6.546	2.24	34	0.011
J2-1039-18-MAJ-blue	17/03/2018	34 51.756888 S	179 3.471468 E	1617	302	3.257	-0.61	36	277.8
J2-1041-29-MAJ-orange	24/03/2018	34 51.716450 S	179 3.498216	1638		3.237	-0.48		24.3
Upper Cone									
J2-1040-8-MAJ-blue	22/03/2018			1213	160	2.117	-7.41	33	17.9
J2-1040-8-MAJ-green	22/03/2018			1213	160	2.081	-7.79	34	15.22
J2-1040-10-MAJ-red	22/03/2018	34 52.788432 S	179 4.098246 E	1214		2.208	-5.99	34	14.92
Lower Cone									
J2-1041-6-MAJ-green	24/03/2018	34 54.387768 S	179 2.272476 E	1330		5.144	1.79		127
J2-1041-4-MAJ-red	24/03/2018	34 54.368778 S	179 2.280036 E	1315	60	5.658	5.76		202
J2-1041-7-MAJ-blue	24/03/2018	34 54.381798 S	179 2.273100 E	1328		5.517	2.51		35

5. Diffuse Fluids Microbiology (Lucy Stewart)

Diffuse fluids were sampled on each dive using the Major water samplers and divided for chemistry and gas analyses, microbial incubations, and filtration for DNA extraction. Microbial incubations focused on counting thermophilic anaerobes in diffuse samples (autotrophic iron-reducers, sulfur-reducers, and methanogens, and heterotrophic sulfur-reducers) using most-probable-number analyses (MPNs); microcosm incubations to assess carbon sources for thermophilic methanogens; and testing the growth of thermophilic methanogens at low pH values. Microcosm incubations were also replicated using media and successful incubations filtered to assess the affect of media additives (e.g., vitamins) on methanogen community composition.

Table 8 lists that samples taken, experiments conducted, and preliminary results. Remaining diffuse fluids after core chemical analyses and microbial incubations were filtered onto Sterivex filters, which were immediately frozen at -80°C. These will be used for DNA extraction and metagenomic sequencing onshore. Full analysis of microbial growth and metabolite production

will also be completed onshore, as well as sequencing of methanogenic microcosm incubations. All incubations were carried out at 70°C, except where otherwise noted.

Table 8. Microbiological activity experiments

Sample	Site	Temperature (°C)	pH	Incubations	Filtered for DNA?	Preliminary notes
CTD	Seawater above plume	4	7.9	Heterotrophic sulfur-reducers only (control)	No	No growth
J2-1038-14-MAJ-Green	Northwestern caldera, microbial mats with diffuse venting	8.1	7.62	MPNs at 70 and 85°C, microcosm incubations, pH tests	Yes – 150mL	Iron reduction and sulfur reduction detected at 85°C, heterotrophic sulfur reduction at 85 and 70°C
J2-1039-16-MAJ-Red	Northwestern caldera, small low-temp chimney	42	6.52	MPNs, microcosm incubations, pH tests	Yes – 165 mL	Methanogenesis detected supported by H_2 only, sulfur reduction detected
J2-1041-7-MAJ-Blue	Diffuse venting at Lower Cone site with microbial mats/sulfur	16		MPNs, microcosm incubations, pH tests	Yes – 125 mL	<24 hr incubation on ship; further incubation needed in home lab
J2-1041-4-IGT8	Focused venting at Lower Cone with lots of sulfur	61		MPNs and pH tests	No	<24 hr incubation on ship; further incubation needed in home lab

6. Rock and Molecular Microbiological Collections

(Gilberto Flores, Anna-Louise Reysenbach and Cornel de Ronde)

Rock/chimney/deposits collected during the *Jason* dives are presented in Table 9 and are individually described in the Appendix. DNA from sulfide/rock and other deposits was extracted at sea using the MoBio soil DNA kit following the modified protocol of the Reysenbach laboratory.

Table 9. Rock and chimney deposit descriptions

SampleID	Event	Date	Lat	Long	Depth
J2-1038-3-R1	896	3/14/18 12:31	-34.858913	179.050096	1300.72
J2-1038-4-R2	952	3/14/18 12:56	-34.858887	179.050305	1302.16
J2-1038-5-R3	1110	3/14/18 14:05	-34.85792	179.051933	1319.25
J2-1038-6-R4	1126	3/14/18 14:11	-34.857913	179.051935	1319.26
J2-1038-12-R5	2172	3/14/18 21:35	-34.861055	179.057429	1581.87
J2-1038-12-R6	2249	3/14/18 22:44	-34.86105	179.05746	1580.34
J2-1038-13-R7	2512	3/15/18 0:02	-34.861509	179.0573	1582.48
J2-1038-13-R8	2590	3/15/18 0:36	-34.861506	179.057304	1582.51
J2-1038-15-CH1	3377	3/15/18 6:24	-34.857812	179.052121	1330.97
J2-1038-15-CH2	3381	3/15/18 6:25	-34.857812	179.052121	1330.93
J2-1039-10-R1	5313	3/16/18 10:18	-34.861014	179.057679	1594.06
J2-1039-11-CH1	5430	3/16/18 11:04	-34.861119	179.057665	1599.49
J2-1039-12-CH1	5570	3/16/18 11:59	-34.861079	179.057636	1591.96
J2-1039-12-CH2	5665	3/16/18 12:37	-34.861076	179.057638	1591.5
J2-1039-13-CH1	5783	3/16/18 13:25	-34.861079	179.057703	1596.49
J2-1039-14-CH1	6211	3/16/18 16:09	-34.862094	179.057395	1610.7
J2-1039-14-CH2	6298	3/16/18 16:42	-34.86209	179.057388	1611.18
J2-1039-15-CH1	6474	3/16/18 17:53	-34.86208	179.057289	1604.62
J2-1039-17-R1	7360	3/17/18 0:15	-34.863467	179.05809	1698.76
J2-1039-18-CH1	7540	3/17/18 1:24	-34.862008	179.057639	1617.46
J2-1039-18-CH2	7673	3/17/18 2:24	-34.862015	179.057642	1618.38
J2-1040-4-CH1	8520	3/22/18 1:49	-34.881821	179.065582	1308.66
J2-1040-7-CH1	8840	3/22/18 3:40	-34.882092	179.068375	1212.35
J2-1040-7-CH2	8886	3/22/18 3:57	-34.882103	179.068342	1208.24
J2-1040-7-CH3	8897	3/22/18 4:01	-34.882098	179.068336	1208.22
J2-1040-8-CH1	9260	3/22/18 6:11	-34.882344	179.068273	1213.51
J2-1040-10-CH1	9541	3/22/18 7:59	-34.882356	179.068265	1214.18
J2-1040-10-CH2	9582	3/22/18 8:13	-34.882365	179.068228	1212.89
J2-1041-4-R1	10531	3/23/18 1:09	-34.878368	179.071443	1315.44
J2-1041-6-R1	10947	3/23/18 3:45	-34.878848	179.071378	1329.78
J2-1041-6-R2	10959	3/23/18 3:49	-34.878866	179.071394	1329.87

7. CTD and MAPR Operations (Sharon Walker and Cornel de Ronde)

Hydrothermal plumes at Brothers volcano were mapped during TN350 using the ship's CTD and Niskin bottle sampling rosette (24 x 10 L bottles). The CTD was a Seabird 911*plus* system with

dual, ducted temperature-conductivity sensors, two dissolved oxygen sensors (model SBE-43), and a Valeport (VA-500) altimeter. Additional analog sensors for optical backscatter (two high-sensitivity Seapoint turbidity meters) and oxidation-reduction-potential (one NOAA/PMEL ORP sensor) were supplied by Sharon Walker (NOAA/PMEL) and integrated with the system.

Two CTD tow-yos and two vertical cast were completed. Time between ROV dives was limited, and bad weather further reduced the opportunity to do more; however, the operations that were completed will significantly add to the two-decade long effort by GNS Science and NOAA to investigate the long-term variability of the distribution, intensity, and chemistry of the above-bottom plumes at Brothers volcano.

Discrete water samples (20) were taken during each CTD tow for shipboard or shorebased analyses of $^{3}He/^{4}He$ (11), pH (41), CH_4 (3), total dissolved metals (9), and microbiology (7). (Number after analyses type indicates how many subsamples were taken for each analysis)

A PMEL Miniature Autonomous Plume Recorder (MAPR) was mounted on ROV *Jason* for all dives. The MAPR measured temperature, pressure, optical backscatter, and ORP. The optical backscatter and ORP sensors on the MAPR are identical to those integrated with CTD. The descent/ascent portion of all ROV dives provided additional full water column profiles of these properties to supplement the CTD plume mapping efforts. The MAPR also provided information about the physio-chemical properties along the near-bottom portions of all dives. The last several hours of *Jason* dive 1041 were dedicated to completing a high-resolution multibeam survey, at 70 or 30 m above bottom, over the N-NW rim, upper wall and slope outside the caldera. Plume distributions were mapped during this survey as well.

Table 10. CTD two-yos and vertical casts conducted during cruise TN350

Cast	Station Name		Latitude (S)	Longitude (E)	Start time	End time
1	V18A-01		34° 51.9660’	179° 3.7180’	08-Mar-2018 06:32	08-Mar-2018 07:56
2	T18A-01	start	34° 50.1610’	179° 2.8410’	19-Mar-2018 21:20	
		end	34° 54.0660’	179° 4.5820’		20-Mar-2018 05:04
3	T18A-02	start	34° 53.9060’	179° 3.1880’	22-Mar-2018 12:12	
		end	34° 51.3450’	179° 5.6330’		22-Mar-2018 17:11
4	V18A-02		34° 51.9600’	179° 3.7320’	24-Mar-2018 23:55	25-Mar-2018 01:09

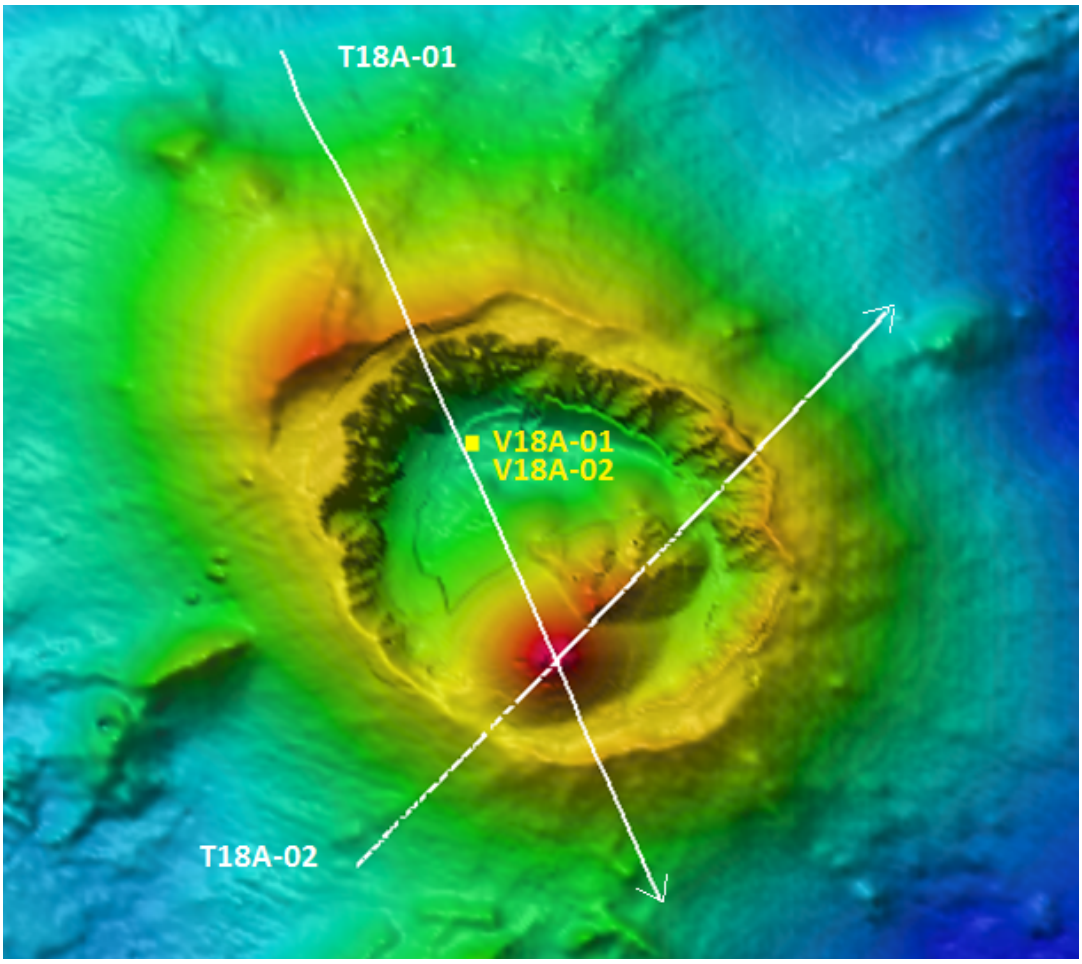


Figure 17. Map of Brothers volcano showing CTD tow track lines (white lines) and vertical cast locations (yellow square).

APPENDIX I
Scientific Personnel/Responsibilities

R/V Thomas Thompson Captain: Eric Haroldson
***Chief Scientist*:** Anna-Louise Reysenbach

TGT Scientific Marine Technicians: Patrick A'Hearn and Steve Jalickee
Jason Group Team

Expedition Leader: Ben Tradd
Andy Billings
Alberto Collasius
Molly Curran
Jon Howland
Chris Judge
Akel Kevis-Stirling
Chris Lathan
James Pelowski
Korey Verhein

Watch Leaders/ Virtual Van/ Video

Fabio Caratori-Tontini/ Laura Rea/ Monika Swick
Cornel de Ronde/ Anna Wietelmann/ Vanessa Schenker
Maurice Tivey/ Sam Nadell/ Lucy Stewart and Sharon Walker

Sample/Data Collection Lead Scientists

Geophysics: Maurice Tivey, Fabio Caratori-Tontini
Microbiology: Anna-Louise Reysenbach, Gilbert Flores, Lucy Stewart
Geology: Cornel de Ronde, Vanessa Schenker
Geochemistry: Sean Sylva, Valerie Stucker, Alex Diehl
CTD: Cornel de Ronde and Susan Walker

Students (*Jason* van data loggers, watchstanders; general helpers):

Sam Nadell (Cornel)
Laura Rea (Whitman)
Anna Wietelmann (Stanford)
Vanessa Schenker (ETH)
Monika Swick (UW)

Outreach

Dive and Discover: Eric Olsen
Making Movies Documentary Company: Scott Mouat

APPENDIX II

ROV *Jason* Dive Plans

Dive 1037 Plan: NW Caldera Rim—Engineering Dive

- When on station, deploy elevator first on a wire.

Elevator landing site: -34.86086 °S, 179.054017 °E
Elevator deployment with Cassius, five thermal blankets. If navigation not good, will need to do a Cassius USBL calibration (about 8 hrs), after which *Jason* can be deployed. If Cassius calibration not required, then after elevator deployment, *Jason* in.

Jason launch coordinates: Close to elevator launch

Objectives:
Engineering Dive. *Jason team operations have priority*
This should take about 8 hours. Once completed;

- Proceed to the elevator and pick up five blankets, investigate the high temperature site (NW Caldera rim) for good heat flow measurement sites, deploy blankets at sites determined by Fabio and Maurice,
- Once blankets deployed, map Upper Caldera site. Using the following coordinates, develop a multibeam (Reson) survey grid for this unmapped area, ~60 m off bottom, ~ 200 m line spacing:
    - W corner - 34.8590°S, 179.041 °E
    - N corner - 34.8493°S, 179.0527°E
    - E corner - 34.8557°S, 179.0590°E
    - S corner - 34.8649°S, 179.0470°E
- Test new heat flow probe. Also, starboard magnetometer may need some monitoring,
- If all going well, survey area, video, take two Majors and possibly chimney (4) samples. For chimneys, take sample, then measure temperature, unless IGT first then use the IGT to measure the temperature
- Collect thermal blankets and place in elevator and
- Return elevator to surface.

Jason
MAPR
CTD, 2 magnetometers
***Jason* basket**
2 IGTs
Rock box with dividers
1 sidearm: biobox (port)
Hi Temp probe
4 chamber pots
Heat flow probe
1 sidearm 2: Majors

Elevator: Five thermal blankets, MAPR

Dive 1038 Plan: Upper Caldera site and NW Caldera site

Launch *Jason* at Elevator landing site: -34.86086°S, 179.054017°E

Objectives:
- Redeploy and retrieve blankets
- Heat flow probe measurements
- Deploy and retrieve two Hobo probe,
- Sample up to eight flanges and chimneys. Preferably four from the Upper Caldera site and four from the upper NW Caldera site
- Obtain two pairs of IGTs, one high temperature fluid pair from Upper Caldera site and one high temperature pair from upper NW Caldera site.

For all chimney and flange sampling, ALR or Gilbert should be in the van.
For all IGT samples Sean should be in the van.

1. Proceed to the elevator, remove some weights (elevator maintenance).

Upper Caldera Site:
2. Move and redeploy the two blankets (TB-1, TB-2) at sites determined by Fabio and Maurice.
3. Take a chimney sample and place in chamber pot. Check the temperature of the fluid after each sample (this can be done using the IGT probe if that water sample is taken).
4. Take an IGT pair from this same orifice. IGT samples are always taken in pairs.
5. Take a Major water sample.
5. Deploy a Hobo probe in this orifice.
6. Take a second chimney sample and two flange samples, and place in chamber pots. Check the temperature of the fluid after each sample.
7. Take a second Major from one of these sites, Valerie to decide where.
8. Cornel may need a rock? Place in box with sampled IGTs or behind chamber pots.
9. Move to TB-3 site and take some heat flow probe measurements at TB-3, TB-4 and TB-5.
10. Move and redeploy the TB-3, TB-4 and TB-5 (probably near caldera rim or upper region of caldera wall).
11. Move to NW Caldera site.

NW Caldera site (upper part):
1. Take a chimney sample and place in chamber pot. Check the temperature of the fluid after each sample (this can be done using the IGT probe if that water sample is taken).
2. Take an IGT pair from this same orifice.
3. Take a major water sample.
4. Deploy a Hobo probe in this orifice.
6. Take a three additional chimney samples and place in chamber pots. Check the temperature of the fluid after each sample.
7. Take a second Major from one of these sites, Valerie to decide where.
8. Sample rocks for Cornel as needed.

Clean-up:
9. Once sampling is complete, retrieve Hobo probes from both sites and place in elevator.

10. Collect thermal blankets and place in elevator or in *Jason* first.
11. Return to surface.
12. Return elevator to surface.

Jason
MAPR, CTD, 2 magnetometers
***Jason* Basket:**
2 Hobo probes
4 IGTs
8 chamber pots
Rock box
2 sidearms with 2 majors each
Hi Temp probe
Heat flow probe

Dive 1039 Plan: Caldera floor, NW Caldera wall

Launch *Jason* and Elevator : -34.87527°S, 179.05857°E

Objectives:

- Obtain video footage of IODP site WC-1A and deploy a marker
- Deploy (and retrieve) nine heat blankets around the IODP site towards the NW Caldera wall and up the wall
- Obtain video footage of the NW Caldera wall stockwork zone seen during the R/V *Sonne* cruise in January 2017
- Sample chimneys and water immediately above and below stockwork zone and then proceed towards the caldera floor.

For all chimney and flange sampling, ALR or Gilbert should be in the van.
For all IGT samples, Sean should be in the van.

1. Land at the IODP site WC-1A.
2. Deploy the marker 1. Obtain ~10 minutes of good video survey of the area.
3. Proceed to elevator and pick up five thermal blankets.
4. Place the thermal blankets on a transect as determined by Fabio and Maurice.
5. Return to elevator and retrieve the remaining four blankets and continue blanket deployment towards and up the NW Caldera wall.
6. Take a careful video traverse and survey of the previously discovered ~40 m wide x 15 m high stockwork zone (have Cornel in the van for this!)
7. Take samples from the stockwork veins and place in the blue divided milk crate.
8. Proceed to the chimneys immediately above the stockwork area, and take a chimney sample, paired IGTs and a Major water sample.
9. Obtain up to three more chimney samples in the area, taking temperature readings after each collection. Obtain another Major at one of these collection sites.
10. Proceed further up the NW Caldera wall and retrieve the Hobo probe that was deployed there. Event 2584: 34°51.714354'S, 179°3.387708'E.
11. Return to the caldera floor via the base of the stockwork zone, and collect up to four chimneys, one collection with paired IGTs and a major.
12. If diffuse fluids are noted, return to the elevator to pick up a Major, for another diffuse flow sample for Lucy. Alternatively, if any more Major samples are desired, take these as per Valerie and Cornels' direction.
13. Finish dive by retrieving all the blankets and placing them in the elevator.
14. Return the elevator to the surface.

Jason
MAPR, CTD, 2 magnetometers
Jason **Basket:**
4 IGTs
8 chamber pots
Rock box
2 sidearms with 2 majors each
Marker #1
Hi Temp probe
Heat flow probe

Dive 1040 Plan: Caldera Floor to Upper and Lower Cones

***Jason* launch coordinates**: 34°52.2270'S, 179°3.5124'E

Objectives:
- Heat probe measurements on NW Cone slope and towards lower cone
- Four discrete IGT and Major sample pairs
- Chimney/rock associated with water samples.

1. At landing, start taking heat flow measurements at sites determined by Fabio and Maurice. At each site, measure for 20 minutes.
2. Once at the top of the Cone, recover the heat flow blanket at the summit. Take a heat-flow measurement (34°52.9260'S 179°4.0980' E).
3. On the summit of the Upper Cone, there are white smokers; take one discrete water sample. One IGT, one Major, one chimney (approx. location 34°52.9500'S, 179°4.0982'E).
4. Explore east and northeast side of the plateau and take one Major sample, one IGT, one chimney.
5. Continue down the flank towards the Lower Cone site. Take heat flow probe measurements (as directed by Fabio and Maurice).
6. At Lower Cone, take additional chimneys, two IGT Major samples, two discrete water and paired chimney samples. (Approx. Location: 34°52.734'S, 179°4.2636'E and 34°52.7316'S, 179°4.2792'E)
7. Additional heat probe measurements at Lower Cone as directed by Fabio and Maurice.
8. Return to the surface.

***Jason* Basket:**
2 rock boxes, one with divider
4 IGTs
Hi Temp probe
8 chamber pots
Heat flow probe

Proposed heat flow probe stations
#1 179°3.5124'E -34 -52.2270'S (*Jason* landing)
#2 179°3.7416'E -34 -52.7436'S
#3 179°3.9786'E -34 -52.7382'S
#4 179°3.9306'E -34 -52.9134'S
#5 179°4.0674'E -34 -52.9362'S
#6 179°4.1244'E -34 -52.9614'S
#7 179°4.1802'E -34 -52.8420'S
#8 179°4.2930'E -34 -52.7040'S

Dive 1041 Plan: Lower Cone, NE wall and Rim, back to NW Caldera Rim

***Jason* launch coordinates**: 179.06676°E, -34.87298°S (179°4.006'E, 34°52.3788'S)

Objectives

- Heat probe measurements on Lower Cone and flanks, and follow-up probe measurements at NW Caldera site
- Four discrete IGTs, Major sample pairs (one diffuse flow Major)
- Chimney/rock associated with water samples
- Slurp bacterial mats
- NE Caldera wall video transect for volcanic stratigraphy and rock sampling
- Multibeam mapping survey of Upper Caldera site

1. Land on northern spur ridge of Lower Cone. Take a heat flow probe measurement and then move south up the flank of the Lower Cone, taking heat flow probe measurements at sites determined by Fabio and Maurice. At each site, measure for 20 minutes.
2. At the top of the cone, take an IGT, four Major samples, and chimney/rock sample, SLURP.
3. Take another heat flow measurement at Lower Cone summit.
4. Proceed down the northeastern flank of the Lower Cone and take one heat flow probe measurement.
5. Move to the IODP drill site SEC-1A drill site (179.081069°E, -34.876105°S). Deploy a marker, take a heat-flow probe measurement.
6. Proceed towards the north flank of the Lower Cone. Take a heat-flow measurement.
7. Proceed across caldera floor to the NE Caldera wall. At base, take a heat flow measurement.
8. Video survey up the caldera wall - collect representative rocks where needed. Take heat-flow stations at the following locations:
   179.07268°E, -34.86510°S
   179.07467°E, -34.86273°S
   179.07594°E, -34.86163°S
9. At summit of NE Caldera wall, take two heat flow probe measurements and then traverse wall rim over to the NW Caldera site.
10. In NW Caldera area, take heat probe measurements as indicated.
11. If there are empty IGTs, take samples and chimneys here. SLURP here.
12. If time permits, map the Upper Caldera wall area with multibeam sonar (~8 hrs)
13. Return to the surface.

***Jason* Basket:**
2 rock boxes, one with divider
4 IGTs
Hi Temp probe
4 chamber pots
Heat flow probe
Slurp gun
2 sidearms - 4 Majors
RESON multibeam sonar

APPENDIX III

Cruise Log TN-350

Note: Local time: 13 hrs ahead GMT

GMT	Local Time	Comments
01:00 Mar 6 jd=65	14:00 Mar 6 jd=65	Departed Auckland.
02:00	15:00	Pilot disembarks Ship is transiting to the first waypoint at Brothers volcano 179.054017°E -34.86086°S
19:30 Mar 6	08:30 Mar 7 (jd 66)	Slow the ship – we are about 1 hr away from site. We have a ship's power issue with Jason. We will be doing a power switch over to another clean power circuit for the Jason van. Requires power turned off to all science labs and sensor systems, incl. multibeam, satellite comms, email, etc.
22:00 Mar 6	11:00 Mar 7	Clean power back on in the labs
		Install and lower USBL pole from ship
02:27 Mar 7	15:27 Mar 7	Elevator in water – being lowered on CTD wire
04:05	17:05	Elevator released 179.054017°E -34.86086°S Very close to proposed IODP drill site location in Northwest Caldera area
		Start USBL survey Seems to be a good calibration, so only need to verify settings.
11:04 Mar 7	00:04 Mar 8 (jd 67)	Launch *Jason* *Jason* in the water **START *JASON* DIVE 1037**
		Jason at 100 m. Have a ground fault on AVTRAK. Will need to recover Jason.
		Medea back on deck
11:54 Mar 7	00:54 Mar 8	Recover Jason – Jason back on deck Replace faulty AVTRAK
15:00	04:00	Jason back in the water DIVE 1037 continued
15:39	04:39	Stop winch at 700 m depth for Maggie calibration spin Spin CW 1 degree/sec
15:50	04:50	Spin CCW
15:57	04:57	End mag calibration spin
16:30 Mar 7	05:30 Mar 8	*Jason* on bottom: 1458 m

16:46	05:46	Spotted XBT weight on seafloor 1460 m Lat: 34°51.647444'S Lon: 179°3.235184'E
16:48	05:48	Marker in sight: depth 1461 m Lat: 34°51.652306'S Lon: 179°3.237283'E Note: this likely to be IODP marker 6; see later 19:54
16:48	05:48	Elevator in sight
16:51	05:51	At elevator: depth 1461 m Lat: 34°51.657425'S Lon: 179°3.239415'E
16:52 Mar 7	05:52 Mar 8	Retrieve thermal blankets A/B/C from elevator
17:15 Mar 7	06:15 Mar 8	Deploy thermal blanket TB-A J2-1037-1-TB-A; event #110; depth 1447 m Lat: 34°51.606386'S Lon: 179°3.197541'E
17:45 Mar 7	06:45 Mar 8	Deploy thermal blanket TB-B on steep slope J2-1037-2-TB-B; event# 160 Lat: 34°51.560637'S Lon: 179°3.133384'E
18:31 Mar 7	07:31 Mar 8	Deploy thermal blanket TB-C J2-1037-3-TB-C; event# 224; depth 1296 m Lat: 34°51.533345'S Lon: 179°2.975265'E
18:50 Mar 7	08:50 Mar 8	Drive back to elevator
19:37	08:37	At elevator – retrieve two remaining thermal blankets D and E and move off to deploy these.
19:54 Mar 7	08:54 Mar 8	At IODP marker #6; depth 1461 m Lat: 34°51.652076'S Lon: 179°3.240377'E
20:59	09:59	Deploy thermal blanket TB-D J2-1037-4-TB-D; event #383; depth 1399 m Lat: 34°51.647429'S Lon: 179°2.974070'E
21:08	10:08	A/C in Jason van stops working
21:28 Mar 7	10:28 Mar 8	Deploy thermal blanket TB-E J2-1037-5-TB-E; event #414; depth 1449 m Lat: 34°51.694789'S Lon: 179°3.086842'E
22:23 Mar 7	11:23 Mar 8	Winch stopped working – remote control unit not working and brake is not working. Reson multibeam electronics is not working – overheating electronics in the rack. Note A/C is out in the van – electronics getting hot.
02:41 Mar 8	15:41 Mar 8	Winch fixed temporarily, but systems are not working properly. Decide to bring Jason up
03:30 Mar 8	16:30 Mar 8	Jason back on deck **END *JASON* DIVE 1037**
04:00 Mar 8	17:00 Mar 8	Prepare to run a CTD

		Do a vertical CTD cast over caldera floor V18A-01 179°03' 43.06"E (179.061961) -34°51' 57.95"S (-34.866097)
06:38 Mar 8	19:38 Mar 8	CTD deployed
07:56 Mar 8	20:56 Mar 8	Finished CTD
13:30 Mar 8	02:30 Mar 9 (jd=68)	Spin the ship with EM302 over the top of Brothers
14:20 Mar 8	03:20 Mar 9	Finished spin – move the ship south 1 mile and repeat spin with EM302
14:30 Mar 8	03:30 Mar 9	Move south to do another spin 179°4'E -34 °53'S
15:20 Mar 8	04:20 Mar 9	Begin EM302 spin over southern Brothers caldera and cone site
16:00 Mar 8	05:00 Mar 9	Finished spin Move back north to elevator site
20:00 Mar 8	09:00 Mar 9	Will set up to do underway geophysics survey south towards Auckland. Waypoints as follows: Longitude, E Latitude, S Waypoint 178 54.3954, -34°53.1186, 1 start 178 43.2839, -34°57.1482, 2 178 31.6836, -35. 6.0618, 3 178 17.2752, -35 20.4708, 4 178 4.6980, -35 43.7928, 5 178 0.5466, -35 49.6542, 6 177 57.0054, -35 52.7064, 7 177 48.4578, -36 3.0858, 8 end survey Recover towed sea surface magnetometer at the end of the survey
21:18 Mar 8	10:18 Mar 9	Magnetometer deployed Ship underway ~12.6 kts EM302 multibeam and NZ gravity meter are running Estimated 7 hr 20 min duration
05:10 Mar 9	18:10 Mar 9	End of survey line Magnetometer recovered on board.
		Maggie cable has a horrible twist in the cable. Cable is unusable. We will not do the CTD Tow-yo as we will head directly to Auckland.
05:20 Mar 9	18:20 Mar 9	Now heading directly to Auckland to get a stand alone power generator for Jason. Major storm (cyclone Hola) is forecast for Brothers area and south and so we have to leave anyway. The cyclone is due to hit Auckland as well over the late weekend into Monday.
19:05 Mar 9	08:04 Mar 10 (jd=69)	Driving through Hauraki Gulf towards Auckland Pilot is on board and we are heading for Auckland harbor
20:00 Mar 9	09:00 Mar 10	At the dock, Auckland – Freyberg Quay Generator for Jason is here at the dock
	Mar 11	At the dock, Auckland
22:01	11:01	At the dock, Auckland

Mar 11	Mar 12 (jd=71)	Rain from storm Hola finally arriving this a.m. Not much wind. Blows through by 10:30 pm
Mar 12	Mar 13 (jd=72)	At the dock, Auckland Plan is to depart at 23:59 local
10:59 Mar 13	23:59 Mar 13	Depart Auckland harbor
19:00 Mar 13	08:00 Mar 14	In transit to Brothers volcano
07:00 Mar 14	20:00 Mar 14	Arrive on site at Brothers
07:30	20:30	Deploy USBL pole
08:26 Mar 14	21:26 Mar 14 (jd=73)	**BEGIN *JASON* Dive 1038** Deploy Jason at elevator site Lat: -34°51.6516'S Lon: 179°03.2410'E
08:33	21:33	Medea deployed - going down with Jason Stop at 745 m for magnetometer calibration spins
09:58 Mar 14	22:58 Mar 14	Jason on bottom
10:13 Mar 14	23:13 Mar 14	Recover thermal blanket A: depth 1447 m Lat: 34°51.606154'S Lon: 179°3.198389'E then proceed to recover thermal blanket B
10:37 Mar 14	23:37 Mar 14	Recover thermal blanket B: depth 1383 m Lat: 34°51.559552'S Lon: 179°3.132536'E Now move off to redeploy blankets
11:20 Mar 14	00:20 Mar 15	ReDeploy blanket A 1038-1-TB-A: depth 1352 m Lat: 34°51.447425 S Lon: 179°3.141308 E
12:00 Mar 14	01:00 Mar 15	ReDeploy blanketB 1038-2-TB-B 1321 m Lat: 34°51.501180'S Lon: 179°3.048382'E
12:31	01:31	Chimney flange sample – put in POT-6 J2-1038-3-R1 depth 1301 m Lat: 34°51.534751'S Lon: 179°3.005755'E Flange opening temperature 42C
12:56	01:56	Chimney flange sample – put in POT-5 J2-1038-4-R2 depth 1302 m Lat: 34°51.533233' S Lon: 179°3.018278'E Temperature 55C
14:05 Mar 14	03:05 Mar 15	Chimney sample in POT-7 J2-1038-5-R3 depth 1319 m Lat: 34°51.475177' S Lon: 179°3.115996'E
14:14	03:14	Chimney sample from small beehive in POT-8 J2-1038-6-R4 (Note: This is the same station as station 5) Bottom part fell to seafloor (will retrieve later)
14:25	03:25	Gas-tight water sample at same chimney J2-1038-6-IGT3 Temperature: 279C

14:33	03:33	Gas-tight water sample (second sample) J2-1038-6-IGT4 Temperature: 272C
14:57 Mar 14	03:57 Mar 15	Major water sample at the same vent site J2-1038-6-MAJ-WHITE
15:05 Mar 14	04:05 Mar 15	Deploy HOBO hi-T temperature probe white/red in vent 1038-6-TC/red/white Event # 1249; depth: 1319 m lat: 34°51.476250' S lon: 179°3.108366' E
15:50	04:50	Heat Flow Probe measurement at thermal blanket C site J2-1038-7-HF1; depth 1297 m Lat: 34°51.533566'S Lon: 179°2.976365' E
16:47	05:47	Finished heat flow measurement, retrieve blanket C Lat: 34°51.533336'S Lon: 179°2.976224'E
17:33	06:33	Retrieve thermal blanket D Lat: 34°51.646147'S Lon: 179°2.974106 E
18:05 Mar 14	07:05 Mar 15	At thermal blanket E, retrieve blanket Lat: 34°51.691661'S Lon: 179°3.088627' E Heat flow probe measurement J2-1038-8-HF2: depth 1449 m
18:25	07:25	Finished heat flow probe measurement, now move off to redeploy the thermal blankets
18:56	07:56	Redeploy thermal blanket C J2-1038-9-TB-C depth: 1465 m Lat: 34°51.734557'S Lon: 179°3.228263' E
19:33 Mar 14	08:33 Mar 15	Deploy thermal blanket D J2-1038-10-TBD depth 1488 m Lat: 34°51.683366 S Lon: 179°3.339113 E
20:06 Mar 14	09:06 Mar 15	Redeploy thermal blanket E J2-1038-11-TB-E: depth 1570 m Lat: 34°51.651154 S Lon: 179°3.431846 E
21:35	10:35	Crumbled beehive chimney pieces placed in POT-4 J2-1038-12-R5: depth 1582 m Lat: 34°51.663299'S Lon: 179°3.445754'E
22:08	11:08	Gas-tight water sample J2-1038-12-IGT6: Temperature 243°C Decided not to take second IGT here as too unstable
22:45 Mar 14	11:45 Mar 15	Dead chimney sample placed in IGT 3&4 basket J2-1038-12-R6: depth 1580 m

		Lat: 34°51.662980'S Lon: 179°3.447616'E
		Move off to look for a diffuse sample location – test several shimmering water sites
00:02 Mar 15	13:02 Mar 15	Black smoker chimney sample placed in POT-2 J2-1038-13-R7: depth 1582 m Lat: 34°51.690513'S Lon: 179°3.438007' E
00:11 Mar 15	13:11 Mar 15	Gas-tight water sample at same site J2-1038-13-IGT5: Temperature 303°C Note van says site 14 but is 13
00:23 Mar 15	13:23 Mar 15	Major water sample at same site as IGT J2-1038-13-MAJ-YELLOW
00:33 Mar 15	13:33 Mar 15	Deploy hobo HiT temperature probe at same site 1038-13-HOBO-TC RED/BLACK Event # 2584: depth: 1582 m lat: 34°51.714354' S lon: 179 °3.387708' E
00:38 Mar 15	13:38 Mar 15	Chimney sample (placed in port blue bin) 1038-13-R8 piece that fell to the ground earlier Note van says R7 but is R8.
00:52 Mar 15	13:38 Mar 15	Check shimmering water patch temperature Temperature 37°C
01:10	14:10	Temperature continues to rise, so cancel major water sample attempt. Move off to find another site
02:36	15:36	Stop at another shimmering water site Max temp is 65+°C
03:12	16:12	Move to another white patch of shimmering water Take temperature (value not recorded in Van)
03:22 Mar 15	16:22 Mar 15	Major water sample at this diffuse vent patch J2-1038-14-MAJ-GREEN: depth 1595 m Lat: 34°51.676078'S Lon: 179°3.445241'E
03:39	16:39	Finished sampling, move off to pickup blanket
03:52	16:52	Retrieve thermal blanket TB-E
04:13	17:13	Retrieve blanket D but lost blanket E as it slid downhill!
04:18	17:18	Retrieved lost blanket E
04:46	17:46	Retrieved blanket C
		Head towards elevator
04:49	17:49	At elevator
05:04	18:04	Put all three thermal blankets in the elevator
06:15	19:15	Temperature probe measurement of 187°C
06:24	19:24	Chimney sample (large!) from active smoker (in HOBO box) J2-1038-15-CH-1: depth 1331 m Lat: 34°51.468714'S Lon: 179°3.127247'E
		Chimney sample in POT-1 same location J2-1038-15-CH-2
07:21	20:21	Retrieve HOBO RED/WHITE

07:59	20:59	Retrieve thermal blanket A
08:23	21:23	Retrieve thermal blanket B – now go to elevator
09:07	22:07	At the elevator, place blankets in box on elevator
09:47 Mar 15	22:24 Mar 15	Problem releasing elevator. It appears the release arm is hitting the wooden box and not dropping all the way.
09:50 Mar 15	22:50 Mar 15	Elevator released and coming to surface ETA 50 min *Jason* is on its way up as well
09:53	22:53	*Jason* off bottom
		Jason at 300 m Waiting for elevator to surface – no tracking on elevator
10:49 Mar 15	23:49 Mar 15	Elevator at surface but there is a strong surface current. Ship has a hard time closing on elevator. Ship has to drive ~ 2 kts, with Jason and Medea in the water streaming behind to close distance on the elevator.
11:24 Mar 15	00:24 Mar 16	Elevator finally hooked and lifted on deck
11:52	00:52	Medea on deck
12:01 Mar 15	01:01 Mar 16	*Jason* on deck **END *JASON* DIVE 1038**
		We will reconfigure the elevator and process all the samples from the Jason basket.
18:29 Mar 15	07:29 Mar 16	Prep for elevator launch – 9 thermal blankets and 2 major water samplers on board
18:45 Mar 15	07:45 Mar 16	Elevator launched at WC-1A site 34.87527°E 179.05856°S
		Dive 1039 will be a transect from WC-1A site to the Northwest caldera vent site and stockwork zone
		Issues with Medea – blown regulator related to the compass on Medea. This delays launch. The unit is repaired and the dive can begin.
~23:24 Mar 15	12:24 Mar 16	**START *JASON* DIVE 1039** Launch *Jason* WC-1A target Lat: 34°52.5162'S Lon: 179°3.5142'E
		Ground on IGT ICLs. Need to recover Jason and fix Jason back on deck. The ICL is replaced and Jason is prepared to relaunch
23:47 Mar 15	12:47 Mar 16	*Jason* in the water
23:50 Mar 15	12:50 Mar 16	Medea in the water
01:20 Mar 16	14:20 Mar 16	Jason on bottom Going to the elevator – then video survey around the elevator site to find a good open area with no talus for drill site location
01:51 Mar 16	14:51 Mar 16	Find an open sedimented area Deploy IODP Marker-1 Lat: 34°52.521060'S Lon: 179°3.499290'E
		Head back to elevator and get Thermal blanket A

01:58 Mar 16	14:58 Mar 16	At elevator - pickup thermal blanket A and deploy nearby
02:02 Mar 16	15:02 Mar 16	Deploy Thermal Blanket A J2-1039-1-TB A: depth 1756 m Lat: 34°52.507650'S Lon: 179°3.515334' E
02:12 Mar 16	15:12 Mar 16	Deploy heat flow probe next to the blanket Can only get bottom 2 thermistors into sediment (~ 10 cm penetration) J2-1039-1-HF1: depth 1756 m Lat: 34°52.508052'S Lon: 179°3.515598' E 10 min insertion measurement, 20 sec pulse, 10 minute measurement period
02:37	15:37	Return to elevator and pickup 5 thermal blankets
03:23 Mar 16	16:23 Mar 16	Deploy Thermal Blanket C J2-1039-2-TB-C: depth 1804 m Lat: 34°52.360560'S Lon: 179°3.518322'E
03:50 Mar 16	16:50 Mar 16	Deploy Thermal Blanket B J2-1039-3-TB-B: depth 1832 m Lat: 34°52.216020'S Lon: 179°3.519720'E
04:17 Mar 16	17:17 Mar 16	Deploy Thermal Blanket E J2-1039-4-TB-E: depth 1845 m Lat: 34°52.081314'S Lon: 179°3.521514'E
04:46 Mar 16	17:46 Mar 16	Deploy Thermal Blanket D J2-1039-5-TB-D: depth 1806 Lat: 34°51.931980'S Lon: 179°3.506892' E
04:48 Mar 16	17:48 Mar 16	Transit back to elevator to pick up the rest of the blankets
06:01	19:01	At elevator – pick up four blankets
06:09 Mar 16	19:09 Mar 16	Begin transit over to the caldera wall to place the remaining four thermal blankets
08:03 Mar 16	21:03 Mar 16	Deploy Thermal Blanket I J2-1039-6-TB-I depth 1575 Lat: 34°51.818586 S Lon: 179°3.489918 E
		Transit over to next thermal blanket deployment site
08:40 Mar 16	21:40 Mar 16	Deploy Thermal Blanket H J2-1039-7-TB-H depth 1613 Lat: 34°51.839706 S Lon: 179°3.410868 E
		Transit over to next thermal blanket deployment site
09:02 Mar 16	22:02 Mar 16	Deploy Thermal Blanket F J2-1039-8-TB-F: depth 1571 Lat: 34°51.795450'S Lon: 179°3.476526'E
09:24	22:24	Head over to stockwork zone area
09:46	22:46	Video survey the stockwork zone
10:18	23:18	Sample stockwork outcrop for a rock sample

Mar 16	Mar 16	J2-1039-10-R1 Two pieces in port side blue basket
11:01 Mar 16	00:01 Mar 17	Stop at black smoker on steep wall
		Active black smoker chimney sample J2-1039-11-CH1: depth 1599 m: put in POT 6 Lat: 34°51.667120'S Lon: 179°3.459908'E
11:10 Mar 16	00:10 Mar 17	IGT water sample J2-1039-11-IGT1 Temperature: 318°C
11:17 Mar 16	00:17 Mar 17	Second IGT water sample J2-1039-11-IGT2 Temperature: 303°C
11:36 Mar 16	00:36 Mar 17	Take a major water sample at same black smoker vent J2-1039-11-MAJ-WHITE
11:53 Mar 16	00:53 Mar 17	T tubeworm "grotto"
11:59 Mar 16	00:59 Mar 17	Take a chimney sample of small black smoker in front of tubeworm grotto area J2-1039-12-CH1: 1592 m; put in POT 7 Lat: 34°51.664735' S Lon: 179°3.458171'E
12:12 Mar 16	01:12 Mar 17	Take a temperature Temperature 94°C
12:18	01:18	Close up video of tubeworm colony
12:37 Mar 16	01:37 Mar 17	Sample an active white covered sulfide chimney next to grotto J2-1039-12-CH2: 1592 m; put in POT 2 Lat: 34°51.664574'S Lon: 179°3.458306'E
12:43 Mar 16	01:43 Mar 17	Temperature of chimney Temperature 153°C
13:25 Mar 16	02:25 Mar 17	Move to another black smoker chimney area Take a sample of active black smoker J2-1039-13-CH1: 1596 m; put in POT 8 Lat: 34°51.664752'S Lon: 179°3.462178'E
		Head over to pickup HOBO probe
13:47	02:47	HOBO in sight
13:57 Mar 16	02:57 Mar 17	HOBO REDBLACK retrieved onto Jason basket Lat: 34°51.691433'S: depth 1582 m Lon: 179°3.438496'E
14:04 Mar 16	03:04 Mar 17	Head back to south stockwork zone and vent chimneys at lower caldera wall area
16:09	05:09	Stopped at a small chimney to sample J2-1039-14-CH1: 1611 m; put in POT 1 Lat: 34°51.725634'S Lon: 179°3.443707'E
16:22	05:22	Take a temperature measurement Temperature 183°C
16:30	05:30	Take a major water sample at this location

Mar 16	Mar 17	J2-1039-14-MAJ-YELLOW Lat: 34°51.724907'S Lon: 179°3.443547'E
16:42 Mar 16	05:42 Mar 17	Get more of the chimney sample at same location J2-1039-14-CH2; in POT 4
17:05	06:05	Start to take an IGT water sample, but temperature not correct (45°C) Check temperature with T-probe: 303 C
17:30	06:30	Reset up to take IGT sample J2-1039-14-IGT 7: depth 1611 m Lat: 34°51.726441'S Lon: 179°3.443462'E Temperature say 93°C but probably incorrect and closer to 303°C based on T-probe
17:40 Mar 16	06:40 Mar 17	Set up to take major water sample J2-1039-14-MAJ-GREEN: depth 1611 m Lat: 34°51.726441'S Lon: 179°3.443462'E
17:49 Mar 16	06:49 Mar 17	Leave sample site looking to sample a white chimney
17:53 Mar 16	06:53 Mar 17	Sample small white chimney J2-1039-15-CH1: depth 1605 m; in POT 4 Lat: 34°51.724823'S Lon: 179°3.437560'E
18:01 Mar 16	07:01 Mar 17	Take a temperature at chimney sample location Temperature: 42°C
18:05 Mar 16	07:05 Mar 17	Take a major sample at this same location J2-1039-15-MAJ-RED: depth 1605 m Lat: 34°51.724675'S Lon: 179°3.437341'E
18:14	07:14	Finished sampling. Move over to pickup blankets on the caldera floor and take to elevator
18:59 Mar 16	07:59 Mar 17	At blanket – D Lat: 34°51.926377'S Lon: 179°3.480345 E Setup to take a heat flow probe measurement
19:05 Mar 16	08:05 Mar 17	Heat flow probe measurement J2-1039-16-HF1 : depth 1806 m Lat: 34°51.925892'S Lon: 179°3.478930'E Full penetration 10 min measurement, then 20s heat pulse, and 10min measurement
19:24	08:24	Finished heat probe measurement
19:28 Mar 16	08:28 Mar 17	Retrieve thermal blanket D Then travel over to pickup next blanket

19:58 Mar 16	08:58 Mar 17	Retrieve thermal blanket E: depth 1850 Lat: 34°52.075870'S Lon: 179°3.503078'E Travel over caldera floor to pickup next blanket
20:27 Mar 16	09:27 Mar 17	Retrieve thermal blanket B: depth 1834 m Lat: 34°52.213824'S Lon: 179°3.508042'E Move to next thermal blanket
20:54 Mar 16	09:54 Mar 17	Retrieve thermal blanket C : depth 1805 m Lat: 34°52.353896'S Lon: 179°3.515702'E Move to next thermal blanket
21:22	10:22	At elevator
21:24 Mar 16	10:24 Mar 17	Place blankets in the elevator : depth 1754 m Blankets D,C,E,B Lat: 34°52.515841'S Lon: 179°3.512074'E
21:29 Mar 16	10:29 Mar 17	Go and find thermal blanket A
21:30 Mar 16	10:30 Mar 17	Retrieve thermal blanket A: depth 1757 m Lat: 34°52.505390'S Lon: 179°3.512590'E
21:33	10:33	Back at the elevator. Put thermal blanket A in the elevator Secure lid to box
21:48 Mar 16	10:48 Mar 17	Swap out fired major water samplers with empty ones on the elevator Move White & Yellow from the basket to elevator Move Blue & Orange from elevator to starboard basket
21:58 Mar 16	10:58 Mar 17	Finished moving major samplers on elevator. Prepare to transit back to caldera wall. Estimate 1 hr 12 min
23:14	12:14	At base of cliff / massive outcrop
23:29 Mar 16	12:29 Mar 17	Jason arm and basket gets tangled in thin copper wire … XBT wire?
23:59 Mar 16	12:59 Mar 17	Finally free of the XBT copper wire Head over to stockwork 2 site
00:04 Mar 17	13:04 Mar 17	Arrive at a stockwork zone (stockwork zone 3) - white altered rock that is heavily veined with dark brown veins several cms thick. Top of outcrop has dead sulfide chimneys Do video imaging here first and then take a sample
00:15 Mar 17	13:15 Mar 17	Take a sample of the vein material J2-1039-17-R1: depth 1699 m Lat: 34°51.808015'S Lon: 179°3.485389'E Place sample in right hand blue basket
00:20	13:20	Begin a slow ascent of the outcrop for video
00:35	13:35	Massive blocky lava to the left
00:38	13:38	Continue traverse onto stockwork 2 area
00:44	13:44	Veined altered outcrop
00:58 Mar 17	13:58 Mar 17	Diffuse flow on a small field of small 25 cm high chimneys Depth: 1657 m Lat: 34°51.759487'S Lon: 179°3.476755'E

01:19 Mar 17	14:19 Mar 17	Stop at a solitary black smoker chimney Will get rock sample and IGT here
01:24 Mar 17	14:24 Mar 17	Take sulfide chimney sample J2-1039-18-CH1: depth 1617 m Lat: 34°51.720484'S Lon: 179°3.458347'E Sample in POT 5
01:35 Mar 17	14:35 Mar 17	Set up for IGT water sample J2-1039-18-IGT8: depth 1617 m Lat: 34°51.720538'S Lon: 179°3.458717'E Temperature 301°C
01:43 Mar 17	14:43 Mar 17	Want to take major water sample but need to move to get starboard swing arm out
01:59 Mar 17	14:59 Mar 17	Reset position after getting major water bottle out of swing arm Take major water sample J2-1039-18-MAJ-BLUE: depth 1617 Lat: 34°51.721531'S Lon: 179°3.457583'E
02:20	15:20	Try and take a sample of the remaining stump of the chimney
		Broke sample and picked up small wall piece of sample and put in IGT1 basket J2-1039-18-CH2 Lat: 34°51.720908'S Lon: 179°3.458537'E
02:32 Mar 17	15:32 Mar 17	Have to go and get thermal blankets. Weather is going to worsen here in the next few hours.
		Head over to nearest blanket 'G'
02:34	15:34	Retrieve blanket G: depth 1613 m Lat: 34°51.711668' S Lon: 179°3.463627' E Head over to next blanket location
02:55	15:55	Retrieve blanket I: depth 1573 m Lat: 34°51.777262'S Lon: 179°3.441636'E Head over to next blanket location
03:01	16:01	Retrieve blanket F: depth 1569 m Lat: 34°51.756756'S Lon: 179°3.397812'E Head over to next blanket location
03:15	16:15	Retrieve blanket H: depth 1612 m Lat: 34°51.806437'S Lon: 179°3.328318'E
03:20 Mar 17	16:20 Mar 17	Need to move to the elevator with the blankets Will move up in the water column and get towed over by Medea and the wire.
04:28 Mar 17	17:28 Mar 17	Arrive at the elevator

04:33 Mar 17	17:33 Mar 17	Place the four blankets in the elevator: depth 1754 m Lat: 34°52.515532'S Lon: 179°3.513748'E
04:42	17:42	Release elevator by pulling pin: depth 1754 m
04:44	17:44	*Jason* on way up because of worsening weather outlook for tonight and Sunday
06:09 Mar 17	19:09 Mar 17	*Jason* on deck **END *JASON* DIVE 1039**
06:35 Mar 17	19:35 Mar 17	Elevator reached surface sometime around 6:30 UTC Ship had it in their sights but now have lost track of it.
		In search mode for elevator! The wind has kicked up dramatically with sustained 25-30 kts and gusts to 35 kts
08:05 Mar 17	21:05 Mar 17	No acoustic tracking of elevator. No radio tracking of elevator. No visual of elevator
		At 6:35 UTC last known position of elevator from USBL at 90 m depth. 34°52.42967' S 179°3.35100'E coming up at 20/min and tracking along a bearing of 308 degrees. Released at 4:42 UTC at 1754 m depth Ship has tried predicting the drift path of the elevator from surface currents and last known position
09:41 Mar 17	22:41 Mar 17	Current status is no contact visual or otherwise with elevator. Elevator has all nine of the thermal blankets, 2 major water samplers, a MAPR and Jason beacons.
11:00 Mar 17	00:00 Mar 18	Search overnight and through the day for elevator with no luck. Storm is up 35 kts winds and heavy seas 10-12 ft.
06:30 Mar 18	19:30 Mar 18	End search for elevator and steam back to start point for a geophysical survey.
06:33 Mar 18	19:33 Mar 18	Sea surface magnetometer , multibeam EM302 survey along with gravity (GNS system) 1, 178, 45.805, -34, -36.002 Start 2, 178, 36.538, -34, -28.323 3, 178, 26.344, -34, -34.546 4, 179, 23.008, -35, -06.916 5, 178, 53.948, -35, -43.787 6, 178, 53.815, -35, -48.222 7, 179, 26.119, -35, -07.512 8, 179, 04.605, -34, -50.698 End
07:05 Mar 18	20:05 Mar 18	Will turn the ship where we are and line up on line to start surveying
07:38 Mar 18	20:38 Mar 18	Deploy magnetometer (100 m tow cable) Start geophysical survey; 6 kts transit speed (USBL pole is down for now) EM302 start logging Heading to WP 2

11:13 Mar 18	00:13 Mar 19	At WP 3 turning to head to WP 4
04:00 Mar 19	17:00 Mar 19	Continue with survey
18:48 Mar 19	07:48 Mar 20	On last line of survey
		Will set up for CTD Tow-yo
21:03 Mar 19	10:03 Mar 20	Finished geophysics survey Recover magnetometer on board
21:20 Mar 19	10:20 Mar 20	Begin CTD tow-yo Launch CTD Cast-1: T18A-01 Tow is from north to south, wind is from the east at 20 kts Lower CTD to 1900 m then start ship along track 179 2.8920' E -34°50.1960' S start 179°4.5540' E -34°54.0300' S end
21:47 Mar 19	10:47 Mar 20	Start ship heading down the line at 1 kt Wire out 1064 m
05:00 Mar 20	18:00 Mar 20	End of CTD Tow-yo survey
05:50 Mar 20	18:50 Mar 20	Deploy magnetometer for a 36 hr geophysics survey

Waypoint		**Long (deg min) E**		**Lat (deg min) S**	
Start	1	179	4.402	-34	-51.368
	2	179	11.496	-34	-31.111
	3	179	14.829	-34	-22.308
	4	178	59.444	-34	-5.214
	5	178	56.966	-34	-2.906
	6	178	52.949	-34	-0.342
	7	178	54.573	-33	-54.957
	8	179	0.726	-33	-58.889
	9	179	5.256	-34	-2.821
	10	179	8.248	-34	-2.479
	11	179	8.333	-33	-47.949
	12	179	3.632	-33	-39.658
	13	179	9.188	-33	-35.299
	14	179	13.974	-33	-37.179
	15	179	17.393	-33	-39.573
	16	179	20.983	-33	-42.137
	17	179	27.393	-33	-44.957
	18	179	33.803	-33	-42.735
	19	179	38.590	-33	-41.709
	20	179	30.214	-33	-40.940
	21	179	28.077	-33	-38.803
	22	179	34.060	-33	-39.145
	23	179	39.957	-33	-39.915
	24	179	41.239	-33	-36.239

			25	179	48.077	-33	-32.393
			26	179	52.009	-33	-34.359
			27	179	47.906	-33	-41.709
			28	179	45.171	-33	-46.496
			29	179	46.880	-33	-50.855
			30	179	30.470	-34	-12.650
			31	179	15.513	-34	-38.462
		End	32	179	5.085	-34	-51.966
01:04 Mar 21	14:04 Mar 21	Continuing with geophysical survey Slowed the ship to 6 kts for better data and to arrive back at Brothers by 5:00 am local					
02:17 Mar 21	15:17 Mar 21	On our way to waypoint 27					
15:30	04:30 Mar 22	Finished geophysics survey – recover magnetometer					
16:00	05:00	Ship hoves to at Brothers dive site We will change the oil in the generator					
17:00 Mar 21	06:00 Mar 22	Put the USBL pole down in preparation for diving.					
18:00	07:00 Mar 22	Sunrise – weather has relented and a dive seems possible. Start preparation for diving with Jason					
19:34 Mar 21	08:34 Mar 22	*Jason* in the water **BEGIN *JASON* DIVE 1040**					
20:24	09:24	Stop at 938 m for Maggie calibration spin					
20:41	09:41	Finished Maggie calibration spin, resume descent to bottom					
21:25	10:25	Bottom in sight, fixing issues with level wind n winch					
21:31	10:31	*Jason* on bottom					
21:41	10:41	Do heat flow probe measurement J2-1040-1-HF1 depth 1829 m Lat: 34°52.219458 S Lon: 179°3.498840 E 600 sec wait period 20 sec heat pulse 20W heat level and 600 sec measurement wait					
22:03	11:03	End of heat flow measurement Move on to next station					
23:32	12:32	Do heat flow probe measurement – half-way in J2-1040-2-HF1: depth 1559 m Lat: 34°52.692624'S Lon: 179°3.727890'E					
23:49	12:49	End of heat flow measurement Move on to next station					
00:33 Mar 22	13:33 Mar 22	Do heat flow probe measurement – half-way in J2-1040-3-HF1: depth 1414 m Lat: 34°52.695270'S Lon: 179°3.799314'E Do 480 sec wait period (8 mins), then heat pulse, then 8 min measurement					
00:49	13:49	End of heat flow measurement. Move on to next station					

01:06 Mar 22	14:06 Mar 22	Just starting to cross from talus and volcanic sediments into more silica oxy-hydroxide deposits on the seafloor
01:27	14:27	Stop for heat flow probe measurement – all the way in J2-1040-4-HF1: depth 1309 m Lat: 34°52.766826'S Lon: 179°3.957282' E Do 480 sec wait period (8 mins), then heat pulse, then 8 min measurement
01:43	14:43	Finished heat flow probe measurement. Prepare to take a sample from this location. Try to get small silica-iron oxyhydroxide chimney piece
01:49	14:49	Small chimney sample of silica-iron oxyhydroxide deposit J2-1040-4-CH1: depth 1309 Lat: 34°52.766826'S Lon: 179°3.957282'E Placed in POT 7
01:54	14:54	Move to next heat flow probe site
02:10	15:10	Crossed into sulfur-rich area: depth 1222 m
02:13	15:13	Reached the crest of the volcano: 1194 m
02:17	15:17	Stop for heat flow probe measurement – all the way in J2-1040-5-HF1: depth 1197 m Lat: 34°52.774950'S Lon: 179°4.076100'E Do 480 sec wait period (8 mins) then heat pulse then 8 min measurement
02:34	15:34	Finished heat flow measurement. Head to find old thermal blanket that was deployed in 2017. Head down into crater of the volcano
02:41	15:41	Sulfur chimneys
02:54 Mar 22	15:54 Mar 22	Find thermal blanket in the pit crater
02:56 Mar 22	15:56 Mar 22	Make a heat flow probe measurement near the thermal blanket – probe all the way in J2-1040-6-HF1: depth 1227 m Lat: 34°52.771512'S Lon: 179°4.121664'E Do 480 sec wait period (8 mins), then heat pulse, then 8 min measurement
03:14	16:14	End of heat flow measurement, move off to find a sample of the sulfur chimneys
03:37	16:37	Stopping at sulfur chimney
03:42	16:42	Sulfur chimney sample – very fragile J2-1040-7-CH1: depth 1212 m Lat: 34°52.774416'S Lon: 179°4.113276'E Put in POT 8
03:49	16:49	Move over to sample bigger chimney
03:57	16:57	Sample another sulfur chimney nearby J2-1040-7-CH2: depth 1208 m Lat: 34°52.776294'S Lon: 179°4.111062'E Placed in blue crate

04:01	17:01	Sulfur chimney J2-1040-7-CH3: depth 1208 m Lat: 34°52.776618'S Lon: 179°4.110684'E Placed in blue crate
04:10	17:10	Move off to next site
04:14	17:14	White smokers – set up to check temperatures and get water samples
04:27	17:27	Max temp 167°C – decide to take an IGT sample
04:33 Mar 22	17:33 Mar 22	Water sample of white smoker J2-1040-8-IGT3: depth 1213 m Temperature 160°C Lat: 34°52.789518'S Lon: 179°4.102686'E
04:36 Mar 22	17:36 Mar 22	Finished IGT set up for major water sampler. Try BLUE sampler but have problems with it. Swap out samplers
05:17	18:17	Finally get major water sample J2-1040-8-MAJ-GREEN: depth 1213 m Lat: 34°52.789518'S Lon: 179°4.102686'E
05:25	18:25	Move off to next target
05:29	18:29	Get another gas tight water sample IGT4 is not working properly. Swap out for IGT 5 J2-1040-8-IGT5: depth 1213 m Temperature 198°C Lat: 34°52.789518'S Lon: 179°4.102686'E
06:02	19:02	Finished sampling and check the temperature with T-probe
06:11	19:11	Chimney sample of white smoker J2-1040-8-CH1: depth 1213 Lat: 34°52.789518'S Lon: 179°4.102686'E Put in POT 6
06:24	19:24	Finished sampling and move on
06:37	19:37	At heat flow probe site - only half way in J2-1040-9-HF1: depth 1202 m Lat: 34°52.806090'S Lon: 179°4.126074'E Do 480 sec wait period (8 mins), then heat pulse, then 8 min measurement
07:33	20:33	White smoker area. Stop for water sample J2-1040-10-MAJ-RED: depth 1214 m Lat: 34°52.788432'S Lon: 179°4.098246'E
07:44 Mar 22	20:44 Mar 22	Temperature probe registers 199°C at vent where fluid sample was taken. Now look around for more rock samples
07:59 Mar 22	20:59 Mar 22	Rock sample of red/white fragile material J2-1040-10-R1: depth 1214 m Lat: 34°52.941360'S Lon: 179°4.095877'E Put in POT-2

08:03	21:03	Move up a bit to sample ledge
08:13	21:13	Rock sample of ledge material J2-1040-10-R2: depth 1212 m Lat: 34°52.941928'S Lon: 179°4.093691'E Put in POT 1 Move on to next heat flow station
09:00	22:00	Make a heat flow probe measurement Probe fully inserted J2-1040-11-HF1: depth 1279 m Lat: 34°52.843445'S Lon: 179°4.181976'E
09:17		Finished heat flow station
		Head towards Lower Cone. Bottom slope drops off, Jason doesn't track the bottom
10:01	23:01 Mar 22	Tether to Jason caught up on Medea. Decide to end dive and come up.
11:06	00:06	*Jason* on deck No issues with tether although plan is now for an 8-hour turnaround. **END *JASON* DIVE 1040**
		Will in the meantime do a CTD tow-yo
11:48 Mar 22	00:48 Mar 23	Get ready for CTD tow-yo: on station T18A-02 (cast 3) Start 34°53.9100'S 179°3.1800'E End 34°51.5040' S 179°5.4900' E
12:04 Mar 22	01:04 Mar 23	CTD going down 34°53.906'S 179°3.188'E
		CTD going over Upper Cone and Lower Cone sites SW to NE
16:52	05:52	End of CTD tow coming up 34°51.345'S 179°5.633'E
17:11	06:11	CTD back on deck
		Prepare for Jason dive
19:17	08:17	*Jason* in the water **BEGIN *JASON* DIVE 1041**
19:26	08:26	*Jason* going down
19:55	08:55	Stop at 700 m for Magnetometer calibration spin
20:12	09:12	Finished magnetometer spin
		Issues with winch and level wind
21:14	10:14	*Jason* on bottom Look for a good heat flow station
21:38	10:38	Make a heat flow probe measurement Probe fully inserted J2-1041-1-HF1: depth 1608 m Lat: 34°54.033384'S Lon: 179°2.055480'E
21:54	10:54	Finished heat flow station. Retrieve and move off to next heat flow target

23:06	12:06	Stop for a heat flow probe measurement Probe not all the way in – about 10 cm above sediment J2-1041-2-HF1: depth 1427 m Lat: 34°54.179304'S Lon: 179 2.305566'E Doing 8 min measurement periods
23:22	12:22	Finished heat flow station. Move on to next heat flow target
00:01 Mar 23	13:01 Mar 23	Stop for a heat flow probe measurement Probe not all the way in – about 15 cm above sediment J2-1041-3-HF1: depth 1432 m Lat: 34°54.308346'S Lon: 179°2.144064' E
00:17 Mar 23	13:17 Mar 23	Finished heat flow station. Move on to summit cone area and next heat flow target
00:38 Mar 23	13:38 Mar 23	Move into sulfur sand dominated terrain
00:45	13:45	In crater – at Marker '08': depth 1319 m Lat: 34°54.368064'S Lon: 179 2.282190'E
00:48	13:48	Stop at a shimmering water, clear water venting at cracks in sulfur crust. Take a temperature probe measurement of shimmering water vent
00:55	13:55	Temperature max 62°C Decide to take water samples at this location. But first move slightly to get a sample of a ledge of sulfur
01:06	14:06	Take a sample of sulfur ledge material J2-1041-4-R1: depth 1315 m Lat: 34°54.368904'S Lon: 179 2.279784'E Put in POT 1
01:17	14:17	Moved back to original shimmering water crack and take IGT water sample J2-1041-4-IGT8: depth 1315 m Lat: 34°54.368790'S Lon: 179 2.280024'E Max temperature 61°C
01:20	14:20	Finished IGT and now decide to get a major water sample
01:28	14:28	Take a major water sample at same location as IGT J2-1041-4-MAJ-RED: depth 1315 m Lat: 34°54.368790'S Lon: 179 2.280024'E
01:32	14:32	Move off to look for more sample locations. Do a slow video transect to the west. Barnacle city!
01:55	14:55	Find a sediment hollow for a heat flow measurement
01:57 Mar 23	14:57 Mar 23	Make a heat flow probe measurement Probe not all the way in – about 10 cm above sediment J2-1041-5-HF1: depth 1304 m Lat: 34°54.389604'S Lon: 179 2.253216'E
02:13	15:13	Heat flow measurement finished Dig into the sediment to reveal sulfur liquid and dust beneath the surface
02:24	15:24	Move off to find another water sample location. Move down outside of crater and then run east along a contour just outside the crater rim

02:34	15:34	Barnacle forest
03:01	16:01	Stopped at a potential sample location for water. Will check temperature with T-probe
03:04	16:04	Temperature max 59°C
03:07	16:07	Prepare for an IGT water sample J2-1041-6-IGT7: depth 1329 m Lat: 34°54.387492'S Lon: 179°2.273046'E Max temperature 65°C
03:17	16:17	Finished IGT water sample. Now take a major water sample from the same location
03:31	16:31	Major water sample J2-1041-6-MAJ-GREEN: depth 1329 m Lat: 34°54.387492'S Lon: 179°2.273046' E
03:34	16:34	Finished major water sample. Decide to take a rock sample here
		Rock sample J2-1041-6-R1: depth 1329 m Lat: 34°54.387492'S Lon: 179°2.273046'E Place in black milk crate top left corner
03:49 Mar 23	16:49 Mar 23	Take another rock sample here J2-1041-6-R2: depth 1329 m Lat: 34°54.387492'S Lon: 179°2.273046'E Place in POT 2
03:55 Mar 23	16:55 Mar 23	Move off to next target - a place for low temperature fluids for Lucy's sample
04:08	17:08	Stopped at potential location
04:17	17:17	Temperature measurement shows 16°C
04:21	17:21	Major water sample for Lucy J2-1041-7-MAJ-BLUE: depth 1328 m Lat: 34°54.381798'S Lon: 179°2.273100'E
04:23	17:23	Finished sampling, head off to next heat flow site to the east
05:38	18:38	Stopped at a heat flow site Probe only half way in J2-1041-8-HF1: depth 1455 m Lat: 34°54.197220'S Lon: 179°2.493084'E
05:53	18:53	Finished heat flow measurement. Move on to next heat flow site
06:53	19:53	Stopped at a heat flow site Probe fully inserted J2-1041-9-HF1: depth 1672 m Lat: 34°54.223662'S Lon: 179°2.860608'E

07:09	20:09	Heat flow station done. Move on to next target
07:14	20:14	Place IODP Marker 2 at potential alternate drill site SEC – 1A Depth 1672 m. Lat: 34°54.223674'S Lon: 179°2.860590' E
07:17 Mar 23	20:17 Mar 23	Head off north across caldera floor
08:45 Mar 23	21:45 Mar 23	Stopped at a heat flow site Probe fully inserted J2-1041-10-HF1: depth 1604 m Lat: 34°53.905968'S Lon: 179°2.489880'E
09:01	22:01	Heat flow measurement finished. Move on across the caldera floor to the north east wall
		Jason comes up into water column to transit over.
09:54	22:54	Back on the bottom
10:13	23:13	Stopped at a heat flow site Probe 2/3rds inserted J2-1041-11-HF1: depth 1811 m Lat: 34°53.845362'S Lon: 179°2.486166'E
10:30	23:30	Finished heat flow station Move over to start video traverse up the caldera wall scarp face
10:34	23:34	Take a rock sample near base of scarp J2-1041-11-R1: depth 1813 m Lat: 34°53.845446'S Lon: 179°2.486196'E Put in rock basket left side
10:49	23:49	Start transect at 1805 m
11:11	00:11 Mar 24	Take a rock sample J2-1041-12-R1: depth 1773 m Lat: 34°53.823426'S Lon: 179°2.495628'E Put in 2 front row center basket
11:49	00:49 Mar 24	Take a rock sample J2-1041-13-R1: depth 1700 m Lat: 34°53.812578'S Lon: 179°2.515716' E Put in 3 front row center basket
12:24	01:24 Mar 24	Take a rock sample J2-1041-14-R1: depth 1634 m Lat: 34°53.797626'S Lon: 179°2.541312'E Put in rightmost slot of center basket

12:37	01:37	Take a rock sample J2-1041-15-R1: depth 1608 m Lat: 34°53.794878'S Lon: 179°2.547426'E Put sample in leftmost slot rear of center basket
13:08	02:08	Take a rock sample J2-1041-16-R1: depth 1563 m Lat: 34°53.794362'S Lon: 179°2.551596'E Put sample in second from left slot rear of center basket
13:26	02:26	Take a rock sample J2-1041-17-R1: depth 1511 m Lat: 34°53.796216'S Lon: 179°2.553594'E Put sample in third from left slot rear of center basket
13:39	02:39	Take a rock sample J2-1041-18-R1: depth 1483 m Lat: 34°53.791464'S Lon: 179°2.558136'E Put sample in IGT 1/2 basket
13:52	02:52	Now into sediments at top of scarp
14:10	03:10	Stop for heat flow probe measurement. Fully inserted J2-1041-19-HF1: depth 1461 m Lat: 34°53.759460'S Lon: 179°2.581776'E
14:29	03:29	Finished heat flow measurement – now move over to next measurement site
15:36 Mar 23	04:36 Mar 24	Stop for heat flow probe measurement. Probe 2/3rds inserted J2-1041-20-HF1: depth 1592 m Lat: 34°53.704590'S Lon: 179°2.287308'E
15:52 Mar 23	04:52 Mar 24	Finished heat flow measurement Move to next station. Transit west across caldera rim
16:51 Mar 23	05:51 Mar 24	Stop for heat flow probe measurement. Probe 2/3rds inserted J2-1041-21-HF1: depth 1611 m Lat: 34°53.695164'S Lon: 179°2.078508'E
17:09	06:09	Finished heat flow measurement. Move on
18:11	07:11	Stop for heat flow probe measurement near black smoker field. At first location is too hot so find a cooler location to insert the probe. Probe just over half inserted J2-1041-22-HF1: depth 1610 m Lat: 34°53.740926'S Lon: 179°1.955682'E
18:27	07:27	Finished heat flow station. Transit to new site

18:55	07:55	Stop for heat flow probe measurement. Probe 85% inserted J2-1041-23-HF1: depth 1569 m Lat: 34°53.771766'S Lon: 179°1.909992'E
19:12	08:12	Finished heat flow measurement. Transit to new site
19:43	08:43	Stop for heat flow probe measurement. Probe 75% inserted J2-1041-24-HF1: depth 1569 m Lat: 34°53.819520'S Lon: 179 1.862682' E
19:59	08:59	Finished heat flow measurement. Move to next site
20:59	09:59	Stop for heat flow probe measurement. Probe 85% inserted J2-1041-25-HF1: depth 1573 m Lat: 34°53.809608'S Lon: 179°1.939782'E
21:15 Mar 23	10:15 Mar 24	Finished heat flow measurement. Move to next site on caldera floor WC-2A drill location
22:48 Mar 23	11:48 Mar 24	Stop for heat flow probe measurement. Probe fully inserted J2-1041-26-HF1: depth 1873 m Lat: 34°53.976744' S Lon: 179°2.092386'E
23:04	12:04	Finished heat flow measurement. Head back to caldera wall and upslope to next heat flow station
23:50 Mar 23	12:50 Mar 24	Stop for heat flow probe measurement. Probe fully inserted J2-1041-27-HF1: depth 1750 m Lat: 34°53.775750'S Lon: 179°2.042040'E
00:07 Mar 24	13:07 Mar 24	Finished heat flow measurement. Move on to take a rock sample and water samples
00:38	13:38	Stop to sample yellow fluffy slime on chimneys Sample of yellow fluffy stuff J2-1041-28-CH1: depth 1669 Lat: 34°51.753240'S Lon: 179°3.521844'E Put in POT-3 Max temperature measured to be 30°C
00:57	13:57	Move on to find black smoker chimneys to sample fluids
01:48	14:48	Stopped at sulfide chimney complex to sample black smoker fluid
02:08 Mar 24	15:08 Mar 24	Take an IGT water sample J2-1041-29-IGT 1: depth 1638 Lat: 34°51.717228'S Lon: 179°3.523764'E

02:11	15:11	Finished IGT sample. Now setup to take a major water sample
02:37	15:37	Take a major water sample at same location as IGT J2-1041-29-MAJ-ORANGE: depth 1638 Lat: 34°51.717228'S Lon: 179°3.523764'E
02:46 Mar 24	15:46 Mar 24	Move off to look for a small 'snow cone' sample for ALR
03:06 Mar 24	16:03 Mar 24	At sample site of bio-sample at white-coated chimney J2-1041-30-CH1: depth 1621 m Lat: 34°51.714474'S Lon: 179°3.526752'E Place sample in POT 4
04:00	17:00	Stop to try a slurp sample But slurp is not working – abandon attempt.
04:16	17:16	Move off to get the last IGT at a black smoker
04:32	17:32	At a tall skinny black smoker chimney. Break of the chimney to get at orifice for IGT
04:32	17:32	Take an IGT water sample J2-1041-31-IGT 2: depth 1622 Lat: 34°51.723384'S Lon: 179°3.517734'E Temperature 200°C
04:42	17:42	Finished IGT sample
04:46 Mar 24	17:46 Mar 24	Pickup small skinny chimney sample and put in blue sample crate right hand side J2-1041-31-CH 1: depth 1622 Lat: 34°51.723384'S Lon: 179°3.517734'E
04:50	17:50	Move off to next heat flow station
05:19 Mar 24	18:19 Mar 24	Stop for heat flow probe measurement. Probe fully inserted J2-1041-32-HF1: depth 1589 m Lat: 34°51.696846'S Lon: 179°3.598968'E
05:37	18:37	Finished heat flow measurement. Move over to next HF station
06:19	19:19	Stop for heat flow probe measurement. Probe fully inserted J2-1041-33-HF1: depth 1454 m Lat: 34°51.596058'S Lon: 179°??
06:36	19:36	Finished heat flow measurement.
06:40	19:40	Transit over to start of multibeam (Reson) survey
07:31	20:31	Setup for survey
		Now doing multibeam survey with Reson on Jason But issues with setting up
08:38	21:38	Start line 1 - 1500 m long
10:30	23:30	The long range Doppler is acting up. Will need to use short range Doppler, that means flying closer 20-30 m to bottom and closer tracklines
11:00	00:00	Resuming line 1
11:57	00:57	End of line 1

12:18	01:18	Start line 2
14:00	03:00	End of line 2 - 1500 m
14:12	03:12	Start line 3
15:49	04:49	End of line 3
15:55	04:55	Start line 4 – 1500 m
18:00	05:00	End of line 4
18:05	05:05	Start line 5 - 1500 m
19:26	06:26	End of Line 5
19:46	06:46	Start Line 6 – shorten line to 800 m
20:45	07:45	End of Line 6
20:54	07:54	Start Line 7 – 800 m long
21:32	08:32	End of Line 7
21:41	08:41	Doing 'patch' test for Jason…
22:13	09:13	End of multibeam (Reson) survey
22:13	11:13	Coming up with Jason. Weather related – apparently winds and waves increase after lunch.
23:28 Mar 24	12:28 Mar 25	*Jason* on deck **END *JASON* DIVE 1041**
23:30	12:30	Do another quick CTD over caldera - no water samples Pull the USBL pole
00:00 Mar 25	13:00 Mar 25	CTD in the water and going down V18A-02 (cast 4) 179°03' 43.06"E (179.061961°) -34°51' 57.95"S (-34.866097°)
01:16 Mar 25	14:16 Mar 25	CTD on deck – end of operations
01:21 Mar 25	14:21 Mar 25	Start heading for Auckland. End of science operations.
11:01 Mar 25	00:01 Mar 26	In transit to Auckland
21:30 Mar 26	10:30 Mar 26	Auckland harbor Pilot
11:30 Mar 25	11:30 Mar 26	At fuel dock, Auckland **END OF CRUISE**

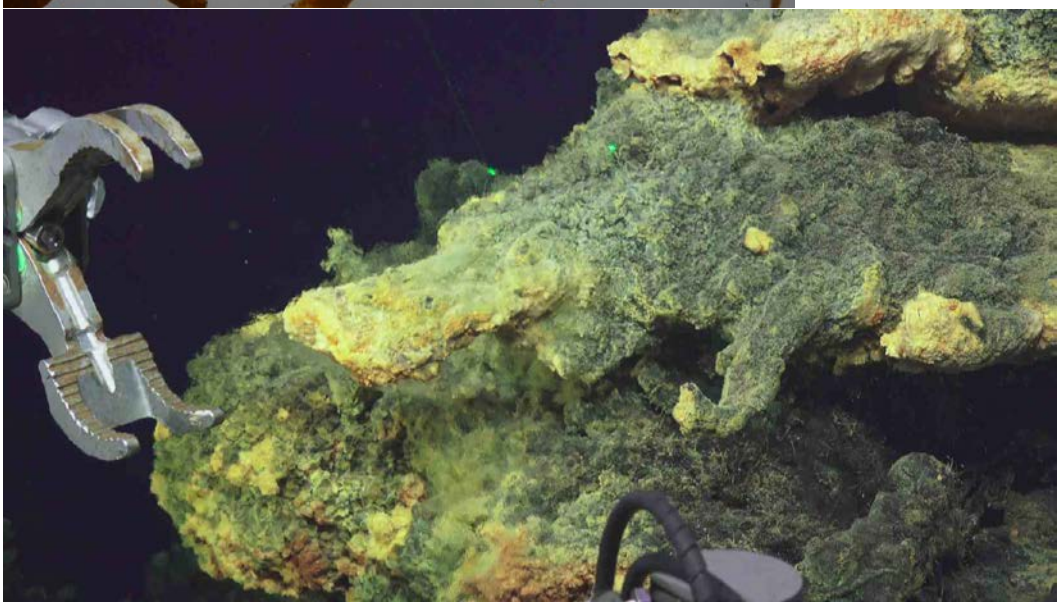
Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1038	3	J2-1038-3-R1	14-17 = DNA extract 18-22 = Cryovials 23-28 = serum 29, 30 = 50cc falcon 101, 102 = 50cc falcon 103 = small whirlpack 104 = large whirlpack	42C	No

Event #	Chemistry	
896	No	Lat: -34.85891252 Long: 179.05009592 Hdg: 15.28 Depth: 1300.72 Alt: 4.29m

Description: Flange sample, hollow interior, event 906 has picture of hollow area left behind, pot 6, red/black, manganese crust, orange biofilm, slimy inside, soft fragile, ground up thin wall structure.

From Cornel: Tapered sample, 14 cm long by 6 cm wide of very light weight, orange-tan-colored silica-rich Fe-oxide 'chimney'. Two-thirds of sample of sample sits with A-L R. Represents low-temperature diffuse venting, as given by measure temperature of 42°C. Interior has a 'flaky' appearance, reminiscent of pages in a book.

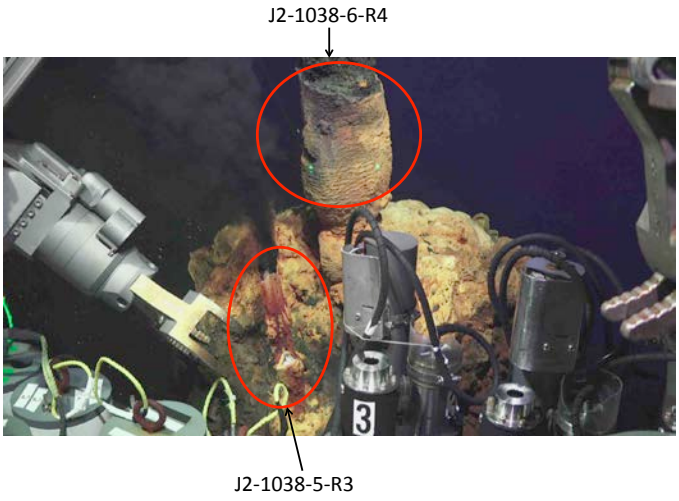
Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1038	4	J2-1038-4-R2	1-4 = DNA extract 5-9 = Cryovials 10-13 = Serum	55C	No
Event #	**Chemistry**				
952	No	Lat: -34.85888722 Long: 179.05030464 Hdg: 264.42 Depth: 1302.16m Alt: 1.81m			
Description: Flange sample, hollow interior, event 965, flange, ground whole structure, slimy interior, in Pot 5 white/black					



Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1038	5	J2-1038-5-R3	63-66 = DNA extract 67-72 = cryovials 73 = serum tube	279C, 272C	No
Event #	**Chemistry**				
1110	J2-1038-6-IGT3 J2-1038-6-IGT4 J2-1038-6-MAJ-White J2-1038-6-TC-Red/White	Lat: -34.85791961 Long: 179.05193327 Hdg: 70.95 Depth: 1319.25m Alt: 6.50m			

Description: sulfide chimney piece from black smoker, chimlet, same station as J2-1038-6-R4, outer approx.. 2mm crust, hard mineralized interior, smaller sample, pot 7 red.

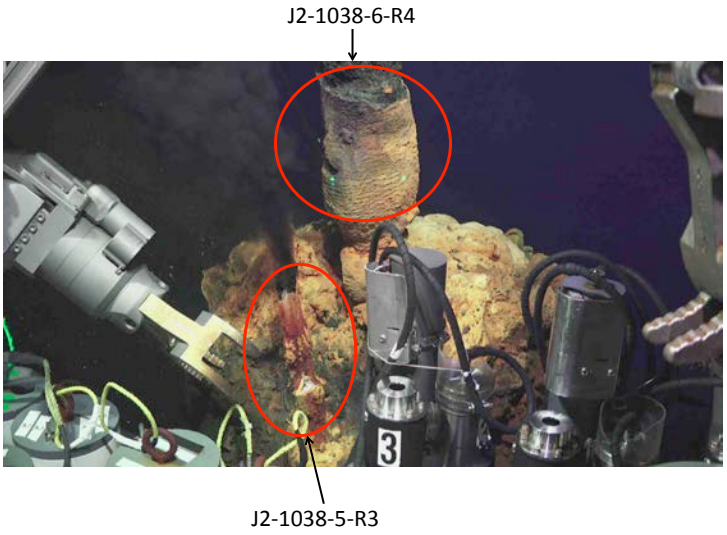
From Cornell: Sample was actively venting hydrothermal fluids up to 279°C (see pic below). Larger piece (with A-L R) 16 cm long showing whole chimney and a partially broken conduit, with a smaller, similar piece 8 cm long with 3 cm orifice. Wall is only 3 mm thick and dominated by more coarse chalcopyrite with finer-grained sphalerite ± barite mantle, with very thin Fe-oxide outer coating. Once again, we see the high-temperature, higher flux Cu-rich chimneys have a flattened or oblate morphology, rather than round like the larger chimneys do.



Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1038	6	J2-1038-6-R4	31-34 = DNA extract 35-40 = cryovials 41-46 = serum tubes	279C, 272C	No
Event #	**Chemistry**				
1126	J2-1038-6-IGT3 J2-1038-6-IGT4 J2-1038-6-MAJ-White J2-1038-6-TC-Red/White	Lat: -34.85791311 Long: 179.05193461 Hdg: 71.13 Depth: 1319.26m Alt: 6.60m			

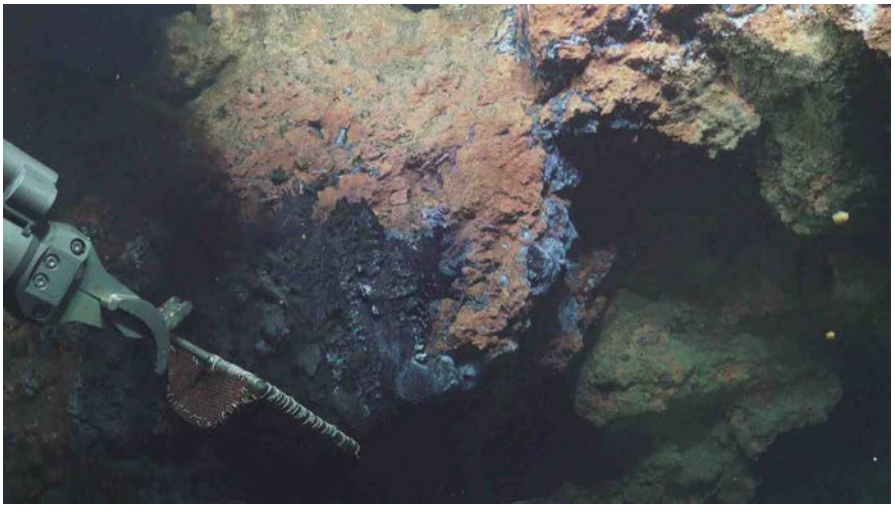
Description: Large structure, beehive on top, collected base, same station as J2-1038-5-R3, outer approx.. 3mm crust homogenized for sample, pot 8 green white.

From Cornell: One piece 21 cm long by 8 cm in diameter part of chimney adjacent to more active ones expelling 279°C fluids (see pic below). Once sampled, hydrothermal fluid did flow from this chimney, which has a 2 x 1 cm orifice at its top, lined by a 1 mm thick wall of chalcopyrite; otherwise is dominated by pyrite-sphalerite + barite. Very exterior has 1 mm rind of Fe-oxides.



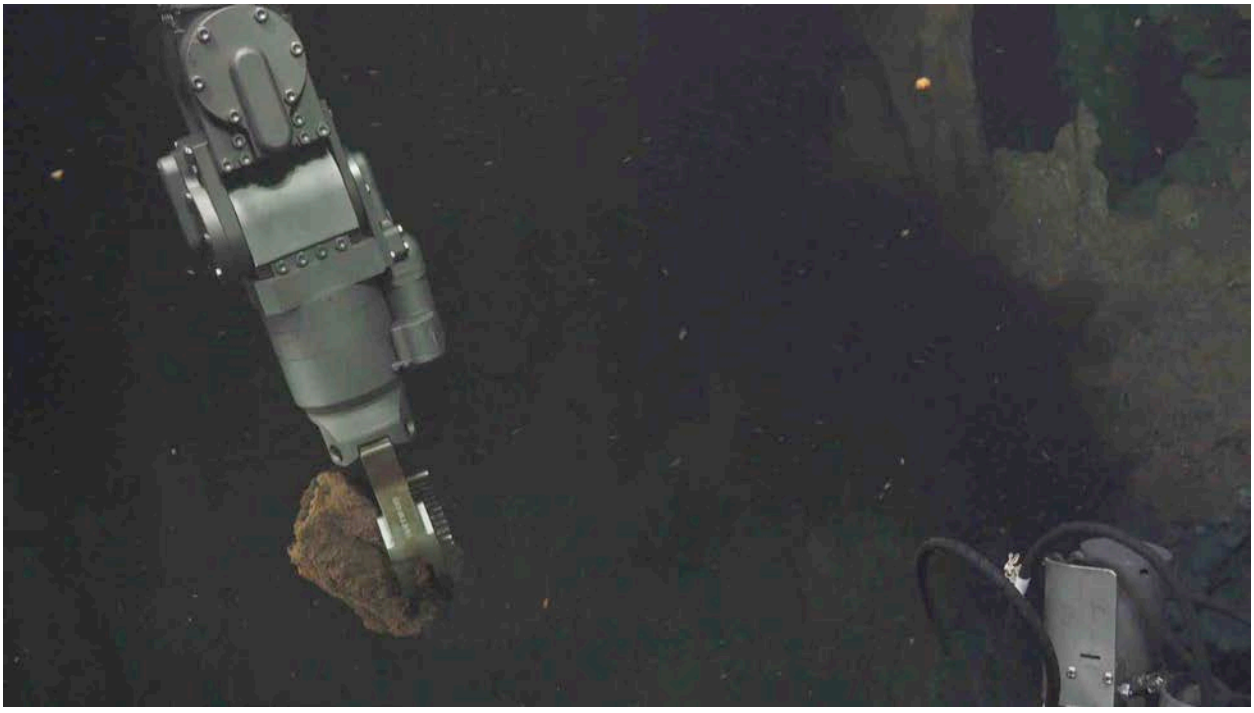
Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1038	12	J2-1038-12-R5	47-50 = DNA extract 51-56 = cryovials 57-62 = serum tube	243C	No
Event #	**Chemistry**				
2172	J2-1038-12-IGT6	Lat: -34.86105499 Long: 179.05742923 Hdg: 261.54 Depth: 1581.87m Alt: 8.56			

Description: Beehive structure, failed attempt at main structure, used scoop to grab fragments, some walls looked to have white biofilm, outer wall, mushy on inside, homogenized mostly outer wall for sample. Pot 4 green
From Cornell: Sample taken using a scoop to collect beehive part of the active chimney that was venting 243°C at time of venting. Very friable. Dominated by fine-grained pyrite and probable sphalerite with noticeable laths of barite. Exterior has classical rib-like features common to beehive chimneys.



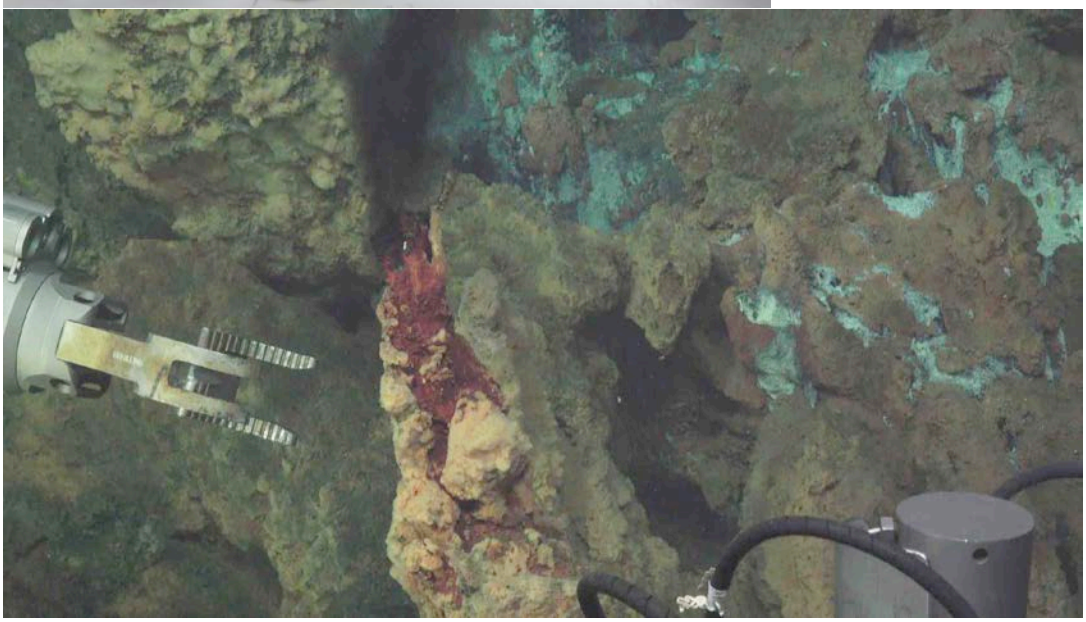
Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1038	12	J2-1038-12-R6			No
Event #	**Chemistry**				
2327	Adjacent to J2-12-IGT-6	Lat: -34.86104967 Long: 179.05746026 Hdg: 295.17 Depth: 1580.34m Alt: 11.58			

Description: Extinct sulfide structure, adjacent to J2-1038-12-R5
From Cornell: Single piece of dense, dead chimney 18 cm long by 12 cm wide. Is oblate in cross section and has a fluted exterior. It was extinct at time of sampling and sat next to some active venting (IGT-6). It is obviously older insomuch as the chimney interior is almost completely infilled by Mn-oxides that will have precipitated in the orifice as the flow ceased and then stopped altogether. The core, or interior of the chimney is lined by a 10-12 mm thick zone of chalcopyrite ± pyrite, surrounded by a thicker (1-2 cm) zone of sphalerite + pyrite + barite, typical of the Cu-rich chimneys seen at Brothers. The exterior of the chimney is colored red-brown, representing oxidation (seafloor weathering) of the sulfides that alter to Fe-oxides. Fossilized worm casts seen on the exterior of the chimney.



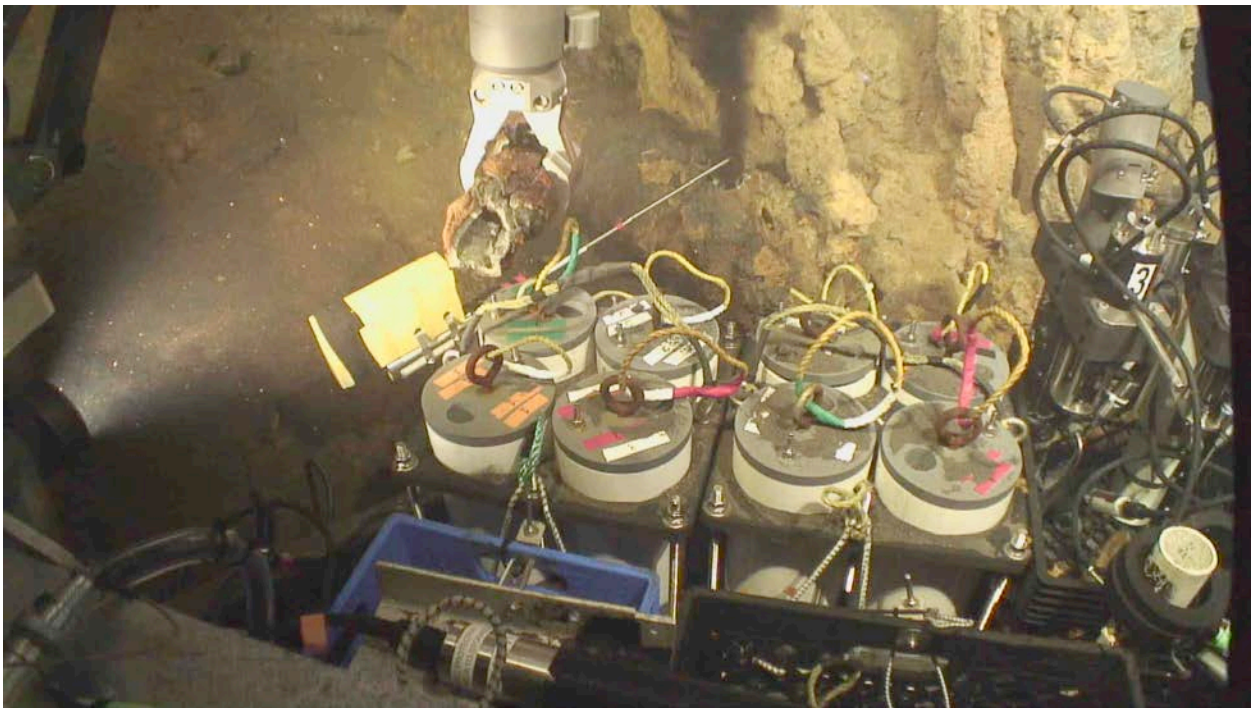
Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1038	13	J2-1038-13-R7	74-77 = DNA extract 78-83 = cryovials 84-85 = serum tubes	303C	No
Event #	**Chemistry**				
2512	J2-1038-13-IGT5 J2-1038-13-MAJ-Yellow J2-1038-13-TC-Red/Black	Lat: -34.86150855 Long: 179.05730011 Hdg: 329.29 Depth: 1582.50 Alt: 1.76			

Description: Small chimlet, labeled as 12-R7 in van sample sheet, correct in virtual van, hard walled, thick walls, iron oxide outer crust, sampled outer crust, Pot 2 white.
From Cornell: Two larger (12 cm long) and few small pieces of Cu-rich chimney wall. Conduit lined by coarse chalcopyrite (2-5 mm), mantled by grey sphalerite ± barite-rich zone (≤1 cm) with 1-2 mm wide exterior of Fe-oxides. Same chimney as J2-1038-13-R8 (cf. description).



Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1038	13	J2-1038-13-R8			No
Event #	**Chemistry**				
2590		Lat: -34.86150617 Long: 179.05730381 Hdg: 330.00 Depth: 1582.51m Alt: 1.71m			

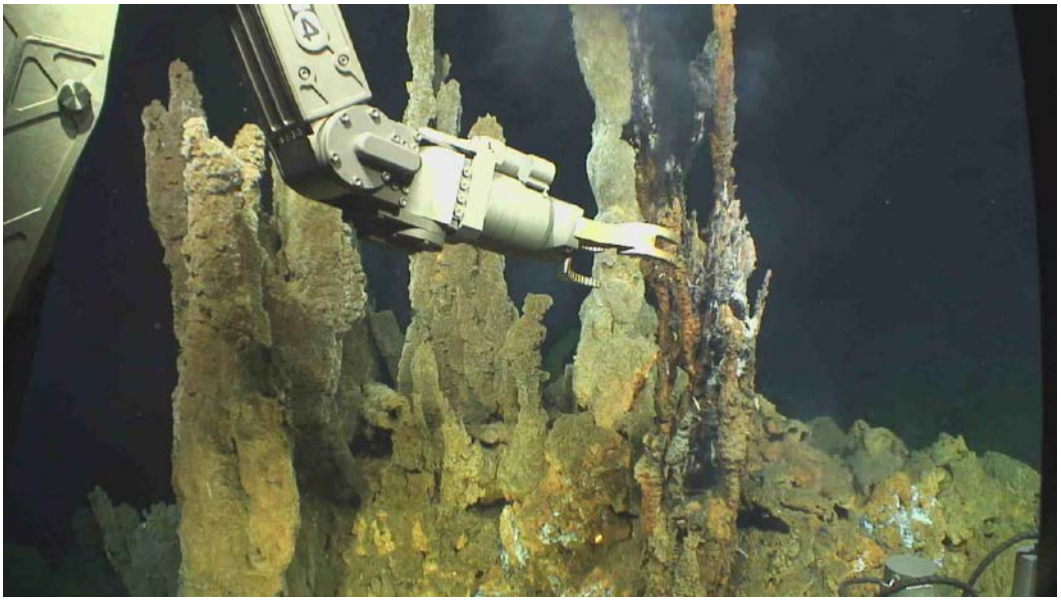
Description: Sulfide chimney from bottom of J2-1038-13-R7, labeled as R7 in virtual van, picked up from ground,
From Cornell: Active black smoker chimney. One larger piece 22 cm long that has the chimney interior exposed, and two other narrower pieces 22 and 24 cm long, respectively that are complete segments of what was initially a larger chimney (see pics and videos during sampling). I suspect the two narrower segments were joined. At least ten smaller pieces <9 cm in length, each a part of the chimney wall. The largest piece shows minimum 1 cm thick walls with a much larger (up to 6 cm) diameter orifice. Interior wall lined by dark grey, fine-grained pyrite + sulfate that looks largely to be barite, but may have some intergrown anhydrite? This is followed by a ~ 5 mm thick zone of massive brass-colored chalcopyrite that is in turn mantled by a ≥8 mm thick zone of grey, dominantly sphalerite ± barite. Finally, a zone mm to cm thick of fine-grained pyrite with more barite, whose outer-most surface is oxidized red to Fe-oxides. Individual barite crystals can be seen radiating inwards from the exterior of the chimney walls towards the chalcopyrite center. One of the two narrower pieces has its interior almost entirely infilled by massive chalcopyrite, whereas the other has 1-2 mm thick walls lined by fine-grained chalcopyrite + pyrite ± barite. No signs of animals on the chimney exterior.



Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1038	15	J2-1038-15-CH1	105=Serum tube	240C	No
Event #	**Chemistry**				
3377	J2-1038-15-MAJ-Red	Lat: -34.8578119 Long: 179.05212078 Hdg: 194.28 Depth: 1330.78m Alt: 2.94m			

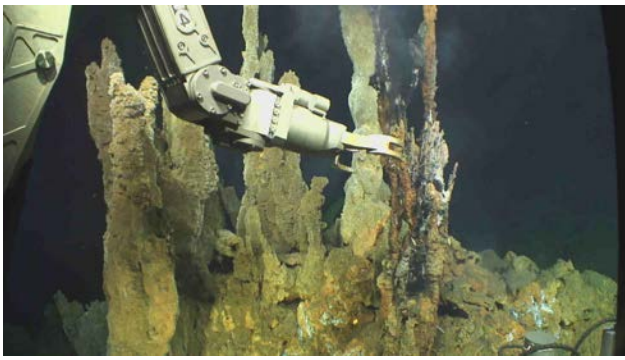
Description: Large chimney structure, attempted to place in chamber pot, ended up in Hobo box, smaller piece is J2-1038-15-CH2, Serum tube filled from white precipitate on chimney after sitting on bench overnight for culturing.

From Cornell: Sample dominated by larger piece of intact chimney ~38 cm long and up to 18 cm wide. Is a delicate structure, as noted in the attached picture and seen on video. It is an intricate array of sinewy chimneys of various diameter. Hydrothermal fluid was seen to be expelled from multiple orifices, with one exposed on this sample showing relatively coarse-grained, mm-thick chalcopyrite lining the interior of the chimney, surrounded by a thicker (cm +) zone of grey, fine-grained sphalerite with coarser barite crystals. The 5 or 6 pieces that accompany the larger one are typically <15 cm in length and each represents a separate, smaller chimney. These are typically thin-walled (<5 mm) and lined by chalcopyrite. Common to these chimneys, and seen elsewhere, is the fact that the orifice is not circular in shape, but rather is flattened, or oblate. This is only really seen in high-temperature Cu-rich chimneys with high fluid flux (i.e., not in Zn-rich chimneys where the orifice is convoluted and flux is lower). Exterior of chimney composed of fine-grained pyrite + barite. No evidence for animals on the chimney exterior. All told, very similar type of chimney to J2-1038-13-R8.



Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1038	15	J2-1038-15-CH2	86-93 = DNA extraction 94-99 = cryovials 100 = serum tube	240C	No
Event #	**Chemistry**				
3381	J2-1038-15-MAJ-Red	Lat: -34.85781167 Long: 179.05212092 Hdg: 195.23 Depth: 1330.93m Alt: 2.96m			

Description: Smaller piece of J2-1038-15-CH1, thin walled, whole sample homogenized for sample, pot 1 orange.
From Cornell: Same chimney complex as J2-1038-15-CH1 (cf. description). Here, a much smaller piece of chimney spire 7 cm long with a 1 cm diameter orifice. Wall is 1-2 mm thick and dominated by chalcopyrite.



Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1039	10	J2-1039-10-R1			No

Event #	Chemistry	
5313	No	Lat: -34.86101402 Long: 179.05767946 Hdg: 280.51 Depth: 1594.06m Alt: 3.79m

Description: Stockwork vein, port blue bin,
From Cornell: Sampled what was a large outcrop of the brown vein-like material that appears to have grown out of the actual red-brown veins that make up the stock work zone in this area. When sampling, loads of green colored 'dust' cascaded down the rock face; almost certainly related to Cu mineralization. Sampling proved to be difficult for the ROV but eventually we prized off a piece. Upon inspection, sample looks more like massive sulfide chimney material, than the flat, planar vein sampled in J2-1039-17-R1. Could fluids have been expelled from one of these veins and produced this massive sulfide, like those sitting chimneys on top of the sequence? Sample is comprised of 4 pieces, the largest 12 cm long by 8 cm wide. The interior is porous with chalcopyrite lining the very center of the sample, mantled by dark grey, probably sphalerite + pyrite + barite. Outermost rind is ~ 1mm thick zone of Mn and Fe-oxide. See worm casts on exterior of sample and odd, nob-like features on the surface of the massive sulfide.

Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1039	11	J2-1039-11-CH1	151-154 = DNA extract 155-156 = cryovial	318C	No
Event #	**Chemistry**				
5430	J2-1039-11-IGT1 J2-1039-11-IGT2 J2-1039-11-MAJ-White	Lat: -34.86111866 Long: 179.05766514 Hdg: 337.44 Depth: 1599.49m Alt: 4.03m			

Description: Chimney piece from back smoker on wall, in pot #6 (red/black), small sample, only DNA, outer 1-2mm scraped.
From Cornell: Three small (<3 cm long) pieces of Cu-rich, active black smoker chimney. Highest temperature recorded to date for vent fluids. Medium-coarse-grained 2 mm zone of chalcopyrite lines the chimney orifice, mantled by 1 cm thick grey, sphalerite + pyrite +barite zone.

Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1039	12	J2-1039-12-CH1	122-125 = DNA extract 126-131 = cyrovial 132-135 = serum tube		No
Event #	**Chemistry**				
5570	No	Lat: -34.86107892 Long: 179.05763618 Hdg: 16.83 Depth: 1591.96m Alt: 2.76m			

Description: Chimney sample, in pot# 7 (red), really hard exterior, 3-4 mm outer crust, white crust
From Cornell: Small, active chimney sampled on massive sulfide-rich sediment and talus. Several pieces, each < 5 cm long. Most have coarse-textured pyrite-sphalerite + barite; one has very coarse chalcopyrite with nice crystals of the latter seen growing into the orifice. Exterior texture is more fine-grained and beehive-like. Exterior surface has bulbous texture in places.

Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1039	12	J2-1039-12-CH2	106-109 = DNA extract 110-115 = cryovials 116-120 = serum	153C	No
Event #	**Chemistry**				
5665	No	Lat: -34.86107624 Long: 179.05763843 Hdg: 49.93 Depth: 1591.50m Alt: 1.96m			

Description: Chimney top, black and white structure, in pot# 2 (white), sampled most of outer white crust, hard exterior, 3-4mm crust

From Cornell: Sampled short, beehive-like chimney and ended up with 4 pieces, the largest of which is 9 cm across. All pieces are similar, with coarse chalcopyrite + pyrite in the interior with more sphalerite + barite near the exterior chimney wall. Finer-grained outer wall. Clots of barite locally.

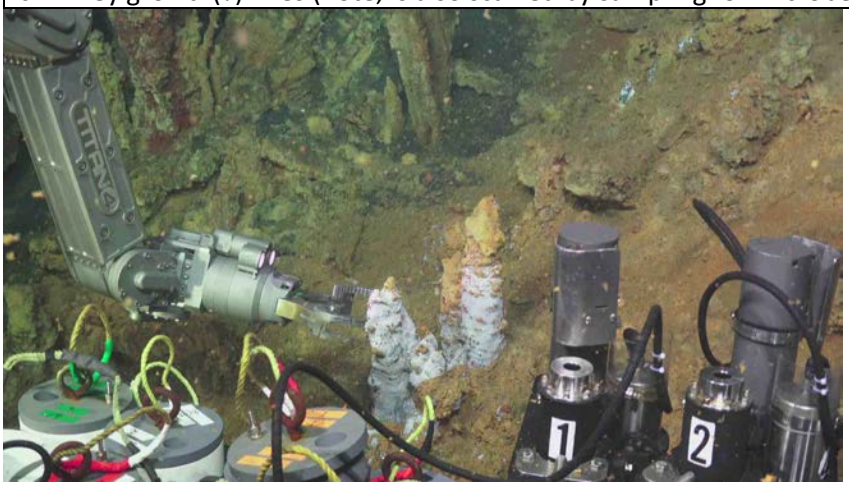
Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1039	13	J2-1039-13-CH1	136-139 = DNA extract 140-145 = cryovials 148-150 = serum tubes		No
Event #	**Chemistry**				
5783	No	Lat: -34.8610792 Long: 179.05770296 Hdg: 208.90 Depth: 1596.49m Alt: 3.96m			

Description: Chimney in pot #8 (green/white), tube worm casings removed, scraped outer chimney crust

From Cornell: Three pieces of active chimney, the largest 10 cm in length. Inside of chimney is moderately grained chalcopyrite + pyrite with 1-1.5 cm zone outwards from the chalcopyrite of grey sphalerite + barite that locally has what looks like black Mn oxide near the chimney exterior. The outside surface of the large chimney piece appears 'ribbed' and marked by worm casts. Mottled surface on the exterior, locally.

Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1039	14	J2-1039-14-CH1	198-201 = DNA extract 202-207 = cryovials 208-209 = serum tube	183	No
Event #	**Chemistry**				
6211	J2-1039-14-MAJ-Yellow	Lat: -34.8620939 Long: 179.05739512 Hdg: 275.09 Depth: 1610.70m Alt: 2.86m			

Description: Low temp. chimney in pot #1 (orange), 1-2mm white crust outer scrape for molecular samples, sterile seawater added for culturing tubes.
From Cornell: Single, conical shaped chimney sample 18 cm high and up to 14 cm wide with a 1-2 cm orifice that is mostly infilled by mineralization, which represents probably half of the chimney that was sampled (see pics). Relatively coarse crystals of chalcopyrite are seen near the chimney center otherwise dominated by finer-grained pyrite in a zone up to 8 cm wide, surrounded by light grey/white zone dominated by (locally laminated) barite followed by a narrow (4-5 mm) wide dark brown zone of Fe-oxides + Mn(?) then 1-2 mm wide zone that marks the chimney exterior that is oxidized. The outside surface of the chimney has whitish colored patches that locally has worm casts on it and some vertical chimney growth(?) lines (note, is also scarred by sampling for microbes). Sample is relatively heavy.

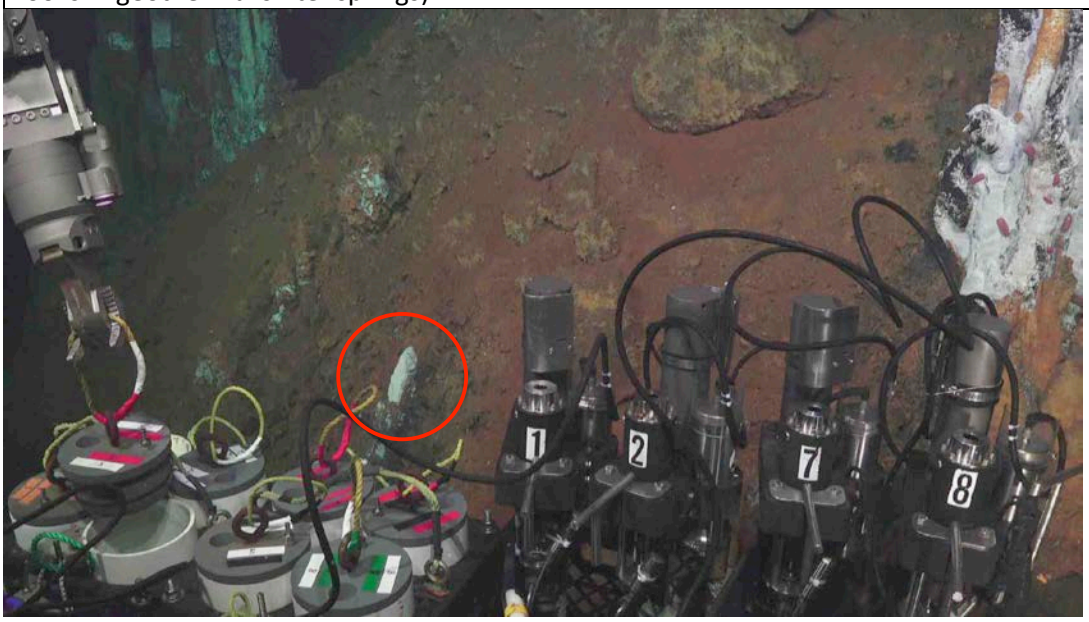


Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1039	14	J2-1039-14-CH2	172-175 = DNA extract 176-181 = cryovials 182-185 = serum tube	303	No
Event #	**Chemistry**				
6298	J2-1039-14-IGT7 J2-1039-14-MAJ-Green	Lat: -34.86208959 Long: 179.05738805 Hdg: 284.42 Depth: 1611.18m Alt: 2.80m			

Description: Orange chimney structure, large, could not close pot in pot #4 (green),, well defined conduit, scraped iron oxide crust from entire chimney for sample
From Cornell: Whole chimney 27 cm long and 12 cm at widest diameter. Typical of most of the active, high temperature chimneys sampled at the NW Caldera site, i.e, lined by 1cm wide band of chalcopyrite with wider, up to 3 cm zone of grey sphalerite + pyrite + barite. Possibly see at least two cycles of this zonation. Inside the orifice, see striped, alternating grey and white bands, probably dominated by more pyrite and more sulfate, respectively. See clots of barite in the chimney walls and exterior is oxidized red-brown Fe-oxides.

Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1039	15	J2-1039-15-CH1	157-160 = DNA extract 161-166 = cryovials 167-171 = serum	42C	No
Event #	**Chemistry**				
6474	J2-1039-15-MAJ-Red	Lat: -34.86207984 Long: 179.05728924 Hdg: 282.80 Depth: 1604.62m Alt: 2.96m			

Description: White chimney in pot #3 (red/white), no photograph on ship, few Alvinellid worms on outer surface, removed and scraped 1mm crust, for serum tubes, top of structure added and homogenized with remaining scrape
From Cornell: Three pieces of low-temperature venting chimney. Largest measures 10 x 8 cm. Interior dominated by moderate to coarsely crystalline chalcopyrite + pyrite, surrounded by similarly coarse crystalline sphalerite + barite. Exterior of sample is whitish and more fine-grained. Exterior has a 'fluted' appearance with outer surface locally covered by a mottle like texture (almost like geyserite looks in geothermal sinter springs).



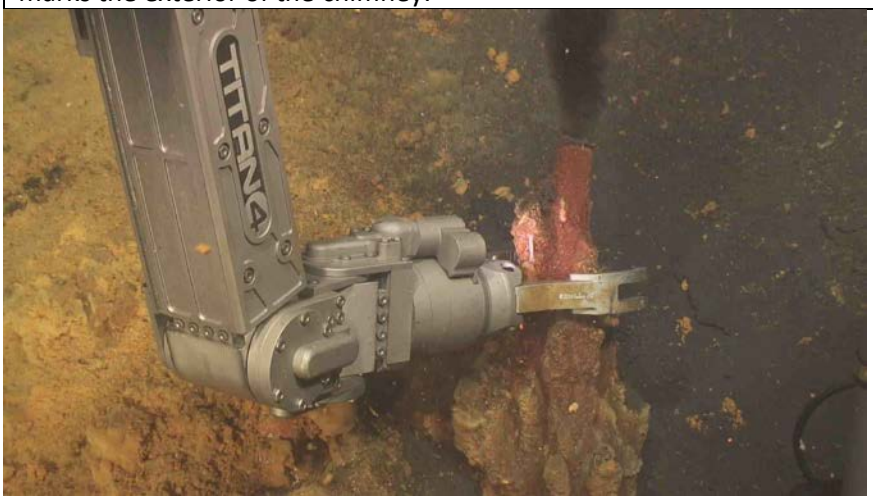
Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1039	17	J2-1039-17-R1			No
Event #	**Chemistry**				
7360		Lat: -34.86346692 Long: 179.05808982 Hdg: 310.22 Depth: 1698.76m Alt: 4.30m			

Description: From Cornell: Piece of stock work vein 16 cm long by 7 cm wide and max 2 cm thick. Planar vein that was protruding from pale grey-colored, highly altered wall rock (as part of this sample—see below). Vein appears to be dominated by massive pyrite, though given greenish hues and flecks of a mineral on margin of sample, and in wall rock (see photo), suggest it almost certainly contains copper. Out margin/surface of vein has coarse textured, probably pyrite grains plus laths of barite. Sample appears laminated in places with inclusions of wall rock enclosed within the massive sulfide vein. Exterior of vein is red-brown in color, as seen for all these veins in the stock work area.

Small pieces of white-grey colored wall rock were included in the sample. Rock has been completely hydrothermally altered by high-temperature, acidic fluids. Clots of fine-grained pyrite seen in the sample.

Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1039	18	J2-1039-18-CH1	186-189 = DNA extract 190-195 = cryovials 196-197 – serum tube	301	No
Event #	**Chemistry**				
7540	J2-1039-18-IGT8 J2-1039-18-MAJ-Blue	Lat: -34.86200807 Long: 179.05763912 Hdg: 318.79 Depth: 1617.46m Alt: 3.04mm			

Description: Reddish black smoker chimney, Pot #5 (white/black), soft outer 2-3mm iron oxide crust, sampling around entire structure, large chimney
From Cornell: Top part of chimney also sampled in J2-1039-18-CH2, which was the basal part. Cu-rich chimney with fine-grained pyrite lining the orifice wall, surrounded by 1 cm thick zone of chalcopyrite with the grey, sphalerite + barite zone closer to the exterior of the sample. Thin, Fe-oxide outer layer marks the exterior of the chimney.



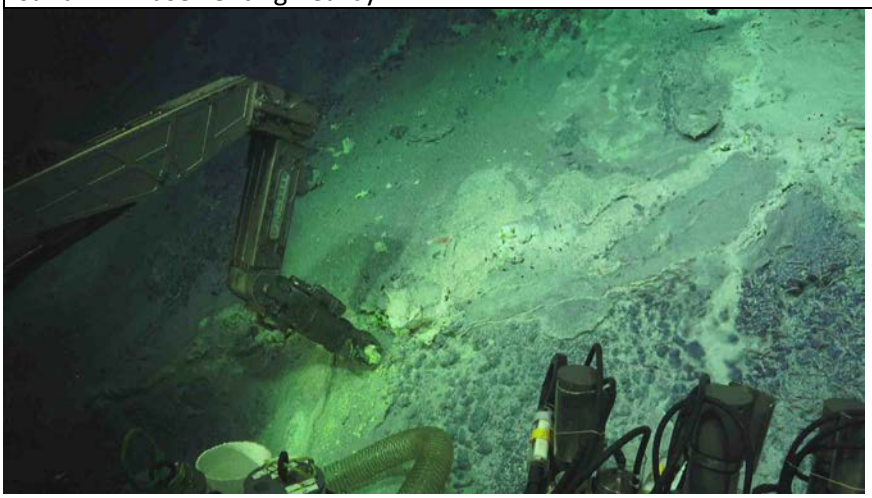
Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1039	18	J2-1039-18-CH2		301	No
Event #	**Chemistry**				
7673	J2-1039-18-IGT8 J2-1039-18-MAJ-Blue	Lat: -34.86201514 Long: 179.05764228 Hdg: 294.59 Depth: 1618.38m Alt: 2.59mm			

Description: Same as J2-1039-18-CH1, placed in IGT crate.
From Cornell: Sample comprised of 3 pieces; largest is 13 cm long and is half of a chimney, broken length-wise. Wall of chimney is ~ 1 cm thick, with inner-most part lined with very fine-grained probable pyrite ± barite which in turn is mantled by 3 mm thick zone of coarse chalcopyrite, itself mantled by 6 mm thick zone of grey, sphalerite ± pyrite + barite. The outer-most rind is ~ 1 mm thick silica(?) + barite with Fe-oxidized red-colored sulfides. Contact between the chalcopyrite zone and the sphalerite zone is locally 'fluted' in a vertical direction.

Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	4	J2-1041-4-R1	295-308 = cryovials 310-314 = serum tube 337-338 = 50cc falcon	60-61C	No
Event #	**Chemistry**	**Notes:**			
10531	J2-1041-4-IGT8 J2-1041-4-MAJ-Red	Lat: -34.878368 Long: 179.071443 Depth: 1315.44 Heading: 317.71 Alt: 2.44			

Description: sulfur ledge sample, pot #1 (orange).

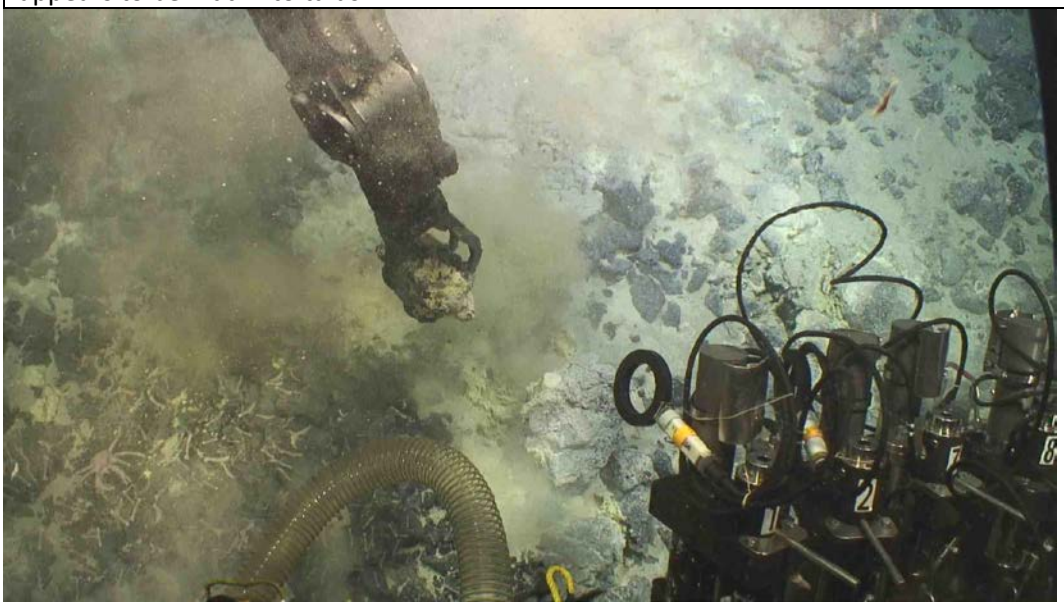
Three pieces, each < 3 cm in size. Is a crust (see pic). Sits on top of ash material. A ~1 cm thick zone of fine-grained, white-tan colored material (alunite?) is mantled by relatively coarse crystalline native sulfur. Diffuse venting nearby.



Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	6	J2-1041-6-R1		59-71C	No
Event #	**Chemistry**	**Notes:**			
10947	J2-1041-6-IGT7 J2-1041-6-MAJ-Green	Lat: -34.878848 Long: 179.071378 Depth: 1329.78 Heading: -			

Description: Rock box #1, too large for chamber pot.

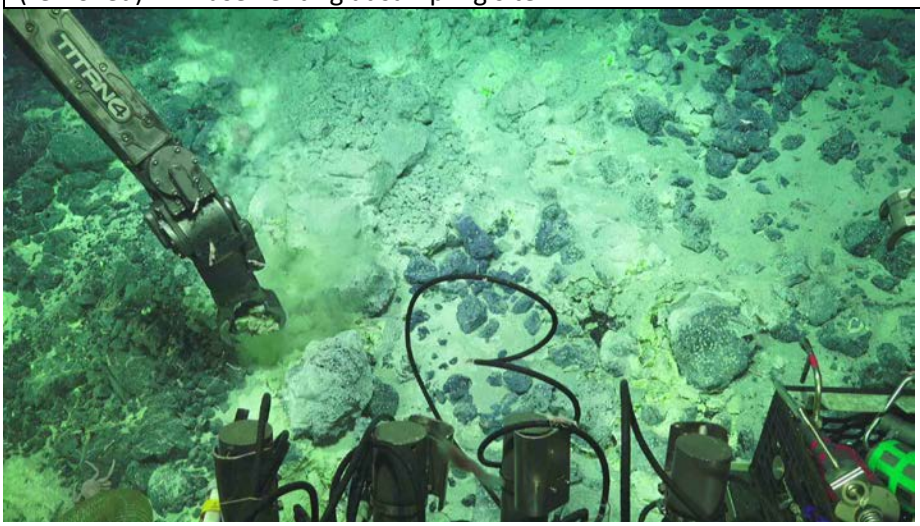
Single, large (22 x 15 x 2 cm) piece of fine-grained, black, lava. Is coated by both white-tan colored possible alunite mineralization and yellow native sulfur, as seen in J2-1041-4-R1. Has worm casts and limpets on it (removed) and is in an area of diffuse venting with lots of shrimps and crabs. Sulfur etc appears to be matrix to talus.



Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	6	J2-1041-6-R2	324-329 = cryovials 330-334 = serum tube 335 = 15cc falcon	59-71C	No
Event #	**Chemistry**	**Notes:**			
10959	J2-1041-6-IGT7 J2-1041-6-MAJ-Green	Lat: -34.878866 Long: 179.071394 Depth: 1329.87 Heading: 320.30 Alt: 1.79			

Description: Pot #2 (white).

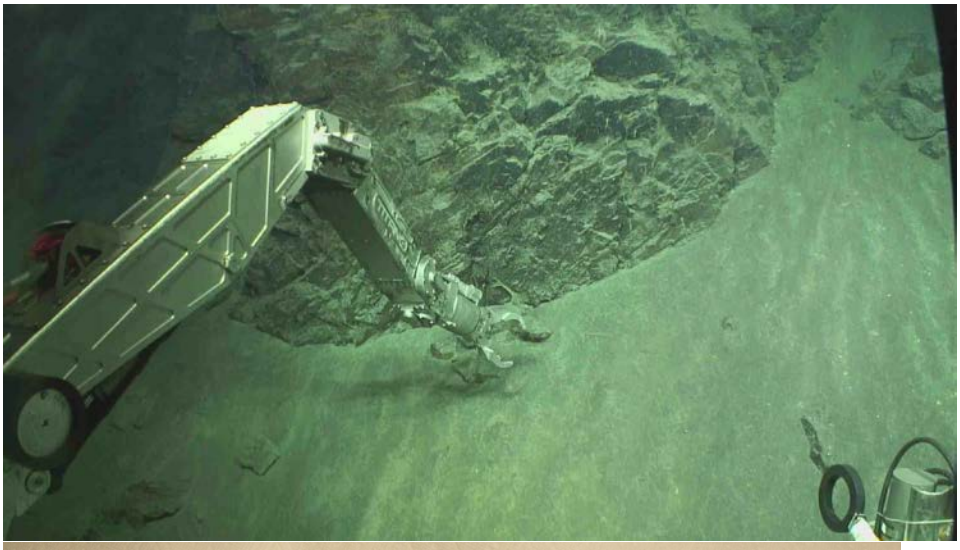
Half a dozen small (< 5 cm) pieces that range from relatively fresh, black, glassy lava mantled by a white-tan colored material (alunite?), to breccia with native sulfur matrix, to native sulfur itself. Covered by limpets (removed). Diffuse venting at sampling site.



Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	11	R1	-	-	-
Event #	**Chemistry**	**Notes:**			
11968	No	Lat: -34.865096 Long: 179.072668 Depth: 1810.92 m Heading: -			

Description: Rock from massive lava flow.

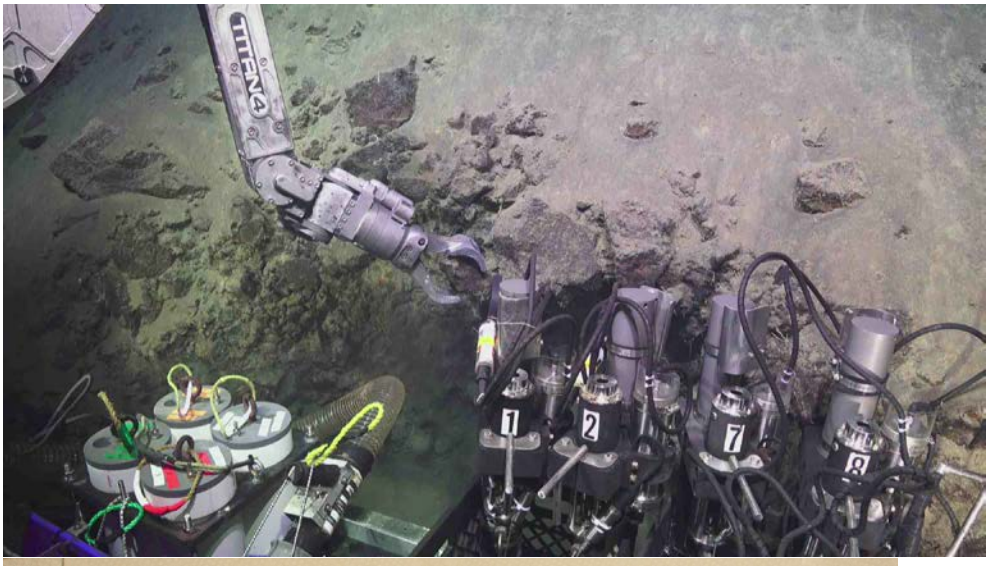
Large (15 x 11 x 13 cm) sample of dark grey, volcanic rock from a massive lava. Quite vesiculated with individual vesicles stretched locally. Largest vesicle is 6 m long, some around 1 cm, with the majority <3 mm. See phenocrysts of feldspars in otherwise fine matrix (porphyritic). See what looks like small (< 1 mm) crystals of quartz = dacite. Cannot easily see mafic phenocrysts.



Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	12	R1	-	-	-
Event #	**Chemistry**	**Notes:**			
12070	No	Lat: -34.864529 Long: 179.073032 Depth: 1773 m Heading: 40 °			

Description: Rock from blocky, fractured lava.

Rock sampled from a flow. Dark grey to black colored piece of lava. Stretched (indicative of flow?) vesicles up to 2 cm long; locally lined by Mn ± weathered suggesting has been exposed to weathering for a time. One surface is more glassy suggesting top of flow? See feldspar phenocryst up to 3 mm long. See what appears to be clots of quartz crystals? Dacite.



Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	13	R1	-	-	-
Event #	**Chemistry**	**Notes:**			
12184	No	Lat: -34.864262 Long: 179.073503 Depth: 1700 m Heading: 14 °			

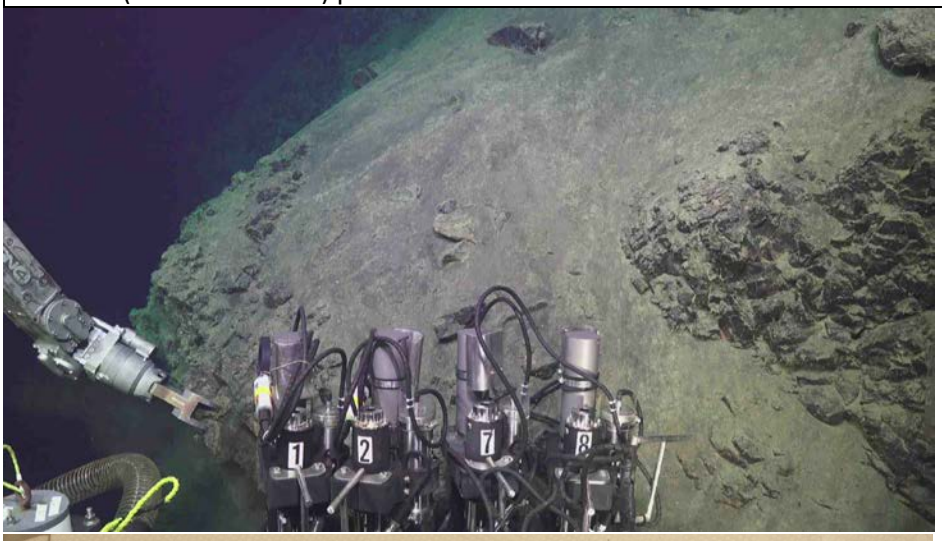
Description: Rock from massive lava.

Single piece of lava 18 x 10 x 8 cm. More weathered than any of the samples collected before this one. Part of a massive lava flow. Similar to the other rocks though, in that is vesiculated, with individual vesicles up to 2 cm in length. See up to 2 mm 'clots' of quartz; otherwise phenocrysts of feldspar hard to see.

Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	14	R1	-	-	-
Event #	**Chemistry**	**Notes:**			
12285	No	Lat: -34.863569 Long: 179.074166 Depth: 1634 m Heading: 314 °			

Description: Rock sample taken from top (?) of layered lava unit.

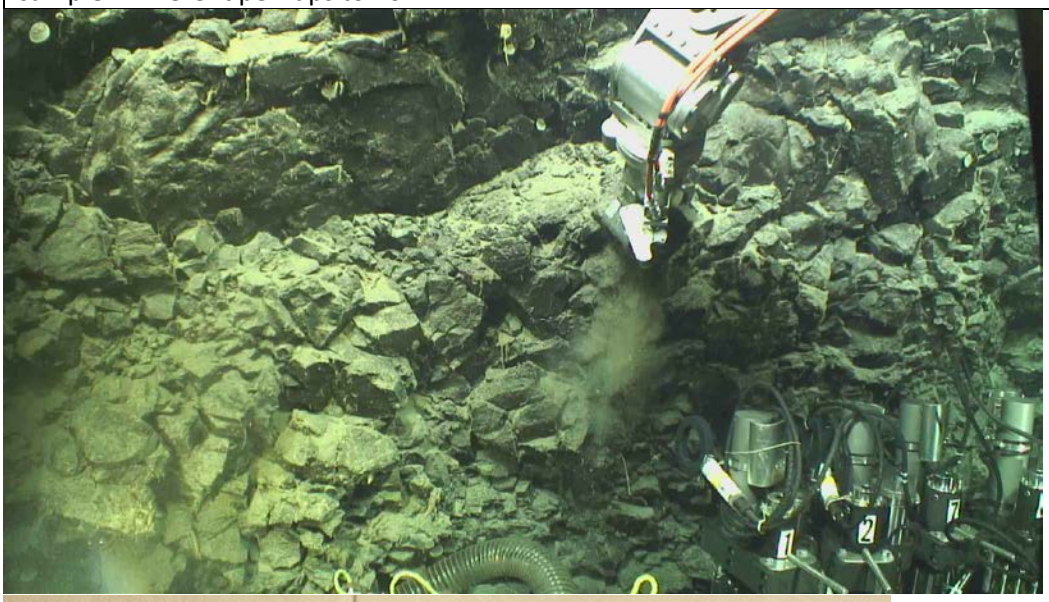
Single piece of lava 19 x 10 x 5 cm. Reasonably seafloor weathered with Fe-oxidation and Mn coating. Stretched vesicles present; up 1 cm but mostly <3 mm. Porphyritic texture with 1-2 mm feldspar phenocrysts and possibly some quartz clots. Like pretty much all the samples, looks like a dacite. Massive (> 300 vertical m) pile of dacite flows?



Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	15	R1	-	-	-
Event #	**Chemistry**	**Notes:**			
12323	No	Lat: -34.863457 Long: 179.074298 Depth: 1608 m Heading: 26 °			

Description: Very blocky, thick lava flow.

Large sample 13 x 12 x 10 cm of black lava. Exterior is weathered/oxidized. Surfaces show abundant, stretched vesicles up to 1 cm long. Possible small phenocrysts though hard to tell without cutting the sample. Different perhaps to 1041-11-R1.



Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	16	R1	-	-	-
Event #	**Chemistry**	**Notes:**			
12407	No	Lat: -34.862991 Long: 179.074822 Depth: 1563 m Heading: 58 °			

Description: Massive lava.

12 x 10 x 8 cm sample of dark lava. Weathered on its exterior. Similar to J2-1041-12-R1 and -15-R1. Almost looks like flow banding? Vesiculated, like all the other samples, with vesicles narrow but up to 1.5 cm long, although typically shorter. See phenocrysts of feldspar up to 2 mm; not so easy to see any quartz crystals?

Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	17	R1	-	-	-
Event #	**Chemistry**	**Notes:**			
12453	No	Lat: -34.86278 Long: 179.075133 Depth: 1511 m Heading: 39 °			

Description: Blocky lava.

Single piece of lava 15 x 10 x 7 cm. Appears fairly fresh. Vesiculated with vesicles up to 1 cm though mostly shorter in length. See feldspar phenocrysts up to 2 mm in length; locally see what appear to be 'clots' of quartz crystals.

Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	18	R1	-	-	-
Event #	**Chemistry**	**Notes:**			
12489	No	Lat: -34.862558 Long: 179.075246 Depth: 1483 m Heading: 356 °			

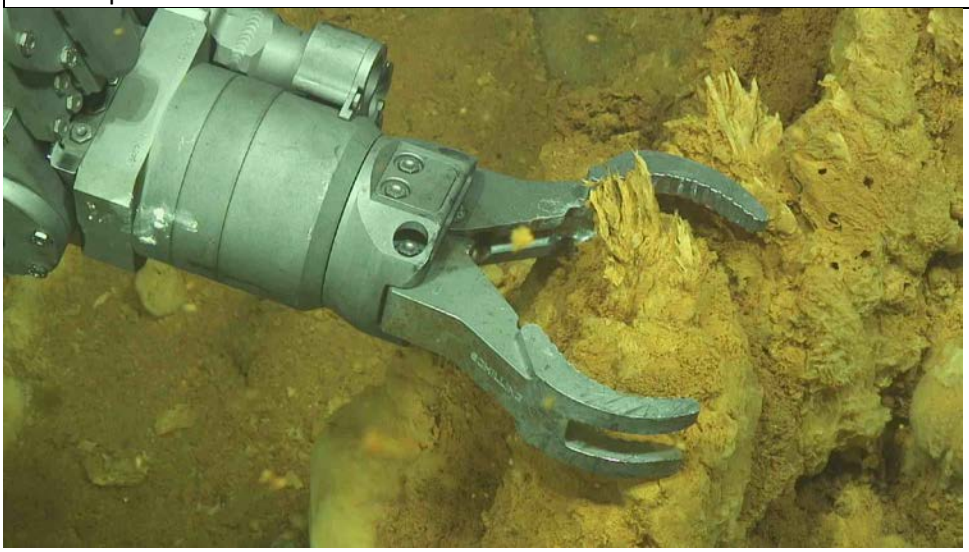
Description: Very blocky lava, top of the ridge.

Two samples; one 12 cm long, the other 8 cm. Sampled from black, blocky lava flow. The smaller sample is quite glassy on its exterior and contains numerous vesicles < 3 mm long, mostly 1 mm. Appear stretched. Outer surface weathered. Larger piece similar, with stretched vesicles more prevalent. Phenocrysts of feldspar not obvious in either sample.

Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	28	J2-1041-28-CH1	279-288 = cryovials 289-294 = serum tubes		No
Event #	**Chemistry**	**Notes:**			
14043		Lat: -34.862587 Long: 179.058108 Depth: 1669.41 Heading: 268.11 Alt: 2.81			

Description: Sample in pot #3 (red/white). unique structure with filaments and bioflocs, microbial mound, iron oxide, two kinds of sample outside filaments for -1, everything else homogenized for -2

No sample left to describe.



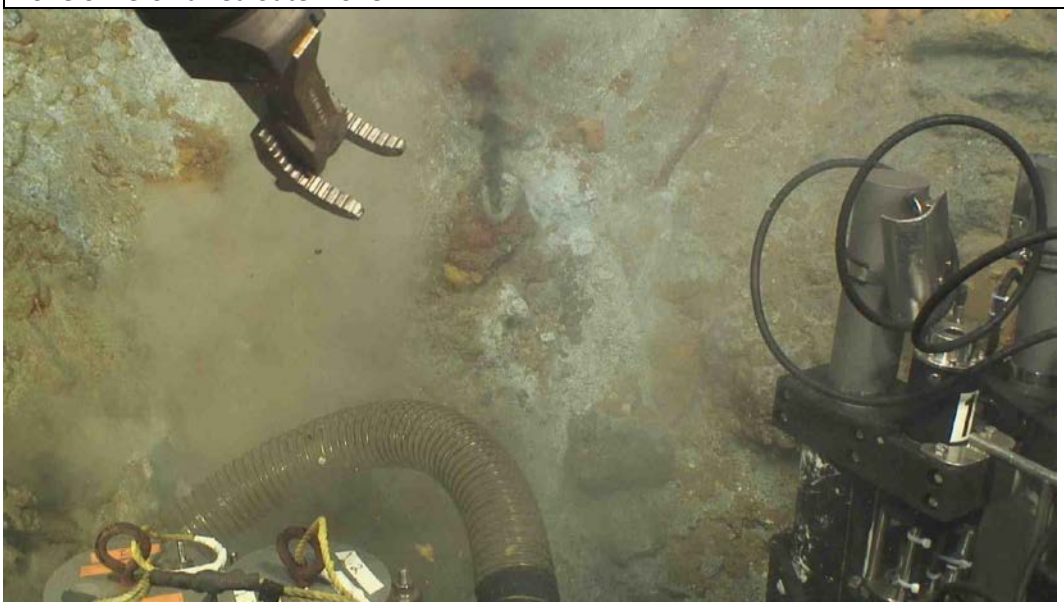
Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	30	J2-1041-30-CH1	315-320 = cryovials 321-323 = serum tubes		No
Event #	**Chemistry**	**Notes:**			
14323		Lat: -34.861904 Long: 179.057875 Depth: 1621.86 Heading: 190.33 Alt: 0.75			
Description: small chimney structure with white biofilm, in pot #4 (green). No sample left to describe.					

Lowering number	Site number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1041	31	J2-1041-31-CH1		200C	No

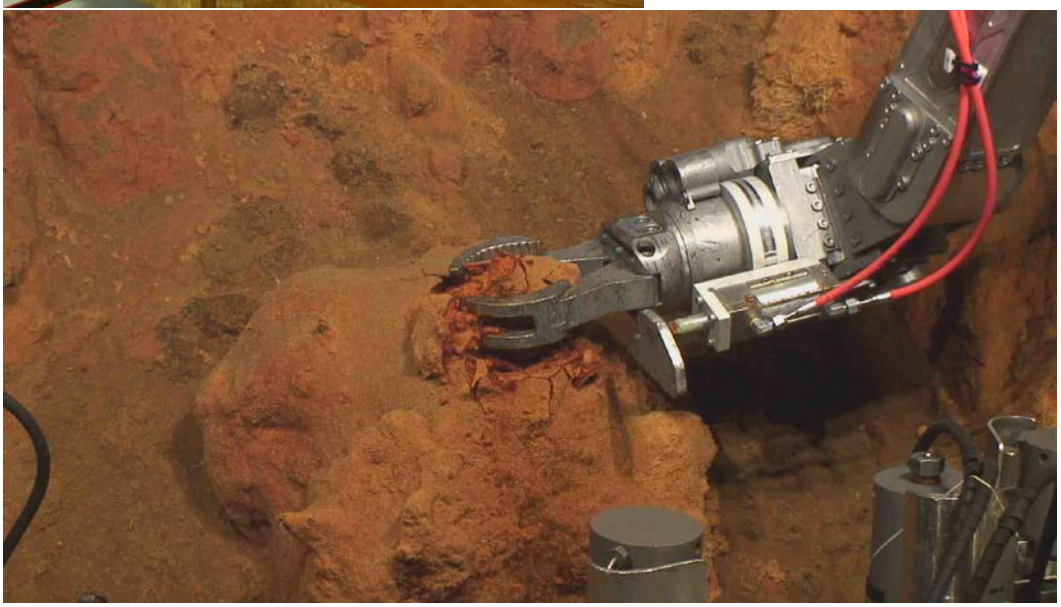
Event #	Chemistry	Notes:
14538	J2-1041-31-IGT2	Lat: -34.861992 Long: 179.057744 Depth: 1622.64 Heading: -

Description: Active high temperature chimney, in starboard blue milk crate.

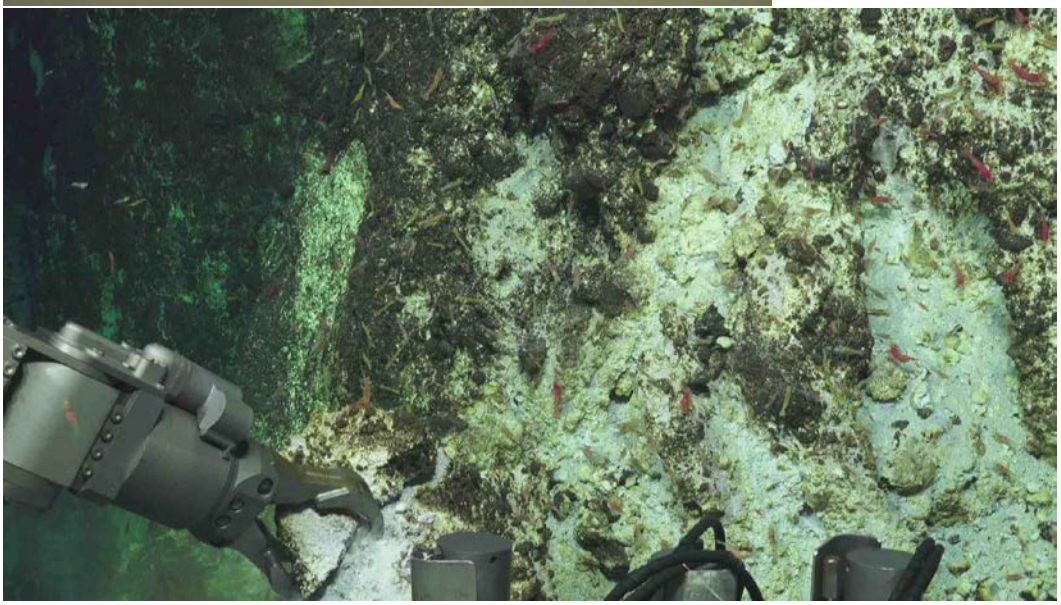
Base of black chimney pictured in the photograph (15 x 13 cm). Inner-most zone is 7-8 mm thick layer of chalcopyrite surrounded by much thicker (2 cm) zone of grey-white sphalerite + pyrite ± barite ± anhydrite(?). Has an outer zone ~ 4 mm thick of more Fe-oxidized material. 'Root' of sample is dominated by the grey-white material which appears to be highly altered host rock (see pic). Seen in the host rock nearby, are yellow-colored, oxidized pieces of massive sulfide. Is this also stockwork here or possibly in part, a mound of massive sulfide? Also have a small piece of very delicate, long (50-60 cm long originally?), spire that was attached to the base shown. Mostly lined by chalcopyrite with a thin zone of Fe-oxidized outer zone.



Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1040	4	J2-1040-4-CH1	264-267 = DNA extract 268-273 = Cryovials 274-276 = Serum tube		No
Event #	**Chemistry**				
8520	No	Lat: -34.88182094 Long: 179.06558181 Hdg: 114.01 Depth: 1308.66m Alt: 2.28m			
Description: sample of oxyhydroxide chimney, pot #7 (red), bright red, iron oxyhydroxide mound, red areas are soft, mushy, 'wall' harder, homogenized together for sample. From Cornell: Two small (~2 cm long) pieces of small Fe-oxyhydroxide chimney that is growing up from an area of extensive Fe-oxide crust. Very light and fragile, strong red-brown colors.					

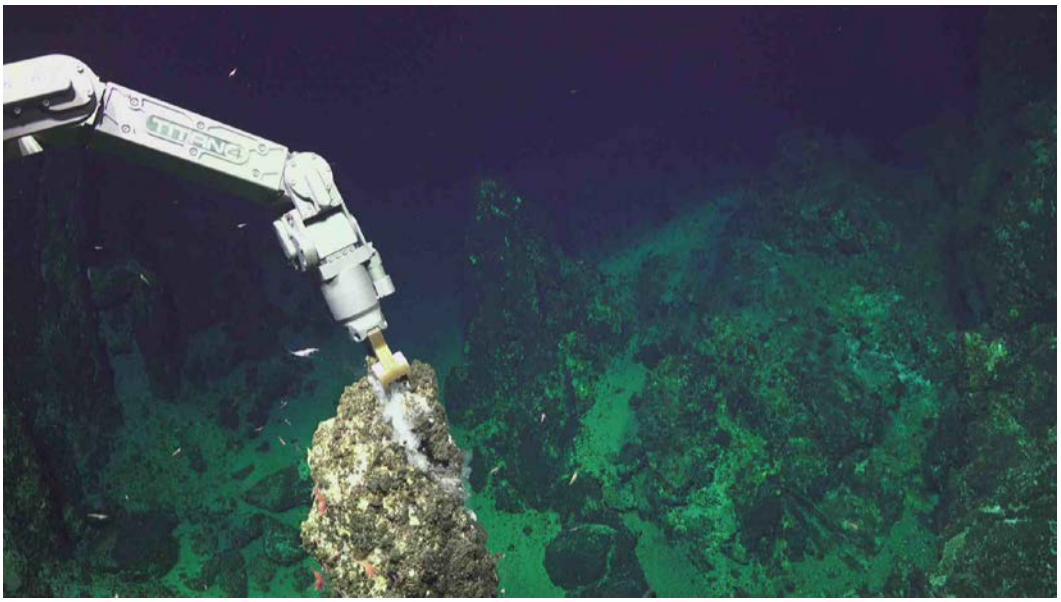


Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1040	7	J2-1040-7-CH1	250-253 = DNA extract 254-259 = Cryovial 260-262 = Serum tube 263 = whirlpack		No
Event #	**Chemistry**				
8840	No	Lat: -34.88209233 Long: 179.06837541 Hdg: 245.34 Depth: 1212.35 Alt: 12.68			
Description: Sulfur chimney, pot #8 (green/white), sulfur chimney, may not be actively venting?, grey cottage cheese with lemon zest :) Sample all used up for microbiology. Sample description as for J2-1040-7-CH2.					



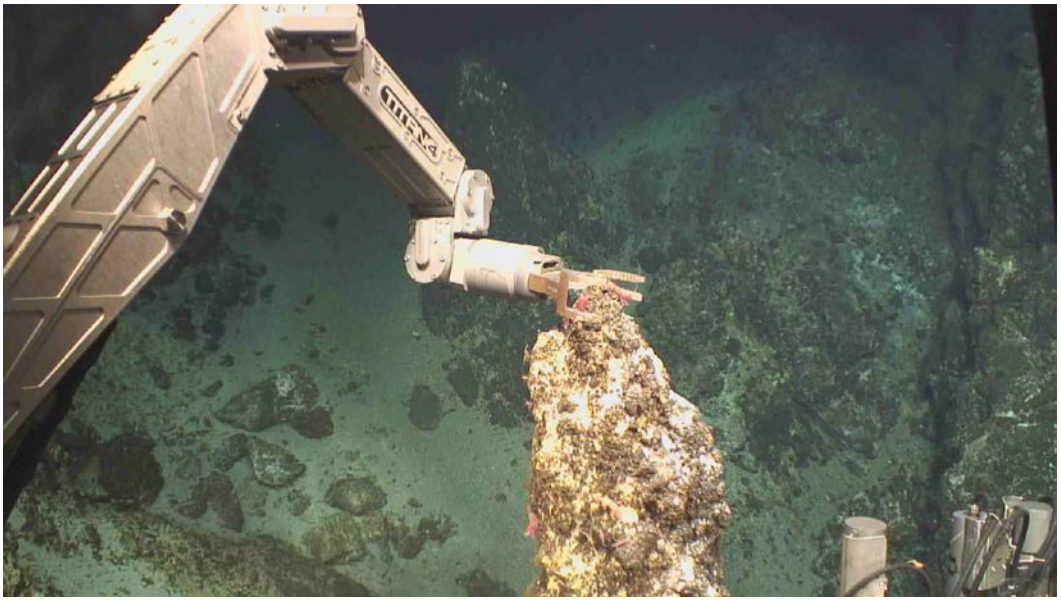
Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1040	7	J2-1040-7-CH2			No
Event #	**Chemistry**				
8886	No	Lat: −34.88210339 Long: 179.06834205 Hdg: 264.36 Depth: 1208.24m Alt: 4.58m			

Description: Sulfur chimney, right side of milk crate
From Cornell: Large sample ~10 cm across. Piece of a subsidiary S-rich chimney as part of a field of them seen inside the pit crater of the Main Cone. Sample is dominated by grey-white matrix that is almost certainly made up of polymorphs of silica, alunite (Al-sulfate), native sulfur and rare small crystals of pyrite. Advanced argillic alteration that we see in the high sulfidation parts of active volcanoes. Of note is the fact that the native sulfur appears 'globular' in places suggestive that was once liquid and solidified in the chimney. Probably high levels of SO_2 streaming through the chimney and mixing with seawater formed the native sulfur and alunite while making acid. Very intriguing sample.



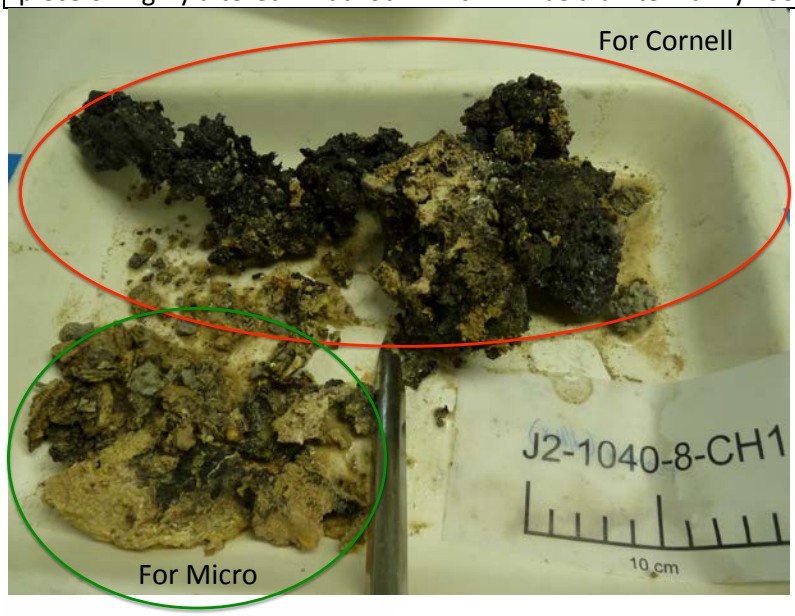
Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1040	7	J2-1040-7-CH3			No
Event #	**Chemistry**				
8897	No	Lat: −34.88209817 Long: 179.06833579 Hdg: 263.63 Depth: 1208.22m Alt: 4.34m			

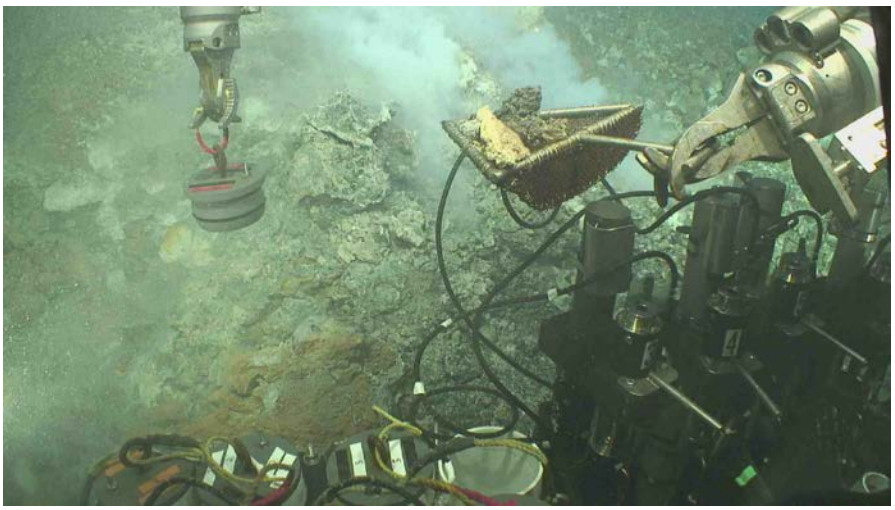
Description: Sulfur chimney, right side of milk crate
From Cornell: Sample from same chimney as for J2-1040-7-CH2. Also about 10 cm across with same mineralogy. Still see remnants of molten sulfur inside the sample and in places looks like intense alteration of a rock, though is found distinctly as a chimney. Outside of this and other sample oxidized with Mn ± Fe.



Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1040	8	J2-1040-8-CH1	228-231 = DNA extract 232-237 = cryovials 238 = serum tube 239 = 50cc falcon	160-192C	No
Event #	**Chemistry**				
9260	J2-1040-8-IGT3 J2-1040-8-MAJ-Green J2-1040-8-IGT5	Lat: -34.88234384 Long: 179.06827322 Hdg: 321.30 Depth: 1213.51m Alt: 1.76m			

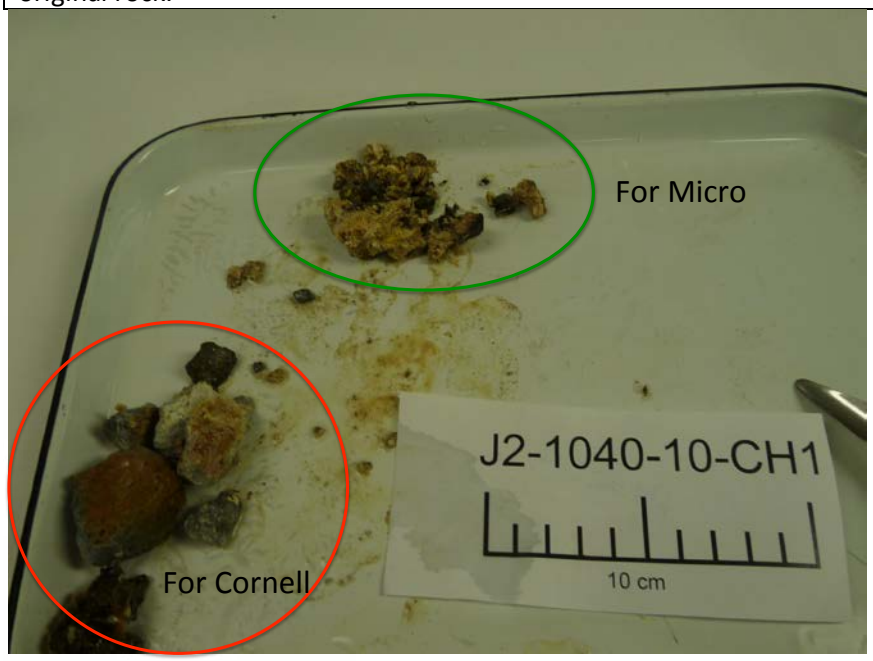
Description: Sampled hydrothermal rubble using scoop, in pot #6 (red/black), hydrothermal rubble sampled with scoop, sampled soft white areas from top, seem laminated, black sections too hard.
From Cornell: Sample dominated by what was molten sulfur. Is black with shiny surface due to molten sulfur being expelled onto seafloor and rapidly chilled. Might have some fine-grained pyrite as we see with molten sulfur samples elsewhere. Sulfur has flowed across the seafloor and picked up small pieces of hydrothermally altered rock. Also has some delicate 'threads' of sulfur. Have one small, ~1 cm diameter piece of highly altered what rock which will be alunite mainly. Some small pieces of yellow sulfur.





Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1040	10	J2-1040-10-CH1	24-243 = DNA extract 244-249 = cryovial	199.8	No
Event #	**Chemistry**				
9541	J2-1040-10-MAJ-Red	Lat: -34.882356 Long: 179.06826462 Hdg: 347.68 Depth: 1214.18 Alt: 1.54			

Description: nice small piece from vent, pot #2 (white), small piece from active vent, small sample only for DNA, white soft areas separated from harder rock material.
From Cornell: Collection of 5 or 6 small (<3 cm in size). Samples range from relatively fresh, unaltered lava, to 100% hydrothermally altered lava, to pieces of sulfur crust. See some possible barite(?) in vug of altered sample. Other rock samples not 100% altered show partial alteration of primary feldspars in the original rock.



Lowering number	Station number	Sample name	Aliquots	Preliminary Temp. (°C)	RNA Later
J2-1040	10	J2-1040-10-CH2	210-213 = DNA extract 214-219 = cryovials 220-225 = serum tube 226 = 50cc falcon 227, 277, & 278 = serum		No
Event #	**Chemistry**				
9582	No	Lat: -34.88236547 Long: 179.06822818 Hdg: 341.4 Depth: 1212.89 m Alt: 2.50m			

Description: warm, still shimmering, pot #1 (orange), mineral ledge overhanging active venting, very stinky still shimmering upon collection, soft, white material, homogenized all, pH measured with strips was about 2-2.5, neutralized tubes(227, 277, &278) with NaOH
From Cornell: Two pieces; one that looks like very fine-grained, tan-colored fluffy probably silica that was also host to lots of bacteria? The other is similar material, also very light but has formed a crust mantled by black sulfur(?)