

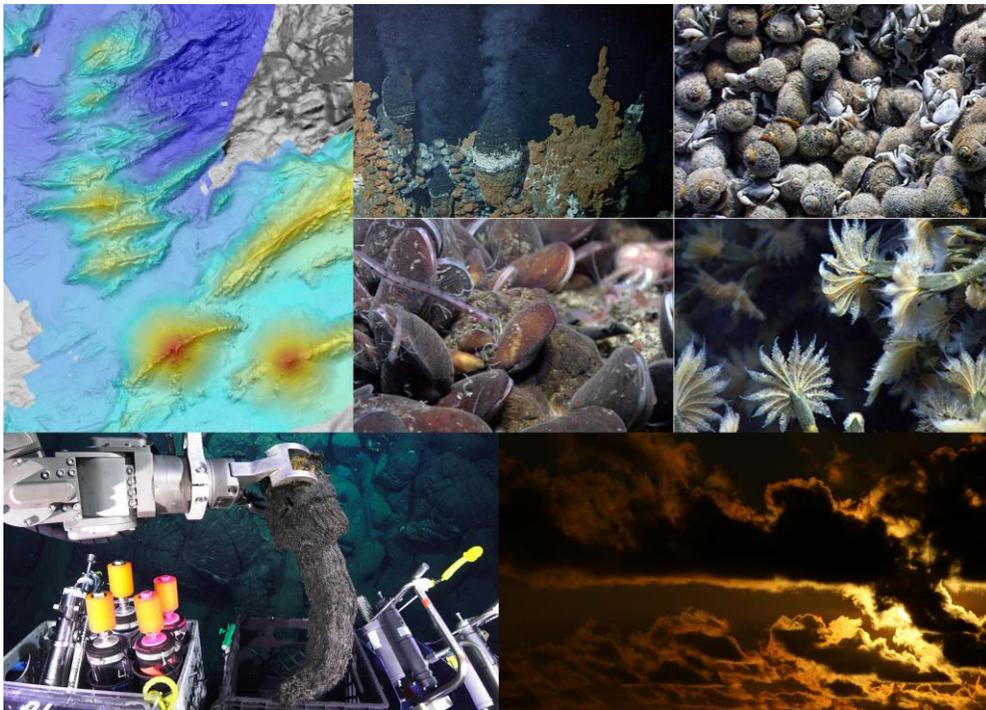
2017 NE Lau Basin Cruise Report

FK171110

R/V Falkor

November 10-December 18, 2017

SuBastian Dives S085-S105



Chief Scientist: Ken Rubin

R/V Falkor Captain: Phillip Guenther (Leg 1) and Peter Reynolds (Leg 2)

SuBastian Expedition Leader: Russell Coffield

SENTRY Expedition Leader: Sean Kelley

Cruise Report prepared by: Andra Bobbitt

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1 – NE Lau Basin 2017 Cruise Summary

Ken Rubin, Chief Scientist

Submarine volcanism is one of Earth's most fundamental processes, yet few active/recently active submarine volcanoes have been studied; even fewer have had time series observations via repeat site visits to understand volcano age, eruption frequency and volcanic duration, how the volcanoes develop/maintain hydrothermal activity, and how the activity affects benthic ecology. On FK171110, the "Underwater Fire" Expedition, we set out with our partners at Schmidt Ocean Institute to develop a detailed geological/hydrothermal/ecological understanding of an active, high-density-submarine-volcano terrain in the NE Lau basin of northern Tonga. Our study site was chosen because of the large number of closely-spaced active volcanoes in the area, revealed by our group's prior work in the area over the past decade.

The expedition was divided into two parts. On the first leg, we used the WHOI AUV Sentry to collect microbathymetry and sidescan, as well as water column sampling of volcanic emissions, and water sampling by towed CTD package. On the second leg, we used ROV SuBastian on 21 dives to observe and sample volcanic structures, hydrothermal vents and macrofaunal ecology. A range of volcanic rock and sediment, water, and macrobiological samples were collected via various sampling methods, and hundreds of samples were processed and analyzed on R/V Falkor during the expedition. A map of the primary study area (i.e., all but the sites at Tafu on the NELSC and the northern large dacite lava flow dive, S105), is on the next page. Each of these operations is described in dedicated sections of this report.

While the primary focuses of this expedition were deciphering geological histories at closely-spaced submarine volcanoes, and their impacts on hydrothermal venting and sea bed ecology, the expedition was also designed to excite the public with visually stunning images and video, very unusual rocks, and lush hydrothermal fauna. The expedition also used intelligent observation/analysis in a nested survey approach, promoted open information sharing, and employed global knowledge communication via live telepresence on YouTube and Facebook, becoming the most popular live streaming expedition for Schmidt Ocean Institute at the time, with many thousands of viewers each day.

Expedition details for the public are available at the Schmidt Ocean Institute website at <https://schmidtocean.org/cruise/underwater-fire-studying-submarine-volcanoes-tonga/>, coordinated by the SOI media and outreach team. This includes a cruise log with written and video 26 entries from many of the expedition participants, made possible by the onboard media coordinator, Monika (see <https://schmidtocean.org/cruise/underwater-fire-studying-submarine-volcanoes-tonga/cruise-log/>).

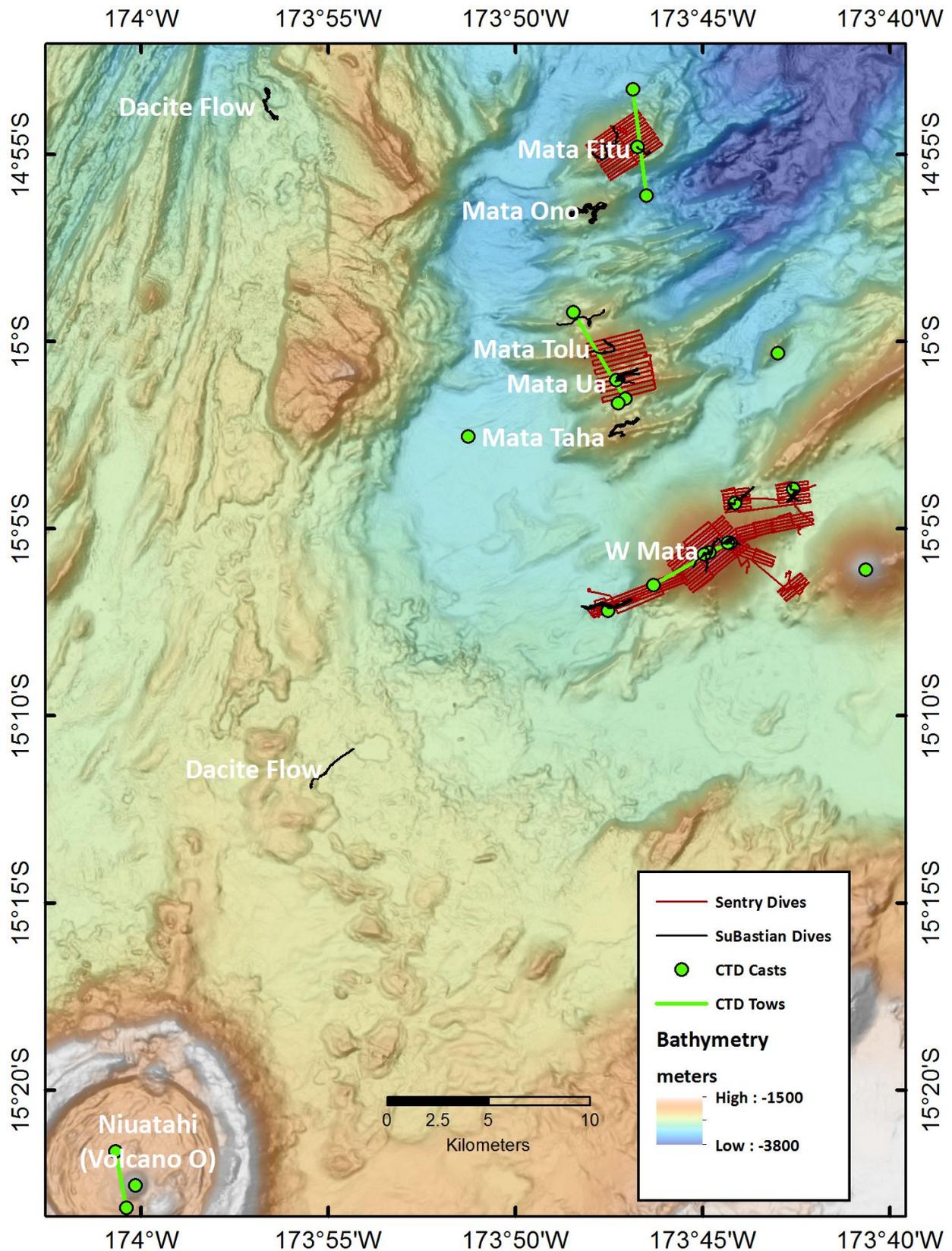
A brief summary of some activities and findings follows, with more details in the body of the report.

FK171110 Leg 1, 8-21 November, 2018, Apia, Samoa to Apia, Samoa

During this leg, we conducted 6 AUV Sentry Deployments with data collected, plus 1 engineering dive to test a different sonar.

- a. 2 Deployments at West Mata volcano and 1 that visited east and West Mata volcanoes collected useful sonar data and some photos of the sea floor.
- b. 3 other deployments had faulty or failing sonar, so there is little to no useable sea floor multibeam data. These includes deployments at Mata Fitu, Mata Ua+Mata Tolu, and the southwest base of West Mata. We do have photos from those dives.
- c. an autonomous MAPR stuck on the vehicle collected some sea water properties (nephelometry, ORP) which we subsequently used to help localize sites of hydrothermal venting.

We also did multibeam sonar mapping from Falkor with the EM302 system (on both legs).



We also conducted CTD package deployments on leg 1. Two types of deployments were done

- a. Vertical casts (13 of them)
- b. “Toyo” casts (4 of them) where the CTD package is dragged along a horizontal track and moved up and down in the water column.

Preliminary results of these studies:

1. Repeat multibeam mapping uncovered a new lava flow near the summit of West Mata volcano, which formed sometime after multibeam surveys here by Falkor in early 2016. We also identified two new lava units that erupted in the past 7 years at Tafu seamount on the Northeast Lau Spreading center
2. Lava units we were able to map with Sentry at West Mata have very different shapes and textures indicating different eruption conditions
3. No new hydrothermal plumes were identified in the area, but in detail, the chemistry of existing plumes has changed to include more methane and less hydrogen at West Mata, suggesting nothing is erupting right now. Plumes at Mata Ua, Fitu, and Tolu remain strong.

FK171110 Leg 2, 27 November- 18 December, 2018, Apia, Samoa to Apia, Samoa

On this leg, ROV SuBastian was deployed 21 times, visiting 11 different submarine volcanoes (see sections 5 and 6 of this report). The vehicle generally went in the water at approximately 7 AM and returned to the ship at 7 PM each day. Ken Rubin and Bill Chadwick shared responsibility for dive planning, alternately producing plans to meet as many science party objectives as possible. Dive navigation was done on the ship using the SOI proprietary Green Seas system, which used real-time USBL, DBL and INS navigation streams to provide a “best estimate” vehicle position. Navigation proved to be the most problematic area of ROV operations, which Andra Bobbitt spent many hours sorting through after the expedition. Some dives have essentially no useful navigation. Instead, we estimated vehicle position from water depth and features observed as discussed elsewhere in the report. Dive logging was another issue that proved difficult initially but was worked out as the Leg progressed. The logging effort was led by Susan Merle, who trained up a handful of other cruise participants on the types of observations to log, descriptive terms, sampling nomenclature, and the like.

All dives were streamed live on YouTube and Facebook live, using capabilities of the ROV and marine tech team. Dives were narrated mostly by Ken and Bill on a spit watch system with opportunities for a handful of other cruise participants to also have time on the microphone. Real-time interaction with a handful of interested, shore-based colleagues (e.g., Embley, Shank, Clague, Carrey, Portner, Resing and the SOI shore-based outreach team of Carley and Logan) were facilitated using Slack.com. A workspace was developed for the program, with each dive getting a separate channel. Dive plans and maps were shared before the dive, and nav screen grabs and other commentary were shared during the dives. We received many helpful suggestions and discussions during the dives from this interaction that enhanced the dives.

Preliminary results of these ROV dives (see section 6 for details):

1. West Mata is the most active volcano in the area, with a significant variety in eruption.
2. Two new eruptions in the last 5 years were discovered and documented at Tafu seamount (NELSC), as well as a diffuse flow hydrothermal site at its summit
3. Focused-flow hydrothermal vent systems were studied at 4 sites, including a new active system discovered at Mata Ono. Distinct differences in chimney size, shape, number, ecology and community structure were observed at the different hydrothermal vent sites.
4. The youngest volcanism at Matas Talu and Ua was discovered to be on satellite cones near to but away from the summits. Mata Fa has a wide mixture of apparent volcanic age across several small

cones, Mata Taha appears to be the least active (recently) and Mata Fitu is largely tectonized, but with some young volcanism at the eastern base of the summit cone.

5. There is a large variety of lava eruption styles at most volcanoes, including pillows (as expected) but with a significant range of morphologies, as well as the co-occurrence of high flow-rate lava forms at West Mata, Mata Tolu and Mata Fitu and a magma intrusion into sediment, causing uplift, and that subsequently erupted from the base of the uplift structure at West Mata. We observed large scale production of volcanic sediments from explosive phases of volcanism at West Mata and Tafu, with lesser amounts at Tolu, Fa and the large dacite lava flows LL_B and LL_D.

2 – Science Participants

Scientist

Affiliation

Expertise

Leg 1

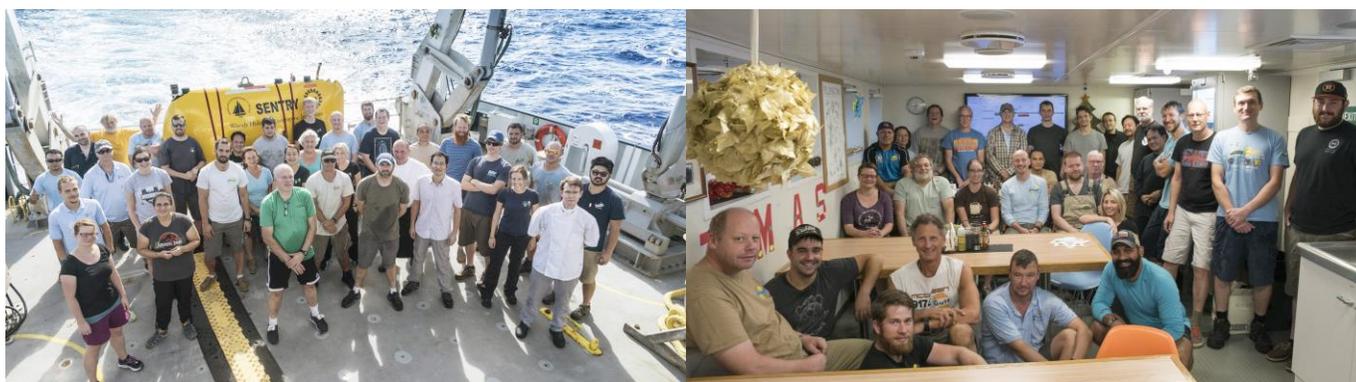
Ken Rubin	University of Hawaii	Chief Scientist-Geology
Bill Chadwick	NOAA EOI	Co-Chief Geology
Susan Merle	Oregon State U.-EOI	EM302 Mapping/ROV Data manager
Tamara Baumberger	Oregon State U.-EOI	Gas Studies
Joe Resing	U. Washington-EOI	Plume Studies
Nathan Buck	U. Washington-EOI	Plume Studies
Millie Wilkinson	Oregon State U.-EOI	Gas Studies
Sharon Walker	NOAA EOI	CTD/MAPRs
Hu Wang	Tongji University	Gas Studies
Mónika Naranjo González	LUMA	Multimedia Correspondent

Leg 2

Ken Rubin	University of Hawaii	Chief Scientist-Geology
Bill Chadwick	NOAA EOI	Co-Chief Geology
Susan Merle	Oregon State U.-EOI	EM302 Mapping/ROV Data manager
Tamara Baumberger	Oregon State U.-EOI	Gas Studies
Dave Butterfield	U. Washington-EOI	Hydrothermal Fluids
Kevin Roe	U. Washington-EOI	Hydrothermal Fluids
Val Finlayson	University of Hawaii	Geology
Terry Naumann	University of Hawaii	Geology
Christian Timm	GNS Science	Sulfide Studies
Walter Cho	Point Loma Nazarene U.	Biological Studies
Mónika Naranjo González	LUMA	Multimedia Correspondent

Leg 1 Scientists

Leg 2 Scientist



3 – Operations Log

3.1 Leg 1

date UTC	time UTC	date local	time local	FK171110 Leg 1 Operations
		8-Nov		Science crew (Leg 1) embarked in Apia by zodiac. Falkor anchored offshore.
		9-Nov		Still waiting offshore to get back into port to load Sentry
		9-Nov	1700	Latest news is that we may be able to get into port early 11-Nov
9-Nov	1500	10-Nov	0500	Pulled anchor - Set sail for West Mata
9-Nov	2023			CTD dunk test SW of Samoa
9-Nov	2120	10-Nov	1120	CTD at the surface
9-Nov	2125	10-Nov	1125	Moving on toward West Mata
10-Nov	0550	10-Nov	1950	XBT 1242527
10-Nov	0556	10-Nov	1956	Start logging EM302. SOL 1. Z=2483
10-Nov	0600	10-Nov	2000	EM302. SOL 2.. Start survey after XBT. Logging water column data also.
10-Nov	0705			EOL 4. End of W Mata Survey. Continuing to summit. Z=2609.
10-Nov	0826	10-Nov	2226	CTD case (V17B-01) over new cone near W Mata summit.
10-Nov	0859	10-Nov	2229	CTD case (V17B-01) back on deck
10-Nov	0925	10-Nov	2325	Only have 1 engine so will head to port now. Heading to Apia to pick up Sentry
		11-Nov	1400	Arrive at Apia. Got into port. Got Sentry and food (not enough snacks) finally!
11-Nov	0330	11-Nov	1730	Departed Apia. Headed back to West Mata ~ 12 hours.
				Did not collect multibeam for North Matas on way in because 2nd engine did not come on line in time.
		12-Nov	0636	CTD off deck. Start of tow T17B-01
		12-Nov	1100	CTD on deck. End of tow T17B-01
11-Nov	2202	12-Nov	1202	Sentry in water over W Mata summit Sentry dive 457.
12-Nov	2020	13-Nov	1020	Sentry on board. End of Sentry dive 457.
12-Nov	2032			SOL multibeam line 14 transit to Niutahi (Volcano).
12-Nov	2214			SOL 17 Survey at Niutahi.
12-Nov	2315			End of logging EM302 - west line over Niutahi.
13-Nov	0210			CTD deployed at Niutahi. T17B-02
				Tried to do a tow but ship had trouble staying on track so will bring CTD up and try a cast afterward.
13-Nov	0245			CTD on deck.
				SOL multibeam line 22 S to N Niutahi.
13-Nov	0428			North end of Niutahi multibeam line 23. Stopped logging.
13-Nov	0431			SOL multibeam line 24.
13-Nov	0505			EOL 25 Stop logging Z-1757.
13-Nov	0526			CTD in the water over Niutahi cone - 2nd CTD here after the previous CTD tow/cast that was in the wrong place. V171B-02.
13-Nov	0654			CTD on board. Will transit back to West Mata

date UTC	time UTC	date local	time local	FK171110 Leg 1 Operations
13-Nov	0700			Logging EM302 multibeam during transit back to West Mata. Line 26.
13-Nov	1000	14-Nov	0000	Sentry launch dive 458 at NE West Mata survey
13-Nov	1905			CTD cast V17B-03 over NE depth anomaly at West Mata.
13-Nov	2130			CTD on deck. Ship moving west to rejoin Sentry (was out of acoustic range for a little bit ~30 minutes).
14-Nov	0003			V17B-04. CTD cast over NE West Mata depth anomaly.
14-Nov	0220	14-Nov	1620	CTD on deck.
14-Nov	0430	14-Nov	1830	Sentry back on deck. End of dive 458.
14-Nov	0545			CTD in the water for tow-yo over Mata Tolu and Mata Ua T17B-03
		15-Nov	0100	CTD back on deck
14-Nov	1230			SOL 32. Start of multibeam survey of the northern Matas.
14-Nov	1620			EOL 42. End of North Mata Survey
		15-Nov	0711	Sentry in the water for engineering dive 459. Should be 6 hours deck to deck.
14-Nov	2220	15-nov	1220	Sentry on deck.
14-Nov	2346			Deep basin CTD cast west of West Mata. V17B-05
				During CTD cast winch had problems with level wind during ascent. Took 2 hours to resolve.
15-Nov	0322			CTD on deck.
15-Nov	0444			Sentry in the water for dive 460 - SE slope of West Mata.
15-Nov	2240	16-Nov	1240	Sentry on board. End of Sentry dive 460.
15-Nov	2245			EM302 multibeam. SOL 44 logging on way to CTD cast at Mata Fitu
15-Nov	2345			Stopped logging multibeam.
16-Nov	0003			CTD tow in the water at Mata Fitu. T17B-04
				Sentry dive delayed due to data quality issues. Switching to Reson 7125 400kHz head from Reson AUV 3 model (switching from newer to older model).
16-Nov	0920			Sentry in the water for dive 461 at Mata Fitu.
16-Nov	2319			CTD cast at Mata Fitu. V17B-06.
17-Nov	0230			CTD back on deck.
17-Nov	0230	17-Nov	1640	Updating EM302 SVP profile with data from previous CTD cast
17-Nov	0435	17-Nov	1835	Sentry on board. End of dive at Mata Fitu.
17-Nov	1048			EM302 mapping during the night. SOL 46
17-Nov	1706	18-Nov	0706	EOL at WP10. Stop EM302 multibeam mapping.
		18-Nov	1024	Delayed Sentry launch until after CTD cast at Mata Tolu.
		18-Nov	1024	Tried CTD cast to test CTD but aborted.
		18-Nov	1024	Recovered CTD. Had communications errors (like the previous night). Have to re-terminate.
18-Nov	0108			Sentry in the water for dive 462.
18-Nov	0312			CTD in the water for cast on south flank of Mata Ua. V17B-08
	0525			CTD on deck. Ship moving to next CTD site.
18-Nov	0602			V17B-09. CTD vertical cast at Mata Ua north side of ridge.

date UTC	time UTC	date local	time local	FK171110 Leg 1 Operations
18-Nov	0836			V17B-09 back on deck.
18-Nov	1750	19-Nov	0750	Sentry on board. End of dive 462
18-Nov	1805			Starting multibeam line 0 - new survey. Swapped out BSP (beam signal Processor) board from EM710 and put it in EM302. New survey (Survey 2)
18-Nov	1805			Bad data on port side now appears "gone".
18-Nov	2006			CTD cast V17B-10 over mound/depression at West Mata summit.
18-Nov	2136			CTD out of water.
18-Nov	2234			On station at East Mata.
18-Nov	2314			CTD in water for V17B-11 at East Mata.
19-Nov	0045			CTD back on deck.
19-Nov	0057			Actual new survey data starts on line 002_2017_1119_005745.
19-Nov	0205			Sentry in water for Dive 463 (SW rift of West Mata). Has original multibeam sonar.
19-Nov	0515			Breaking off to do CTD cast at summit of West Mata V17B-12.
19-Nov	0703			CTD back on board.
19-Nov	1941			CTD cast V17B-13. at West Mata deep SW rift zone during Sentry photo survey.
19-Nov	2256			CTD back on board.
20-Nov	0025			Sentry back on deck after dive 463.
20-Nov	0040			SOL 3 survey 2. Will map until reach the edge of the Tongan EEZ. Heading for Apia.
20-Nov	~0500			EOL7 Stop logging multibeam at edge of Tongan EEZ.
		21-Nov	~1000	Arrive at Apia. End of Leg 1

3.2 Leg 2

Date UTC	Time UTC	Date local	Time local	FK171110 Leg 2 Operations (Nov 27 – Dec 18 2017 local Samoan Time)
26-Nov	17:44	27-Nov	07:44	SuBastian Dive S085 - Vehicle off Deck
26-Nov	18:58	27-Nov	08:58	SuBastian Dive S085 - On bottom; start of dive S085 at West Mata
27-Nov	05:32	27-Nov	19:32	SuBastian Dive S085 - Off bottom; end of dive S085; 22 samples collected (2 fluid; 2 gas; 5 biology; 1 sediment; 12 rock)
27-Nov	05:55	27-Nov	19:55	SuBastian Dive S085 - Vehicle on Deck
27-Nov		27-Nov	14:00	EM302 multibeam survey between dives
27-Nov	17:11	28-Nov	07:11	SuBastian Dive S086 - Vehicle off Deck
27-Nov	18:33	28-Nov	08:33	SuBastian Dive S086 - On bottom; start of dive S086 at West Mata
28-Nov	04:10	28-Nov	18:10	SuBastian Dive S086 - Off bottom; end of dive S086; 21 samples collected (5 biology; 2 sediment; 14 rock)
28-Nov	04:46	28-Nov	18:46	SuBastian Dive S086 - Vehicle on Deck
28-Nov		28-Nov	14:00	EM302 multibeam survey between dives
28-Nov	17:17	29-Nov	07:17	SuBastian Dive S087 - Vehicle off Deck
28-Nov	18:39	29-Nov	08:39	SuBastian Dive S087 - On bottom; start of dive S087 at West Mata

Date UTC	Time UTC	Date local	Time local	FK171110 Leg 2 Operations (Nov 27 – Dec 18 2017 local Samoan Time)
29-Nov	04:10	29-Nov	18:10	SuBastian Dive S087 - Off bottom; end of dive S087; 18 samples collected (4 fluid; 3 gas; 4 biology; 2 sediment; 5 rock)
29-Nov	05:11	29-Nov	19:11	SuBastian Dive S087 - Vehicle on Deck
29-Nov		29-Nov	14:00	EM302 multibeam survey between dives
29-Nov	17:07	30-Nov	07:07	SuBastian Dive S088 - Vehicle off Deck
29-Nov	19:02	30-Nov	09:02	SuBastian Dive S088 - On bottom; start of dive S088 at the "Muffin"
30-Nov	04:48	30-Nov	18:48	SuBastian Dive S088 - Off bottom; end of dive S088; 18 samples collected (1 fluid; 4 sediment; 13 rock)
30-Nov	05:48	30-Nov	19:48	SuBastian Dive S088 - Vehicle on Deck
30-Nov		30-Nov	14:00	EM302 multibeam survey between dives
30-Nov	17:11	1-Dec	07:11	SuBastian Dive S089 - Vehicle off Deck
30-Nov	19:08	1-Dec	09:08	SuBastian Dive S089 - On bottom; start of dive S089 at Mata Ua
1-Dec	03:44	1-Dec	17:44	SuBastian Dive S089 - Off bottom; end of dive S089; 25 samples collected (4 fluid; 3 gas; 8 biology; 3 sulfide; 1 sediment; 6 rock)
1-Dec	05:42	1-Dec	19:42	SuBastian Dive S089 - Vehicle on Deck
1-Dec		1-Dec	14:00	EM302 multibeam survey between dives
1-Dec	17:06	2-Dec	07:06	SuBastian Dive S090 - Vehicle off Deck
1-Dec	19:00	2-Dec	09:00	SuBastian Dive S090 - On bottom; start of dive S090 at Mata Fitu
2-Dec	04:09	2-Dec	18:09	SuBastian Dive S090 - Off bottom; end of dive S090; 17 samples collected (1 sediment; 16 rock)
2-Dec	05:58	2-Dec	19:58	SuBastian Dive S090 - Vehicle on Deck
2-Dec		2-Dec	14:00	EM302 multibeam survey between dives
2-Dec	17:06	3-Dec	07:06	SuBastian Dive S091 - Vehicle off Deck
2-Dec	19:12	3-Dec	09:12	SuBastian Dive S091 - On bottom; start of dive S091 at Mata Tolu
3-Dec	04:38	3-Dec	18:38	SuBastian Dive S091 - Off bottom; end of dive S091; 19 samples collected (2 fluid; 2 gas; 3 biology; 3 sulfide; 1 sediment; 8 rock)
3-Dec	06:02	3-Dec	20:02	SuBastian Dive S091 - Vehicle on Deck
3-Dec		3-Dec	14:00	EM302 multibeam survey between dives
3-Dec	17:15	4-Dec	07:15	SuBastian Dive S092 - Vehicle off Deck
3-Dec	19:10	4-Dec	09:10	SuBastian Dive S092 - On bottom; start of dive S092 at Large Dacite Flow
4-Dec	03:46	4-Dec	17:46	SuBastian Dive S092 - Off bottom; end of dive S092; 23 samples collected (2 biology; 5 sediment; 15 rock; 1 bottle)
4-Dec	05:26	4-Dec	19:26	SuBastian Dive S092 - Vehicle on Deck
4-Dec		4-Dec	14:00	EM302 multibeam survey between dives
4-Dec	17:07	5-Dec	07:07	SuBastian Dive S093 - Vehicle off Deck
4-Dec	18:49	5-Dec	08:49	SuBastian Dive S093 - On bottom; start of dive S093 at base of West Mata (NE Pillow Ridge)
5-Dec	03:19	5-Dec	17:19	SuBastian Dive S093 - Off bottom; end of dive S093; 19 samples collected (5 sediment; 14 rock)
5-Dec	04:57	5-Dec	18:57	SuBastian Dive S093 - Vehicle on Deck
5-Dec		5-Dec	14:00	EM302 multibeam survey between dives
5-Dec	17:09	6-Dec	07:09	SuBastian Dive S094 - Vehicle off Deck

Date UTC	Time UTC	Date local	Time local	FK171110 Leg 2 Operations (Nov 27 – Dec 18 2017 local Samoan Time)
5-Dec	19:01	6-Dec	09:01	SuBastian Dive S094 - On bottom; start of dive S094 at Mata Tolu
6-Dec	03:59	6-Dec	17:59	SuBastian Dive S094 - Off bottom; end of dive S094; 25 samples collected (4 fluid; 3 gas; 7 biology; 4 sulfide; 1 sediment; 6 rock)
6-Dec	05:36	6-Dec	19:36	SuBastian Dive S094 - Vehicle on Deck
6-Dec		6-Dec	14:00	EM302 multibeam survey between dives
6-Dec	17:04	7-Dec	07:04	SuBastian Dive S095 - Vehicle off Deck
6-Dec	19:13	7-Dec	09:13	SuBastian Dive S095 - On bottom; start of dive S095 at SW Base of West Mata (SW Base)
7-Dec	03:43	7-Dec	17:43	SuBastian Dive S095 - Off bottom; end of dive S095; 22 samples collected (2 biology; 3 sediment; 17 rock)
7-Dec	05:54	7-Dec	19:54	SuBastian Dive S095 - Vehicle on Deck
7-Dec		7-Dec	14:00	EM302 multibeam survey between dives
7-Dec	17:08	8-Dec	07:08	SuBastian Dive S096 - Vehicle off Deck
7-Dec	18:50	8-Dec	08:50	SuBastian Dive S096 - On bottom; start of dive S096 at Mata Fa
8-Dec	03:33	8-Dec	17:33	SuBastian Dive S096 - Off bottom; end of dive S096; 20 samples collected (3 biology; 3 sediment; 14 rock)
8-Dec	05:12	8-Dec	19:12	SuBastian Dive S096 - Vehicle on Deck
8-Dec		8-Dec	14:00	EM302 multibeam survey between dives
8-Dec	17:06	9-Dec	07:06	SuBastian Dive S097 - Vehicle off Deck
8-Dec	18:50	9-Dec	08:50	SuBastian Dive S097 - On bottom; start of dive S097 at Mata Fitu
9-Dec	03:56	9-Dec	17:56	SuBastian Dive S097 - Off bottom; end of dive S097; 22 samples collected (4 fluid; 3 gas; 5 biology; 7 sulfide; 1 sediment; 2 rock)
9-Dec	05:50	9-Dec	19:50	SuBastian Dive S097 - Vehicle on Deck
9-Dec		9-Dec	14:00	EM302 multibeam survey between dives
9-Dec	17:09	10-Dec	07:09	SuBastian Dive S098 - Vehicle off Deck
9-Dec	18:43	10-Dec	08:43	SuBastian Dive S098 - On bottom; start of dive S098 at South Tafu
10-Dec	04:14	10-Dec	18:14	SuBastian Dive S098 - Off bottom; end of dive S098; 22 samples collected (2 fluid; 1 biology; 5 sediment; 14 rock)
10-Dec	05:29	10-Dec	19:29	SuBastian Dive S098 - Vehicle on Deck
10-Dec		10-Dec	14:00	EM302 multibeam survey between dives
10-Dec	17:05	11-Dec	07:05	SuBastian Dive S099 - Vehicle off Deck
10-Dec	18:34	11-Dec	08:34	SuBastian Dive S099 - On bottom; start of dive S099 at North Tafu
11-Dec	04:28	11-Dec	18:28	SuBastian Dive S099 - Off bottom; end of dive S099; 26 samples collected (4 fluid; 2 biology; 3 sediment; 17 rock)
11-Dec	05:37	11-Dec	19:37	SuBastian Dive S099 - Vehicle on Deck
11-Dec		11-Dec	14:00	EM302 multibeam survey between dives
11-Dec	17:03	12-Dec	07:03	SuBastian Dive S0100 - Vehicle off Deck
11-Dec	18:50	12-Dec	08:50	SuBastian Dive S0100 - On bottom; start of dive S0100 at Mata Ua (NE Flank)
12-Dec	03:52	12-Dec	17:52	SuBastian Dive S0100 - Off bottom; end of dive S0100; 28 samples collected (5 fluid; 3 gas; 6 biology; 6 sulfide; 1 sediment; 7 rock)
12-Dec	05:41	12-Dec	19:41	SuBastian Dive S0100 - Vehicle on Deck
12-Dec		12-Dec	14:00	EM302 multibeam survey between dives

Date UTC	Time UTC	Date local	Time local	FK171110 Leg 2 Operations (Nov 27 – Dec 18 2017 local Samoan Time)
12-Dec	20:10	13-Dec	10:10	SuBastian Dive S0101 - Vehicle off Deck
12-Dec	22:11	13-Dec	12:11	SuBastian Dive S0101 - On bottom; start of dive S0101 at Mata Ono
13-Dec	04:43	13-Dec	18:43	SuBastian Dive S0101 - Off bottom; end of dive S0101; 21 samples collected (3 fluid; 1 gas; 1 biology; 2 sulfide; 3 sediment; 11 rock)
13-Dec	06:35	13-Dec	20:35	SuBastian Dive S0101 - Vehicle on Deck
13-Dec		13-Dec	14:00	EM302 multibeam survey between dives
13-Dec	17:03	14-Dec	07:03	SuBastian Dive S0102 - Vehicle off Deck
13-Dec	19:00	14-Dec	09:00	SuBastian Dive S0102 - On bottom; start of dive S0102 at Mata Ono
14-Dec	04:05	14-Dec	18:05	SuBastian Dive S0102 - Off bottom; end of dive S0102; 25 samples collected (4 fluid; 3 gas; 4 biology; 3 sulfide; 2 sediment; 9 rock)
14-Dec	05:55	14-Dec	19:55	SuBastian Dive S0102 - Vehicle on Deck
14-Dec		14-Dec	14:00	EM302 multibeam survey between dives
14-Dec	17:06	15-Dec	07:06	SuBastian Dive S0103 - Vehicle off Deck
14-Dec	18:20	15-Dec	08:20	SuBastian Dive S0103 - On bottom; start of dive S0103 at West Mata (upper east rift)
15-Dec	04:15	15-Dec	18:15	SuBastian Dive S0103 - Off bottom; end of dive S0103; 25 samples collected (4 fluid; 3 gas; 4 biology; 3 sulfide; 2 sediment; 9 rock)
15-Dec	05:14	15-Dec	19:14	SuBastian Dive S0103 - Vehicle on Deck
15-Dec		15-Dec	14:00	EM302 multibeam survey between dives
15-Dec	17:06	16-Dec	07:06	SuBastian Dive S0104 - Vehicle off Deck
15-Dec	18:55	16-Dec	08:55	SuBastian Dive S0104 - On bottom; start of dive S0104 at Mata Taha
16-Dec	03:49	16-Dec	17:49	SuBastian Dive S0104 - Off bottom; end of dive S0104; 21 samples collected (2 biology; 2 sulfide; 2 sediment; 15 rock)
16-Dec	05:29	16-Dec	19:29	SuBastian Dive S0104 - Vehicle on Deck
		16-Dec	14:00	EM302 multibeam survey between dives
16-Dec	16:01:33		06:01	SuBastian Dive S0105 - Vehicle off Deck
16-Dec	18:00:46		08:00	SuBastian Dive S0105 - On bottom; start of dive S0105 at North Dacite Flow.
17-Dec	00:10:16		14:10	SuBastian Dive S0105 - Off bottom; end of dive S0105; 18 samples collected (1 biology; 5 sediment; 12 rock)
17-Dec	01:52:25		15:52	SuBastian Dive S0104 - Vehicle on Deck
17-Dec		17-Dec		EM302 multibeam mapping until out of Tongan waters.

4 – Discipline Summaries

4.1 Geology

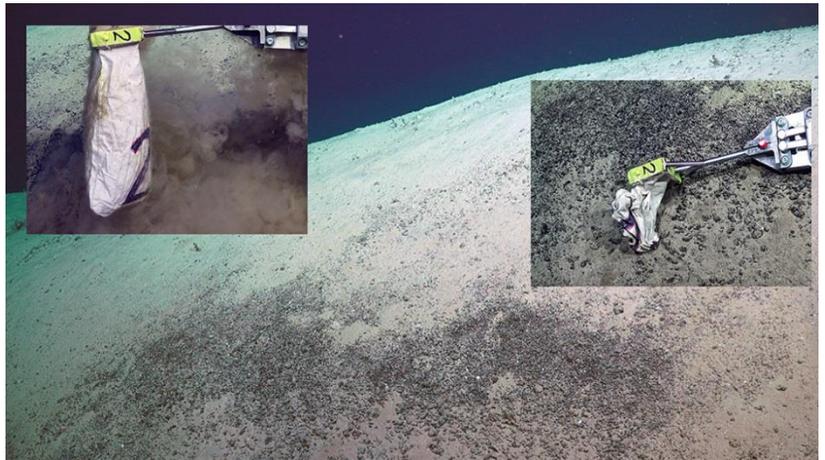
The primary focuses of this expedition were deciphering geological histories at closely-spaced submarine volcanoes, and their impacts on hydrothermal venting and sea bed ecology. Geologic observations and sampling were conducted on each of 21 ROV dives to provide direct information on the types and distribution of rocks (volcanic and hydrothermal) and sediments (primarily volcanoclastic) in the area, their relative ages, textures, mineralogy, and through pending shore-based analysis, their composition and conditions of formation. ROV dives visited and traversed geological structures (e.g., eruption deposits, faults, fissures, vent fields) as identified by ship and AUV sonar surveys, including repeat surveys, with an emphasis on longer ROV geological traverses to provide geospatial information on eruption deposit variations in space and time. We built on observations made during our group's prior expeditions in the area since 2008. Descriptions of the volcanic and hydrothermal rock collections are below.

4.1.1 – Volcanic Rock Collections

Ken Rubin

298 volcanic “rock” samples, were collected with ROV SuBastian, including 238 lava samples and 60 sediment samples, representing at least 75 distinct geological rock units (on average 3 units per dive). The textural, mineralogical and geochemical composition of these samples provide information on the conditions of magma formation, ascent, storage, eruption, and dispersal. All specimens were described, photographed (available on request), and dried on ship, and registered with unique digital identifiers (IGSN) at the System for Earth Science Registration website (geosamples.org). The table below list identifiers and some sample particulars.

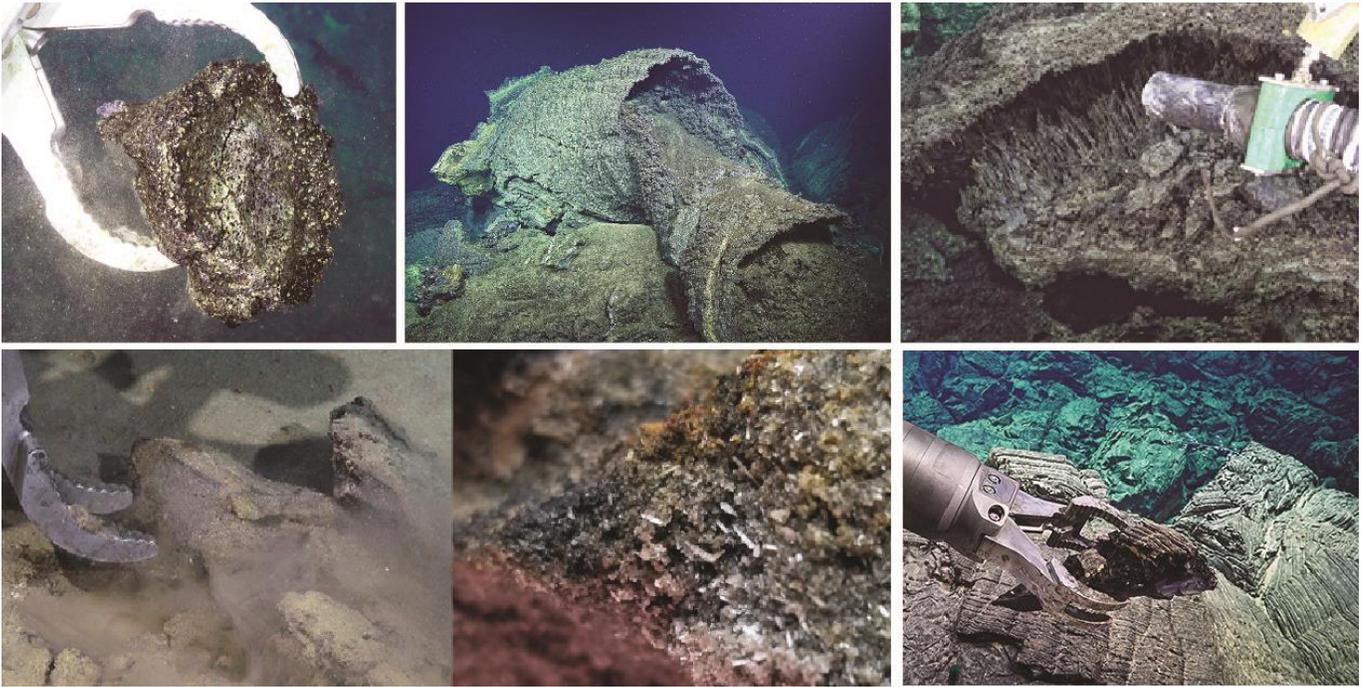
In addition to collecting as much lava as possible, a particular focus of these dives was collection of volcanoclastic sediment at as many sites as it occurred, with co-located volcanic rocks, to begin to decipher the mechanisms and magnitudes of pyroclastic activity in this region. This effort was greatly enhanced by the making and refining, midway through the expedition, of several metal ring/canvas-bag scoopers by the Falkor's engineering team, based on a Hawaii Undersea Research lab design (see photo).



Collection of dacitic tephra on dive S-92

We used these bags to collect 39 volcanoclastic sediment samples, including some with >10 cm-sized tephra and spatter fragments. Our team also employed MBARI pushcore samplers with core catchers kindly provided by Dave Clague (MBARI), plus SOI cores based on the same design, to collect 15 additional volcanoclastic sediment samples, focusing on those that were thicker and/or finer grained. 6 consolidated/lithified volcanic sediments or breccias were collected with the ROV manipulator.

Lava samples were collected from 3 general lithologies. The majority of the lavas collected are boninite and related lithologies ($n = 183$) from the Mata volcanoes, with lesser amounts of basalt ($n = 30$) and dacite ($n = 24$) from the NE Lau Spreading Center and regional large lava flows, respectively. Nearly all lava samples have volcanic glass on them, which was subsampled at sea. West Mata was by far the location with the most volcanic samples collected (111 lavas and pyroclasts).



Montage of volcanic rock samples and sampling methods. Clockwise from upper left: fresh boninite, nested boninite pillow lavas, suction sampling basalt lava drips, lithified pyroclastic deposit and close-up, “buffalo head hair texture dacite lava.

FK171110 Volcanic Rock Samples

Identifier	IGSN	Material	field ID	Dive	Site	Latitude	Longitude	Depth (m)
S85-Rock-01	KHR000246	Rock	Boninite	S85	W Mata summit	-15.098151	-173.753236	-1444
S85-Rock-02	KHR000247	Rock	Boninite	S85	W Mata summit	-15.097375	-173.752821	-1403
S85-Rock-03	KHR000248	Rock	Boninite	S85	W Mata summit	-15.097156	-173.752217	-1375
S85-Sed-04	KHR000249	sediment	Volcaniclastic	S85	W Mata summit	-15.096914	-173.751776	-1369
S85-Rock-05	KHR00024A	Rock	Boninite	S85	W Mata summit	-15.095289	-173.749657	-1232
S85-rock-14	KHR00024B	rock	Boninite	S85	W Mata summit	-15.094489	-173.746982	-1279
S85-rock-15	KHR00024C	rock	Boninite	S85	W Mata summit	-15.094415	-173.746617	-1270
S85-rock-17	KHR00024D	rock	Boninite	S85	W Mata summit	-15.093228	-173.746686	-1288
S85-rock-18	KHR00024E	rock	Boninite	S85	W Mata summit	-15.091314	-173.745501	-1347
S85-rock-19	KHR00024F	rock	Boninite	S85	W Mata summit	-15.089951	-173.745489	-1419
S85-rock-20	KHR00024G	rock	Boninite	S85	W Mata summit	-15.090295	-173.745144	-1418
S85-rock-21	KHR00024H	rock	Boninite	S85	W Mata summit	-15.090421	-173.744978	-1412
S85-rock-22	KHR00024I	rock	Boninite	S85	W Mata summit	-15.090161	-173.745007	-1422
S86-rock-01	KHR00024J	rock	Boninite	S86	W Mata Upper NE Rift	-15.090189	-173.733646	-1928
S86-rock-02	KHR00024K	rock	Boninite	S86	W Mata Upper NE Rift	-15.089918	-173.734169	-1876
S86-sed-03	KHR00024L	sediment	Volcaniclastic	S86	W Mata Upper NE Rift	-15.089962	-173.736151	-1745
S86-Rock-04	KHR00024M	Rock	Boninite	S86	W Mata Upper NE Rift	-15.090115	-173.736912	-1696
S86-Rock-05	KHR00024N	Rock	Boninite	S86	W Mata Upper NE Rift	-15.088428	-173.737816	-1592
S86-rock-06	KHR00024O	rock	Boninite	S86	W Mata Upper NE Rift	-15.089545	-173.738628	-1551
S86-rock-07	KHR00024P	rock	Boninite	S86	W Mata Upper NE Rift	-15.089694	-173.739368	-1517
S86-sed-08	KHR00024Q	sediment	Volcaniclastic	S86	W Mata Upper NE Rift	-15.089813	-173.739527	-1516
S86-rock-09	KHR00024R	rock	Boninite	S86	W Mata Upper NE Rift	-15.089361	-173.739338	-1530
S86-rock-10	KHR00024S	rock	Boninite	S86	W Mata Upper NE Rift	-15.0889824	-173.738986	-1559
S86-rock-11	KHR00024T	rock	Boninite	S86	W Mata Upper NE Rift	-15.0885452	-173.738538	-1583
S86-rock-12	KHR00024U	rock	Boninite	S86	W Mata Upper NE Rift	-15.0881764	-173.738807	-1552
S86-rock-14	KHR00024V	rock	Boninite	S86	W Mata Upper NE Rift	-15.0883336	-173.739133	-1556
S86-rock-15	KHR00024W	rock	Boninite	S86	W Mata Upper NE Rift	-15.0887242	-173.739682	-1534
S86-rock-16	KHR00024X	rock	Boninite	S86	W Mata Upper NE Rift	-15.0898402	-173.740184	-1515
S86-rock-18	KHR00024Y	rock	Boninite	S86	W Mata Upper NE Rift	-15.089515	-173.740517	-1501
S87-rock-01	KHR00024Z	rock	Boninite	S87	W Mata summit	-15.1021118	-173.748562	-1618

Identifier	IGSN	Material	field ID	Dive	Site	Latitude	Longitude	Depth (m)
S87-rock-03	KHR000250	rock	Boninite	S87	W Mata summit	-15.098339	-173.747968	-1405
S87-rock-04	KHR000251	rock	Boninite	S87	W Mata summit	-15.0965204	-173.748156	-1300
S87-rock-05	KHR000252	rock	Boninite	S87	W Mata summit	-15.0948087	-173.748691	-1199
S87-rock-13	KHR000253	rock	Boninite	S87	W Mata summit	-15.0941975	-173.748037	-1176
S87-sed-14	KHR000254	sediment	Volcaniclastic	S87	W Mata summit	-15.0949133	-173.746418	-1271
S87-sed-18	KHR000255	sediment	Volcaniclastic	S87	W Mata summit	-15.0946352	-173.746438	-1267
S88-rock-01	KHR000256	rock	Boninite	S88	W Mata NE of Base	-15.070973	-173.706457	-2674
S88-rock-02	KHR000257	rock	Boninite	S88	W Mata NE of Base	-15.0701082	-173.708654	-2674
S88-rock-03	KHR000258	rock	Boninite	S88	W Mata NE of Base	-15.0696041	-173.709078	-2676
S88-rock-04	KHR000259	rock	Boninite	S88	W Mata NE of Base	-15.0705792	-173.710498	-2674
S88-sed-05	KHR00025A	sediment	Volcaniclastic	S88	W Mata NE of Base	-15.0711963	-173.711887	-2663
S88-rock-06	KHR00025B	rock	Boninite	S88	W Mata NE of Base	-15.0714075	-173.71264	-2676
S88-rock-07	KHR00025C	rock	Boninite	S88	W Mata NE of Base	-15.070676	-173.712478	-2677
S88-rock-08	KHR00025D	rock	Boninite	S88	W Mata NE of Base	-15.069357	-173.710563	-2668
S88-sed-09	KHR00025E	sediment	pelagic+Volcaniclastic	S88	W Mata NE of Base	-15.068861	-173.710567	-2662
S88-sed-10	KHR00025F	sediment	pelagic+Volcaniclastic	S88	W Mata NE of Base	-15.068887	-173.710931	-2669
S88-rock-11	KHR00025G	rock	Boninite	S88	W Mata NE of Base	-15.067038	-173.70864	-2668
S88-rock-12	KHR00025H	rock	Boninite	S88	W Mata NE of Base	-15.066277	-173.708415	-2658
S88-rock-13	KHR00025I	rock	Boninite	S88	W Mata NE of Base	-15.066141	-173.709236	-2660
S88-sed-14	KHR00025J	sediment	volcanic ash	S88	W Mata NE of Base	-15.066141	-173.709236	-2683
S88-rock-15	KHR00025K	rock	Boninite	S88	W Mata NE of Base	-15.0659832	-173.710453	-2680
S88-rock-16	KHR00025L	rock	Boninite	S88	W Mata NE of Base	-15.064681	-173.711074	-2669
S88-rock-18	KHR00025M	rock	Boninite	S88	W Mata NE of Base	-15.06443	-173.710656	-2679
S89-rock-01	KHR00025N	rock	Boninite	S89	Mata Ua north base	-15.016325	-173.787746	-2381
S89-rock-02	KHR00025O	rock	Boninite	S89	Mata Ua north base	-15.016325	-173.787746	-2381
S89-rock-21	KHR00025P	rock	Boninite	S89	Mata Ua north flank	-15.0180612	-173.785018	-2164
S89-rock-22	KHR00025Q	rock	Boninite	S89	Mata Ua north summit	-15.0179408	-173.783528	-2118
S89-rock-23	KHR00025R	rock	Boninite	S89	Mata Ua summit valley	-15.0180825	-173.782178	-2144
S89-sed-24	KHR00025S	sediment	Volcaniclastic	S89	Mata Ua summit valley	-15.0180825	-173.782178	-2144
S89-rock-25	KHR00025T	rock	Boninite	S89	Mata Ua south summit	-15.0183239	-173.780666	-2102
S90-rock-01	KHR00025U	rock	Boninite	S90	Mata Fitu summit platform	-14.9162048	-173.798963	-2520
S90-rock-02	KHR00025V	rock	Boninite	S90	Mata Fitu summit platform	-14.9165203	-173.798524	-2521
S90-rock-03	KHR00025W	rock	Boninite	S90	Mata Fitu summit platform	-14.9177435	-173.796831	-2510
S90-rock-04	KHR00025X	rock	Boninite	S90	Mata Fitu summit platform	-14.9189424	-173.794872	-2533
S90-rock-05	KHR00025Y	rock	Boninite	S90	Mata Fitu summit platform	-14.9150658	-173.79285	-2449
S90-rock-06	KHR00025Z	rock	Boninite	S90	Mata Fitu summit platform	-14.9140812	-173.793375	-2401
S90-rock-07	KHR000260	rock	Boninite	S90	Mata Fitu summit platform	-14.9131281	-173.79402	-2379
S90-rock-08	KHR000261	rock	Boninite	S90	Mata Fitu summit platform	-14.9122213	-173.793732	-2402
S90-rock-09	KHR000262	rock	Boninite	S90	Mata Fitu summit platform	-14.912008	-173.789989	-2497
S90-rock-10	KHR000263	rock	Boninite	S90	Mata Fitu summit platform	-14.9112691	-173.787993	-2515
S90-sed-11	KHR000264	sediment	Volcaniclastic	S90	Mata Fitu summit platform	-14.9096199	-173.788438	-2459
S90-rock-12	KHR000265	rock	Boninite	S90	Mata Fitu summit platform	-14.9096199	-173.788438	-2459
S90-rock-13	KHR000266	rock	Boninite	S90	Mata Fitu summit platform	-14.9070112	-173.788323	-2490
S90-rock-14	KHR000267	rock	Boninite	S90	Mata Fitu summit platform	-14.9068511	-173.789007	-2474
S90-rock-15	KHR000268	rock	Boninite	S90	Mata Fitu summit platform	-14.9063727	-173.789151	-2490
S90-rock-16	KHR000269	rock	Boninite	S90	Mata Fitu summit platform	-14.9049163	-173.789832	-2533
S90-rock-17	KHR00026A	rock	Boninite	S90	Mata Fitu summit platform	-14.9041142	-173.789464	-2538
S91-rock-01	KHR00026B	rock	boninite	S91	Mata Tolu W Rift	-15.0073594	-173.802421	-2147
S91-rock-02	KHR00026C	rock	boninite	S91	Mata Tolu W Rift	-15.006543	-173.802429	-2113
S91-rock-04	KHR00026D	rock	boninite	S91	Mata Tolu W Rift	-15.0056644	-173.801498	-2058
S91-rock-05	KHR00026E	rock	boninite	S91	Mata Tolu W Rift	-15.004744	-173.800419	-2025
S91-rock-06	KHR00026F	rock	boninite	S91	Mata Tolu W Rift	-15.0044739	-173.799758	-2003
S91-rock-07	KHR00026G	rock	boninite	S91	Mata Tolu W Rift	-15.0042155	-173.798212	-1996
S91-sed-08	KHR00026H	sediment	volcaniclastic	S91	Mata Tolu W Rift	-15.0047675	-173.797288	-1962
S91-rock-09	KHR00026I	rock	boninite	S91	Mata Tolu W Rift	-15.0050614	-173.796259	-1926
S91-rock-10	KHR00026J	rock	boninite	S91	Mata Tolu summit	-15.0050717	-173.794759	-1862

Identifier	IGSN	Material	field ID	Dive	Site	Latitude	Longitude	Depth (m)
S92-rock-01	KHR00026K	rock	dacite	S92	Large lava Flow B	-15.1814082	-173.905114	-2565
S92-rock-02	KHR00026L	rock	dacite	S92	Large lava Flow B	-15.181953	-173.906275	-2553
S92-rock-03	KHR00026M	rock	dacite	S92	Large lava Flow B	-15.1821045	-173.906469	-2531
S92-sed-04	KHR00026N	sediment	pelagic+Volcaniclastic	S92	Large lava Flow B	-15.1827425	-173.907218	-2548
S92-rock-05	KHR00026O	rock	dacite	S92	Large lava Flow B	-15.1837684	-173.909046	-2525
S92-rock-06	KHR00026P	rock	dacite	S92	Large lava Flow B	-15.1836678	-173.908885	-2525
S92-rock-08	KHR00026Q	rock	dacite	S92	Large lava Flow B	-15.1841043	-173.909459	-2525
S92-rock-09	KHR00026R	rock	dacite	S92	Large lava Flow B	-15.1867914	-173.913127	-2538
S92-sed-10	KHR00026S	sediment	volcaniclastic	S92	Large lava Flow B	-15.1884906	-173.914804	-2523
S92-rock-11	KHR00026T	rock	dacite	S92	Large lava Flow B	-15.1894163	-173.915977	-2508
S92-rock-13	KHR00026U	rock	dacite	S92	Large lava Flow B	-15.1904939	-173.916791	-2508
S92-sed-14	KHR00026V	sediment	volcaniclastic	S92	Large lava Flow B	-15.1910994	-173.917205	-2500
S92-rock-16	KHR00026W	rock	dacite	S92	Large lava Flow B	-15.1916658	-173.917599	-2504
S92-rock-17	KHR00026X	rock	dacite	S92	Large lava Flow B	-15.192982	-173.919445	-2506
S92-rock-18	KHR00026Y	rock	dacite	S92	Large lava Flow B	-15.194209	-173.921399	-2508
S92-sed-19	KHR00026Z	sediment	volcaniclastic	S92	Large lava Flow B	-15.1950298	-173.923197	-2464
S92-rock-20	KHR000270	rock	Dacite volcaniclastic	S92	Large lava Flow B	-15.1969294	-173.924036	-2419
S92-rock-21	KHR000271	rock	welded volcanic ash	S92	Large lava Flow B	-15.1974217	-173.923905	-2418
S92-rock-22	KHR000272	rock	welded volcanic ash	S92	Large lava Flow B	-15.1981477	-173.924105	-2415
S92-sed-23	KHR000273	sediment	pelagic+Volcaniclastic	S92	Large lava Flow B	-15.1983208	-173.924169	-2415
S93-sed-01	KHR000274	sediment	volcaniclastic	S93	Large lava Flow B	-15.0648277	-173.727832	-2538
S93-rock-02	KHR000275	rock	boninite	S93	W Mata NE of Base	-15.067233	-173.729891	-2588
S93-rock-03	KHR000276	rock	boninite	S93	W Mata NE of Base	-15.0679886	-173.730958	-2597
S93-sed-04	KHR000277	sediment	volcaniclastic	S93	W Mata NE of Base	-15.068251	-173.731173	-2598
S93-rock-05	KHR000278	rock	boninite	S93	W Mata NE of Base	-15.0684445	-173.731269	-2587
S93-rock-06	KHR000279	rock	boninite	S93	W Mata NE of Base	-15.069479	-173.732583	-2508
S93-rock-07	KHR00027A	rock	boninite	S93	W Mata NE of Base	-15.0705715	-173.732931	-2526
S93-rock-08	KHR00027B	rock	boninite	S93	W Mata NE of Base	-15.0704202	-173.734173	-2498
S93-rock-09	KHR00027C	rock	boninite	S93	W Mata NE of Base	-15.0704729	-173.735398	-2516
S93-rock-10	KHR00027D	rock	boninite	S93	W Mata NE of Base	-15.0720838	-173.735895	-2422
S93-sed-11	KHR00027E	sediment	volcaniclastic	S93	W Mata NE of Base	-15.0721996	-173.735831	-2420
S93-sed-12	KHR00027F	sediment	volcaniclastic	S93	W Mata NE of Base	-15.071882	-173.737616	-2489
S93-rock-13	KHR00027G	rock	boninite	S93	W Mata NE of Base	-15.071882	-173.737616	-2490
S93-rock-14	KHR00027H	rock	boninite	S93	W Mata NE of Base	-15.0737576	-173.736979	-2380
S93-rock-15	KHR00027I	rock	boninite	S93	W Mata NE of Base	-15.0739225	-173.737988	-2377
S93-sed-16	KHR00027J	sediment	volcaniclastic	S93	W Mata NE of Base	-15.074485	-173.738824	-2370
S93-rock-17	KHR00027K	rock	boninite	S93	W Mata NE of Base	-15.0746203	-173.73886	-2370
S93-rock-18	KHR00027L	rock	boninite	S93	W Mata NE of Base	-15.0746774	-173.738611	-2372
S93-rock-19	KHR00027M	rock	boninite	S93	W Mata NE of Base	-15.07476	-173.738083	-2376
S94-rock-01	KHR00027N	rock	boninite	S94	Mata Tolu W rift	-14.9997875	-173.793716	-2151
S94-rock-02	KHR00027O	rock	boninite	S94	Mata Tolu W rift	-14.9998698	-173.793597	-2136
S94-rock-03	KHR00027P	rock	boninite	S94	Mata Tolu W rift	-15.0021224	-173.78982	-2043
S94-rock-04	KHR00027Q	rock	boninite	S94	Mata Tolu W rift	-15.0025166	-173.789531	-2051
S94-rock-05	KHR00027R	rock	boninite	S94	Mata Tolu W rift	-15.0035144	-173.789419	-1974
S94-rock-06	KHR00027S	rock	boninite	S94	Mata Tolu W rift	-15.0043754	-173.7908	-1906
S94-sed-07	KHR00027T	sediment	volcaniclastic	S94	Mata Tolu Summit	-15.0044579	-173.790753	-1906
S95-sed-01	KHR00027U	sediment	volcaniclastic	S95	W Mata lower SW rift	-15.1185553	-173.801195	-3012
S95-rock-02	KHR00027V	rock	boninite	S95	W Mata lower SW rift	-15.1185203	-173.801382	-3012
S95-rock-03	KHR00027W	rock	boninite	S95	W Mata lower SW rift	-15.119766	-173.79883	-3007
S95-rock-04	KHR00027X	rock	boninite	S95	W Mata lower SW rift	-15.1188368	-173.801176	-3008
S95-rock-05	KHR00027Y	rock	boninite	S95	W Mata lower SW rift	-15.1186467	-173.80177	-3009
S95-rock-06	KHR00027Z	rock	boninite	S95	W Mata lower SW rift	-15.1179627	-173.798989	-2953
S95-rock-07	KHR000280	rock	boninite	S95	W Mata lower SW rift	-15.1164263	-173.793999	-2955
S95-rock-08	KHR000281	rock	boninite	S95	W Mata lower SW rift	-15.1186448	-173.791287	-2895
S95-rock-09	KHR000282	rock	boninite	S95	W Mata lower SW rift	-15.1182357	-173.788809	-2878
S95-sed-10	KHR000283	sediment	volcaniclastic	S95	W Mata lower SW rift	-15.118314	-173.788999	-2889

Identifier	IGSN	Material	field ID	Dive	Site	Latitude	Longitude	Depth (m)
S95-rock-11	KHR000284	rock	boninite	S95	W Mata lower SW rift	-15.1180362	-173.789111	-2886
S95-rock-12	KHR000285	rock	boninite	S95	W Mata lower SW rift	-15.1177003	-173.787927	-2882
S95-rock-13	KHR000286	rock	boninite	S95	W Mata lower SW rift	-15.1173712	-173.787189	-2889
S95-sed-14	KHR000287	sediment	volcaniclastic	S95	W Mata lower SW rift	-15.1173628	-173.78736	-2887
S95-rock-15	KHR000288	rock	boninite	S95	W Mata lower SW rift	-15.1171825	-173.786925	-2890
S95-rock-16	KHR000289	rock	boninite	S95	W Mata lower SW rift	-15.1171687	-173.786027	-2880
S95-rock-17	KHR00028A	rock	boninite	S95	W Mata lower SW rift	-15.1171412	-173.785585	-2874
S95-rock-20	KHR00028B	rock	boninite	S95	W Mata lower SW rift	-15.1165003	-173.784619	-2804
S95-rock-21	KHR00028C	rock	boninite	S95	W Mata lower SW rift	-15.1157617	-173.78417	-2705
S95-rock-22	KHR00028D	rock	boninite	S95	W Mata lower SW rift	-15.1152072	-173.781644	-2702
S96-rock-01	KHR00028E	rock	boninite	S96	Mata Fa W rift	-14.992273	-173.814206	-2584
S96-rock-02	KHR00028F	rock	boninite	S96	Mata Fa W rift	-14.9926391	-173.813979	-2555
S96-sed-03	KHR00028G	sediment	volcaniclastic	S96	Mata Fa W rift	-14.9926455	-173.813895	-2554
S96-rock-04	KHR00028H	rock	boninite	S96	Mata Fa W rift	-14.9924849	-173.813178	-2552
S96-rock-05	KHR00028I	rock	boninite	S96	Mata Fa W rift	-14.991272	-173.807904	-2482
S96-rock-06	KHR00028J	rock	boninite	S96	Mata Fa W rift	-14.9905126	-173.807157	-2430
S96-rock-07	KHR00028K	rock	boninite	S96	Mata Fa summit	-14.9889273	-173.805432	-2394
S96-rock-08	KHR00028L	rock	boninite	S96	Mata Fa summit	-14.9891885	-173.803137	-2385
S96-rock-09	KHR00028M	rock	boninite	S96	Mata Fa summit	-14.9898825	-173.801549	-2392
S96-rock-10	KHR00028N	rock	boninite	S96	Mata Fa summit	-14.9901953	-173.801157	-2329
S96-rock-12	KHR00028O	rock	boninite	S96	Mata Fa south cone	-14.992032	-173.801012	-2376
S96-rock-13	KHR00028P	rock	boninite	S96	Mata Fa south cone	-14.9930006	-173.800602	-2329
S96-sed-14	KHR00028Q	sediment	volcaniclastic	S96	Mata Fa summit	-14.9894643	-173.799786	-2343
S96-rock-15	KHR00028R	rock	boninite	S96	Mata Fa summit	-14.9894643	-173.799786	-2342
S96-sed-17	KHR00028S	sediment	volcaniclastic	S96	Mata Fa east rift	-14.9882092	-173.797029	-2339
S96-rock-19	KHR00028T	rock	boninite	S96	Mata Fa east rift	-14.9879327	-173.796252	-2344
S96-rock-20	KHR00028U	rock	boninite	S96	Mata Fa east rift	-14.9869386	-173.794229	-2410
S97-sed-01	KHR00028V	sediment	volcaniclastic	S97	Mata Fitu south flank	-14.9159123	-173.773176	-2765
S97-rock-07	KHR00028W	rock	boninite	S97	Mata Fitu south flank	-14.9167949	-173.774818	-2741
S97-rock-12	KHR00028X	rock	boninite	S97	Mata Fitu south flank	-14.9145361	-173.777437	-2652
S98-sed-01	KHR00028Y	sediment	volcaniclastic	S98	Tafu/NELSC south rift	-15.3817075	-174.258768	-2117
S98-sed-02	KHR00028Z	sediment	volcaniclastic	S98	Tafu/NELSC south rift	-15.3822304	-174.258121	-2113
S98-rock-03	KHR000290	rock	basalt	S98	Tafu/NELSC south rift	-15.3831533	-174.25729	-2050
S98-rock-04	KHR000291	rock	basalt	S98	Tafu/NELSC south rift	-15.383682	-174.256903	-2003
S98-rock-05	KHR000292	rock	basalt	S98	Tafu/NELSC south rift	-15.3838068	-174.256748	-1962
S98-sed-06	KHR000293	sediment	volcaniclastic	S98	Tafu/NELSC south rift	-15.3843757	-174.255755	-1935
S98-rock-07	KHR000294	rock	basalt	S98	Tafu/NELSC south rift	-15.3843475	-174.25573	-1934
S98-rock-08	KHR000295	rock	basalt	S98	Tafu/NELSC south rift	-15.3850181	-174.254511	-1908
S98-rock-09	KHR000296	rock	basalt	S98	Tafu/NELSC south rift	-15.3847989	-174.252109	-1904
S98-rock-11	KHR000297	rock	basalt	S98	Tafu/NELSC south rift	-15.3814664	-174.25321	-1938
S98-rock-12	KHR000298	rock	basalt	S98	Tafu/NELSC south rift	-15.3809628	-174.249778	-1808
S98-sed-13	KHR000299	sediment	volcaniclastic	S98	Tafu/NELSC south rift	-15.379499	-174.249056	-1808
s98-rock-14	KHR00029A	rock	basalt	s98	Tafu/NELSC south rift	-15.377967	-174.248763	-1879
S98-rock-15	KHR00029B	rock	basalt	S98	Tafu/NELSC south rift	-15.377229	-174.247788	-1761
S98-sed-16	KHR00029C	sediment	volcaniclastic	S98	Tafu/NELSC south rift	-15.377475	-174.247306	-1749
S98-rock-17	KHR00029D	rock	basalt	S98	Tafu/NELSC south rift	-15.3774147	-174.247162	-1740
S98-rock-18	KHR00029E	rock	basalt breccia	S98	Tafu/NELSC south rift	-15.3773855	-174.247515	-1740
S98-rock-21	KHR00029F	rock	basalt	S98	Tafu/NELSC south rift	-15.3758783	-174.245966	-1673
S98-rock-22	KHR00029G	rock	basalt	S98	Tafu/NELSC south rift	-15.37529	-174.24498	-1659
S99-rock-01	KHR00029H	rock	basalt	S99	Tafu/NELSC north rift	-15.342953	-174.224792	-1955
S99-rock-02	KHR00029I	rock	basalt	S99	Tafu/NELSC north rift	-15.3435188	-174.225383	-1953
S99-rock-03	KHR00029J	rock	basalt	S99	Tafu/NELSC north rift	-15.3446656	-174.225856	-1999
S99-rock-04	KHR00029K	rock	basalt	S99	Tafu/NELSC north rift	-15.3447568	-174.22639	-1974
S99-rock-05	KHR00029L	rock	basalt	S99	Tafu/NELSC north rift	-15.3448187	-174.22664	-1970
S99-rock-06	KHR00029M	rock	basalt	S99	Tafu/NELSC north rift	-15.3463517	-174.226723	-1965
S99-rock-07	KHR00029N	rock	basalt	S99	Tafu/NELSC north rift	-15.347596	-174.2273	-1932

Identifier	IGSN	Material	field ID	Dive	Site	Latitude	Longitude	Depth (m)
S99-rock-08	KHR00029O	rock	basalt	S99	Tafu/NELSC north rift	-15.3479105	-174.227506	-1912
S99-sed-09	KHR00029P	sediment	volcaniclastic	S99	Tafu/NELSC north rift	-15.3488458	-174.227824	-1893
S99-rock-10	KHR00029Q	rock	basalt	S99	Tafu/NELSC north rift	-15.3494868	-174.228144	-1849
S99-rock-11	KHR00029R	rock	basalt	S99	Tafu/NELSC north rift	-15.3510343	-174.228739	-1830
S99-rock-12	KHR00029S	rock	basalt	S99	Tafu/NELSC north rift	-15.3516235	-174.2294	-1809
S99-rock-13	KHR00029T	rock	basalt	S99	Tafu/NELSC north rift	-15.3550389	-174.230906	-1763
S99-rock-14	KHR00029U	rock	basalt	S99	Tafu/NELSC north rift	-15.3566853	-174.231761	-1701
S99-sed-15	KHR00029V	sediment	volcaniclastic	S99	Tafu/NELSC north rift	-15.3574357	-174.232448	-1674
S99-rock-18	KHR00029W	rock	basalt	S99	Tafu/NELSC north rift	-15.358883	-174.233083	-1684
S99-rock-20	KHR00029X	rock	basalt	S99	Tafu/NELSC north rift	-15.3604673	-174.233652	-1620
S99-rock-21	KHR00029Y	rock	basalt	S99	Tafu/NELSC north rift	-15.3636613	-174.236523	-1490
S99-sed-25	KHR00029Z	sediment	volcaniclastic	S99	Tafu/NELSC north rift	-15.3667807	-174.238958	-1379
S99-rock-26	KHR000300	rock	basalt	S99	Tafu/NELSC north rift	-15.3667807	-174.238958	-1378
S100-rock-01	KHR000301	rock	boninite	S100	Mata Ua North Base	-15.012884	-173.780081	-2387
S100-rock-02	KHR000302	rock	boninite	S100	Mata Ua North Base	-15.013013	-173.780076	-2354
S100-rock-03	KHR000303	rock	boninite	S100	Mata Ua North Base	-15.0131041	-173.780077	-2341
S100-rock-04	KHR000304	rock	boninite	S100	Mata Ua North Base	-15.0133684	-173.779926	-2328
S100-rock-05	KHR000305	rock	boninite	S100	Mata Ua North Base	-15.0136037	-173.779825	-2267
S100-rock-06	KHR000306	rock	boninite	S100	Mata Ua North Base	-15.0143006	-173.779556	-2252
S100-sed-07	KHR000307	sediment	volcaniclastic	S100	Mata Ua North Base	-15.014828	-173.779907	-2255
S100-rock-08	KHR000308	rock	boninite	S100	Mata Ua North Base	-15.0132009	-173.781263	-2380
S101-rock-01	KHR000309	rock	boninite	S101	Mata Ono SW rift	-14.9461958	-173.800356	-2669
S101-rock-02	KHR00030A	rock	boninite	S101	Mata Ono SW rift	-14.9458298	-173.799071	-2639
S101-sed-03	KHR00030B	sediment	volcaniclastic	S101	Mata Ono SW rift	-14.945588	-173.799012	-2629
S101-rock-04	KHR00030C	rock	boninite	S101	Mata Ono SW rift	-14.945614	-173.798815	-2626
S101-rock-05	KHR00030D	rock	boninite	S101	Mata Ono SW rift	-14.9450067	-173.79875	-2602
S101-rock-06	KHR00030E	rock	boninite	S101	Mata Ono SW rift	-14.943898	-173.798373	-2588
S101-sed-07	KHR00030F	sediment	volcaniclastic	S101	Mata Ono SW rift	-14.9429548	-173.798687	-2539
S101-rock-08	KHR00030G	rock	boninite	S101	Mata Ono summit	-14.9401213	-173.795375	-2525
S101-sed-09	KHR00030H	sediment	volcaniclastic	S101	Mata Ono summit	-14.9404853	-173.793947	-2513
S101-rock-10	KHR00030I	rock	boninite	S101	Mata Ono summit	-14.9395293	-173.793475	-2465
S101-rock-11	KHR00030J	rock	boninite	S101	Mata Ono summit	-14.9384349	-173.794045	-2486
S101-rock-12	KHR00030K	rock	boninite	S101	Mata Ono summit	-14.9383062	-173.79585	-2455
S101-rock-13	KHR00030L	rock	boninite	S101	Mata Ono summit	-14.9401452	-173.798177	-2363
S101-rock-14	KHR00030M	rock	boninite	S101	Mata Ono summit	-14.940202	-173.798331	-2358
S102-rock-01	KHR00030N	rock	boninite	S102	Mata Ono NW rift	-14.9440072	-173.809198	-2681
S102-sed-02	KHR00030O	sediment	volcaniclastic	S102	Mata Ono NW rift	-14.9432782	-173.808125	-2689
S102-rock-03	KHR00030P	rock	boninite	S102	Mata Ono NW rift	-14.943141	-173.807915	-2704
S102-rock-04	KHR00030Q	rock	boninite	S102	Mata Ono NW rift	-14.9428473	-173.807626	-2689
S102-rock-05	KHR00030R	rock	boninite	S102	Mata Ono NW rift	-14.9426653	-173.807469	-2676
S102-rock-06	KHR00030S	rock	boninite	S102	Mata Ono north flank	-14.9413558	-173.804851	-2564
S102-sed-07	KHR00030T	sediment	volcaniclastic	S102	Mata Ono north flank	-14.9413243	-173.804192	-2578
S102-rock-08	KHR00030U	rock	boninite	S102	Mata Ono north flank	-14.9417867	-173.804478	-2583
S102-rock-09	KHR00030V	rock	boninite	S102	Mata Ono north flank	-14.9416663	-173.803941	-2521
S102-rock-10	KHR00030W	rock	boninite	S102	Mata Ono north flank	-14.941407	-173.80214	-2465
S102-rock-11	KHR00030X	rock	boninite	S102	Mata Ono summit	-14.9389238	-173.800298	-2428
S103-rock-01	KHR00030Y	rock	boninite	S103	W Mata Upper NE Rift	-15.088296	-173.737241	-1596
S103-sed-02	KHR00030Z	sediment	volcaniclastic	S103	W Mata Upper NE Rift	-15.088296	-173.737241	-1596
S103-rock-04	KHR000310	rock	boninite	S103	W Mata Upper NE Rift	-15.0879375	-173.738297	-1577
S103-rock-05	KHR000311	rock	boninite	S103	W Mata Upper NE Rift	-15.0885173	-173.738348	-1578
S103-sed-06	KHR000312	sediment	volcaniclastic	S103	W Mata Upper NE Rift	-15.0884275	-173.73833	-1570
S103-rock-07	KHR000313	rock	boninite	S103	W Mata Upper NE Rift	-15.0886072	-173.738617	-1557
S103-sed-08	KHR000314	sediment	volcaniclastic	S103	W Mata Upper NE Rift	-15.0891194	-173.738816	-1531
S103-rock-11	KHR000315	rock	boninite	S103	W Mata Upper NE Rift	-15.0892066	-173.739811	-1516
S103-rock-12	KHR000316	rock	boninite	S103	W Mata Upper NE Rift	-15.0898751	-173.739899	-1519
S103-rock-13	KHR000317	rock	boninite	S103	W Mata Upper NE Rift	-15.0897973	-173.740884	-1474

Identifier	IGSN	Material	field ID	Dive	Site	Latitude	Longitude	Depth (m)
S103-sed-14	KHR000318	sediment	volcaniclastic	S103	W Mata Upper NE Rift	-15.0891869	-173.741715	-1458
S103-rock-15	KHR000319	rock	boninite	S103	W Mata Upper NE Rift	-15.0880877	-173.74369	-1503
S103-rock-16	KHR00031A	rock	boninite	S103	W Mata Upper NE Rift	-15.0889055	-173.743993	-1450
S103-rock-17	KHR00031B	rock	boninite	S103	W Mata Upper NE Rift	-15.0898594	-173.745147	-1419
S103-rock-18	KHR00031C	rock	boninite	S103	W Mata Upper NE Rift	-15.0909384	-173.74534	-1349
S103-sed-19	KHR00031D	sediment	volcaniclastic	S103	W Mata Upper NE Rift	-15.0910077	-173.745362	-1349
S103-rock-20	KHR00031E	rock	boninite	S103	W Mata Upper NE Rift	-15.0917514	-173.745331	-1321
S103-sed-21	KHR00031F	sediment	volcaniclastic	S103	W Mata Upper NE Rift	-15.0921135	-173.745047	-1306
S103-rock-22	KHR00031G	rock	boninite	S103	W Mata Upper NE Rift	-15.0928636	-173.745859	-1289
S103-rock-24	KHR00031H	rock	boninite	S103	W Mata Upper NE Rift	-15.0933212	-173.746341	-1275
S104-rock-01	KHR00031I	rock	boninite	S104	Mata Taha	-15.0349054	-173.779455	-2351
S104-sed-02	KHR00031J	sediment	volcaniclastic	S104	Mata Taha	-15.0349054	-173.779455	-2352
S104-rock-03	KHR00031K	rock	boninite	S104	Mata Taha	-15.0354933	-173.779694	-2389
S104-rock-04	KHR00031L	rock	boninite	S104	Mata Taha	-15.0361934	-173.781223	-2382
S104-rock-05	KHR00031M	rock	boninite	S104	Mata Taha	-15.035867	-173.782895	-2345
S104-rock-06	KHR00031N	rock	boninite	S104	Mata Taha	-15.0362913	-173.783938	-2309
S104-rock-08	KHR00031O	rock	boninite	S104	Mata Taha	-15.0376508	-173.785257	-2262
S104-sed-09	KHR00031P	sediment	volcaniclastic	S104	Mata Taha	-15.0376508	-173.785257	-2261
S104-rock-10	KHR00031Q	rock	boninite	S104	Mata Taha	-15.0373383	-173.786255	-2260
S104-rock-11	KHR00031R	rock	boninite	S104	Mata Taha	-15.038107	-173.788889	-2222
S104-rock-12	KHR00031S	rock	boninite	S104	Mata Taha	-15.0382772	-173.78867	-2238
S104-rock-16	KHR00031T	rock	boninite	S104	Mata Taha	-15.0404438	-173.790221	-2240
S104-rock-17	KHR00031U	rock	boninite	S104	Mata Taha	-15.0420127	-173.791081	-2197
S104-rock-18	KHR00031V	rock	boninite	S104	Mata Taha	-15.0410653	-173.789049	-2248
S104-rock-19	KHR00031W	rock	boninite	S104	Mata Taha	-15.040291	-173.786037	-2198
S104-rock-20	KHR00031X	rock	boninite	S104	Mata Taha	-15.0417008	-173.785355	-2161
S104-rock-21	KHR00031Y	rock	boninite	S104	Mata Taha	-15.041793	-173.785999	-2167
S105-rock-01	KHR00031Z	rock	dacite	S105	Large lava Flow D	-14.887193	-173.946451	-2791
S105-rock-02	KHR000320	rock	dacite	S105	Large lava Flow D	-14.8879879	-173.944442	-2794
S105-rock-03	KHR000321	rock	dacite	S105	Large lava Flow D	-14.8891448	-173.943791	-2793
S105-rock-04	KHR000322	rock	dacite	S105	Large lava Flow D	-14.8891448	-173.943791	-2793
S105-sed-05	KHR000323	sediment	volcaniclastic	S105	Large lava Flow D	-14.8892748	-173.943138	-2805
S105-rock-06	KHR000324	rock	dacite	S105	Large lava Flow D	-14.889635	-173.943338	-2795
S105-sed-07	KHR000325	sediment	volcaniclastic	S105	Large lava Flow D	-14.8903206	-173.943312	-2815
S105-sed-08	KHR000326	sediment	volcaniclastic	S105	Large lava Flow D	-14.8913405	-173.943666	-2815
S105-sed-09	KHR000327	sediment	volcaniclastic	S105	Large lava Flow D	-14.8919	-173.943727	-2792
S105-rock-10	KHR000328	rock	dacite	S105	Large lava Flow D	-14.8932083	-173.945243	-2707
S105-rock-11	KHR000329	rock	dacite	S105	Large lava Flow D	-14.8961433	-173.945247	-2687
S105-rock-12	KHR00032A	rock	dacite	S105	Large lava Flow D	-14.8961066	-173.944854	-2682
S105-rock-13	KHR00032B	rock	dacite	S105	Large lava Flow D	-14.8963248	-173.944402	-2678
S105-rock-15	KHR00032C	rock	dacite	S105	Large lava Flow D	-14.8993756	-173.941585	-2676
S105-sed-16	KHR00032D	sediment	volcaniclastic	S105	Large lava Flow D	-14.8993756	-173.941585	-2676
S105-rock-17	KHR00032E	rock	dacite	S105	Large lava Flow D	-14.9006223	-173.939346	-2706
S105-rock-18	KHR00032F	rock	dacite	S105	Large lava Flow D	-14.9006223	-173.939346	-2703

4.1.2 - Sulfide Collections

31 sulfides were sampled with ROV SuBastian during the Tongan Underwater Fire expedition to the Mata volcanoes with R/V Falkor (FK171110). The mineralogy and geochemical composition of sulfides will help to understand chemical relation between vent fluids and chimney formation which form the substrate for unique biological vent communities. Isotopic analyses will furthermore allow us to determine how old hydrothermal sulfides are, thus how long these chimney field have been active. This gives valuable information about the evolution of hydrothermal vent field and were entire chimney are recovered changes of fluid flux. All samples were sent to GNS Science in New Zealand.

During the expedition, we investigated active and inactive vent fields on five of the Mata Volcanoes (Mata Ua, Tolu, Fitu, Ono and Taha). Here we provide a brief preliminary description of the sulfides collected during this expedition.

FK171110 Sulfide Samples Quick Index

Sample Identifier	Date	Dive	Site	Latitude	Longitude	Depth (m)
S89-sulfide-03	2017-11-30	S89	Mata Ua	-15.01680	-173.78764	2356.1
S89-sulfide-11	2017-11-30	S89	Mata Ua	-15.01659	-173.78767	2355.9
S89-sulfide-14	2017-11-30	S89	Mata Ua	-15.01729	-173.78805	2350.2
S91-sulfide-11	2017-12-03	S91	Mata Tolu	-15.004654	-173.793096	1836.8
S91-sulfide-12	2017-12-03	S91	Mata Tolu	-15.004782	-173.793617	1821.4
S91-sulfide-16	2017-12-03	S91	Mata Tolu	-15.004646	-173.793661	1819.4
S94-sulfide-09	2017-12-05	S94	Mata Tolu	-15.00457	-173.79389	1823.9
S94-sulfide-14*	2017-12-06	S94	Mata Tolu	-15.00482	-173.79354	1813.3
S94-sulfide-16	2017-12-06	S94	Mata Tolu	-15.00493	-173.79351	1813.1
S94-sulfide-20	2017-12-06	S94	Mata Tolu	-15.00472	-173.79365	1820.3
S94-sulfide-25	2017-12-06	S94	Mata Tolu	-15.00449	-173.79359	1821.7
S97-sulfide-02	2017-12-08	S97	Mata Fitu	-14.91559	-173.77340	2766.6
S97-sulfide-03	2017-12-08	S97	Mata Fitu	-14.91545	-173.77371	2757.8
S97-sulfide-09	2017-12-08	S97	Mata Fitu	-14.91632	-173.77546	2717.9
S97-sulfide-10	2017-12-08	S97	Mata Fitu	-14.91583	-173.77569	2708.1
S97-sulfide-11	2017-12-08	S97	Mata Fitu	-14.91584	-173.77578	2708.0
S97-sulfide-17	2017-12-09	S97	Mata Fitu	-14.91356	-173.77910	2615.9
S97-sulfide-22	2017-12-09	S97	Mata Fitu	-14.91339	-173.77910	2612.5
S100-sulfide-09	2017-12-11	S100	Mata Ua	-15.01635	-173.78672	2346.7
S100-sulfide-15	2017-12-12	S100	Mata Ua	-15.01668	-173.78693	2334.9
S100-sulfide-16	2017-12-12	S100	Mata Ua	-15.01668	-173.78693	2335.0
S100-sulfide-17	2017-12-12	S100	Mata Ua	-15.01679	-173.78695	2340.0
S100-sulfide-21	2017-12-12	S100	Mata Ua	-15.01675	-173.78597	2318.0
S100-sulfide-26	2017-12-12	S100	Mata Ua	-15.01675	-173.78597	2318.0
S101-sulfide-17	2017-12-13	S101	Mata Ono	-14.94058	-173.79956	2362.8
S101-sulfide-19	2017-12-13	S101	Mata Ono	-14.94058	-173.79956	2361.8
S101-sulfide-20**	2017-12-13	S101	Mata Ono	-14.94058	-173.79956	2354.9
S102-sulfide-17	2017-12-14	S102	Mata Ono	-14.94054	-173.79938	2353.7
S102-sulfide-22	2017-12-14	S102	Mata Ono	-14.94058	-173.79956	2360.9
S102-sulfide-25	2017-12-14	S102	Mata Ono	-14.94058	-173.79956	2366.1
S104-sulfide-13	2017-12-16	S104	Mata Taha	-15.03914	-173.78965	2261.1
S104-sulfide-15	2017-12-16	S104	Mata Taha	-15.04021	-173.79055	2254.8

*Logged as S94-bio-14 (bio & sulfide)

**Logged as S101-fluid-20 (fluid & sulfide)

Table 4.1.2-1: List of sulfide samples acquired with ROV SuBastian during FK171110

Dive S89 - Mata Ua, north-eastern flank vent field

The first dive that explored a hydrothermal vent field during FK171110 was dive S89 on Mata Ua. Three sulfide samples were recovered from a vent field located at the lower north-eastern flank of the volcano and is characterized by many up to 7-8m tall chimneys many of them venting vigorously. During dive S89, 3 sulfide samples were recovered. The first sample (S89-Sulfide-03) sampled a small ~1 m tall beehive-bearing chimney that actively vented black high temperature fluid with apparent flashing (phase separation) at the central chimney orifice. Golden patches of mm-thick white-golden cubic(?) sulfide minerals underlain by a hard mm-thick layer of purple-white mineral. The outer part of the sample consists of fine-grained friable greenish-grey pyrite (?). Sample S89-Sulfide-11 is a ~30 cm tall bulbous (~18 cm diameter at the bottom) chimney top from an inactive chimney. The sample is mainly composed of grey barite/anhydrite with a central mm-sized fluid-up flow zone lined with black crystals (barite/sphalerite/galena or hematite?). The outside of the sample is encrusted in white-orange-brown anhydrite? with iron oxides. S89-Sulfide-14 is a very fragile sample from an actively 'black smoke' venting chimney ~1-2m tall. The matrix of the sample is greenish-grey-golden sulfides and a white-purplish anhydrite(?) crust, similar as observed in sample S89-Sulfide-03.

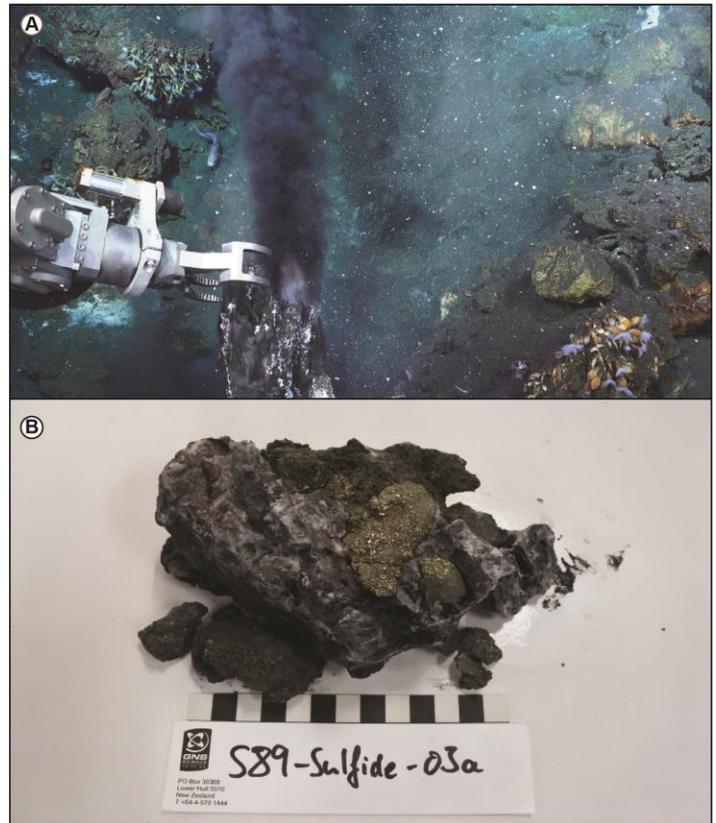


Figure 4.1.2-1 S89-03 A) Sampling sulfides at flashing vent at Mata Ua during dive S89. B) Photograph of the sample taken in A).

Dive S91- Mata Tolu, summit vent field

During dive S91 three sulfide samples were obtained from the summit vent field of Mata Tolu. These include a sample from inactive "deadwood" vent site (S91-Sulfide-11), one sample from the active "Beehive Chimney" and "Saguaro" vent sites. Sample S91-Sulfide-11 is an inactive chimney with a central fluid flow zone lined with mm sized rhombic crystals (chalcopyrite?) ~2 cm across. The chimney matrix is multi-colored (blue-purple-greenish), which is likely bornite. Black-brown Mn-Fe oxides are coating the outside of the sample. Samples S91-Sulfide-12a and 12b have been recovered from the base (inactive) of the of the active "Beehive Chimney". The sample is composed of fragile fine grained mainly greenish grey matrix (12a; pyrite/sphalerite?) containing some golden

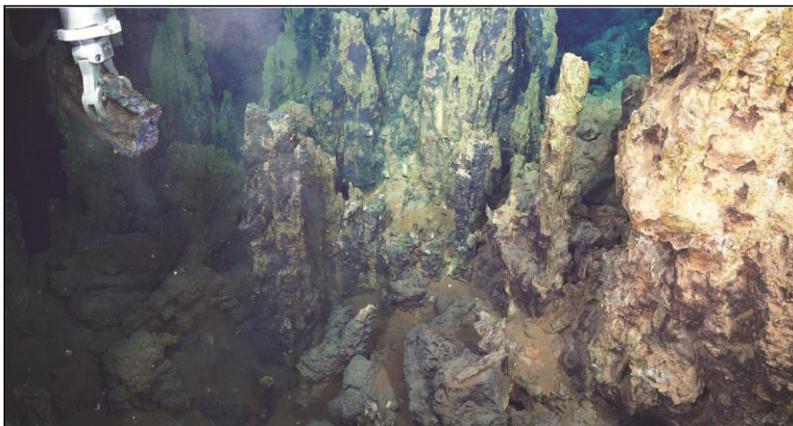
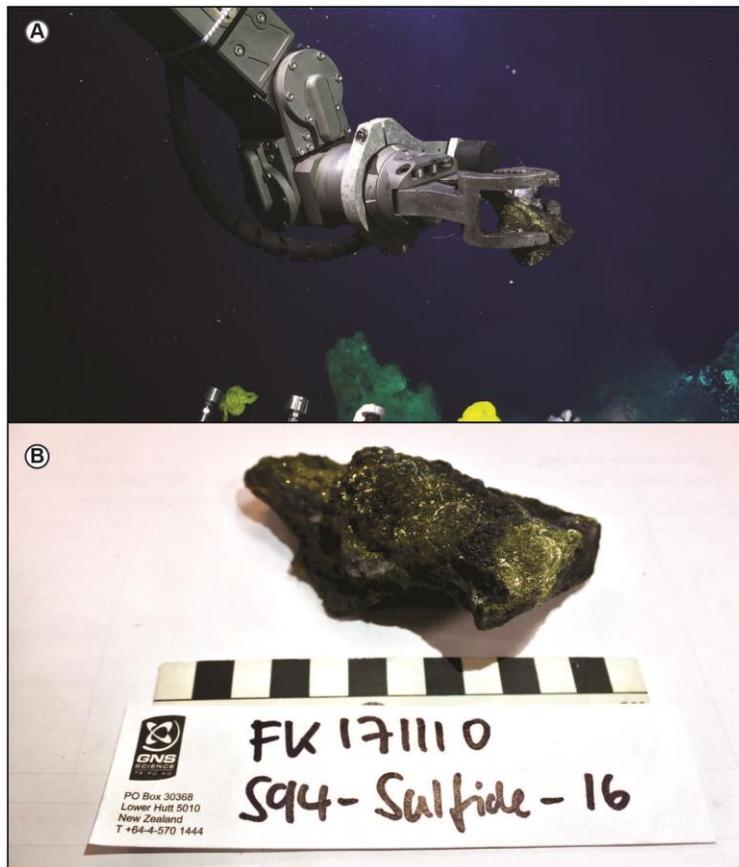


Figure 4.1.2-2 S91-11 A) Sampling of inactive multi-colored chimney top (sample S91-Sulfide-11) at Mata Tolu during dive S91.

specs (pyrite?). The outside of the sample has a mm white-orange anhydrate coat. S91-Sulfide-12b has been samples ~10 cm away from 12a and mainly consists of massive sulfide (maybe chalcopyrite?)-barite (whitish-grey mm-sized barite crystals). Sample S91-Sulfide-16 is from the active vent of the “Saguaro Chimney” site. 9 small fragile fragments were recovered from this site. The fragments have sub mm thin lining of chalcopyrite surrounded by sub-mm thin coat of white/greyish anhydrate/barite? Followed by fragile fine-grained sulfides (probably pyrite in anhydrate matrix?). Vent fluid temperature is 314°C and both, gas and fluids, were also sampled from the same vent.

Dive S94 - Mata Tolu, summit vent field

Dive S94 returned to Mata Tolu to continue to explore the summit vent field. Five sulfide samples were collected during this dive. The first sample (S94-Sulfide-09; four fragments) has been recovered ~10 cm away from actively venting ($T_{max} = 260^\circ\text{C}$) top of the “Low Smoker” chimney (sampling of the active vent failed as too



fragile). All fragments are greenish-grey (prob pyrite/sphalerite with a mm thin outer coating; very fragile. No signs of alteration, so probably young chimney sample. Sample S94-Sulfide-14 is a 6 cm chimlet from “Snail Alcove” Chimney complex, recovered during a bio-scoop (S94-Bio-14). The chimlet is white-grey-black (inactive or low-T diffuse venting) composed of mainly anhydrite and minor barite (light sample). Sample S94-Sulfide-16 is a small chimney stub-fragment from the actively venting ($T_{max} = 201^\circ\text{C}$) “Snail Alcove” Chimney complex. The sample consists of a ~3cm lining of massive chalcopyrite/bornite? coated by thin layer of white to orange anhydrate. Sample S94-Sulfide-20 originally was a ~50 cm high inactive chimney ~20cm in diameter at the bottom thinning to ~15 cm across at the top. Two 10 cm slices (~50-40 cm) and (20-10 cm) were retained. The sample consists of several fluid upflow zones (up to 4 cm across) lined with chalcopyrite/pyrite/bornite? Tree-ring like growth zones of barite/anhydrite and possibly sphalerite/hematite? The outside is coated with brown-black Mn-Fe oxides. S94-Sulfide-25 is sample of the top 15 cm of an inactive side vent

from the top of the “North Tall and Handsome” Chimney. The central fluid up-flow zone is lined with a mm coat

Figure 4.1.2-3 S94-16 A) Sampling sulfides from active “Snail Alcove” vent at Mata Ua during dive S94. B) Photograph of the sample taken in A).

of golden pyrite or chalcopyrite(?) with a sub mm coat of Mn oxide, surrounded by a thin veneer of white anhydrate. The majority of the chimney sample is composed of barite (heavy) and minor anhydrate and finely dispersed pyrite(?), and sphalerite(?). The outside is lined with a mm thin coat of oxidized light brown iron dispersed in anhydrate(?).

Dive S97- Mata Fitu, southeastern flank vent fields

Dive S97 collected seven sulfide samples. The first sample was taken at ~2750 m depth from a newly discovered deep vent field. Small bump-like structures identifiable in the single multi-beam track with the AUV Sentry were chosen as first target. The first sample S97-Sulfide-02

is chunk from the ~5 m high “Leaning Tower of Pisa” chimney. The sample is mainly composed of more barite than anhydrate and black mm-sized mineral (hematite or sphalerite(?)) with thick streaks of pyrite (or bornite/chalcopyrite?). Minor (secondary (?)) globular pyrite is existent at one side and some iron oxide alteration is apparent towards the outer parts of the sample. S97-Sulfide-03 is a small fragment of up to 3 cm thick chalcopyrite/bornite/pyrite lined by a cm layer of barite and anhydrate from an active vent from the ~5m tall “Old Smokey” Chimney. The outside of the sample is coated with brown Fe-oxide in an anhydrate(?) matrix.

S97-Sulfide-09 is a ~20 cm tall oxidized inactive chimlet (~4.5 cm in diameter) from a ~2m tall inactive chimney. The chimlet mainly consists of dark-grey to white crystals of barite and anhydrate (maybe minor sphalerite?) and is lined with brown to black Fe-Mn oxides. The central orifice is ≤1cm across. Sample S97-Sulfide-10 is about 5 cm shorter, by ~7cm wide chimlet from the same chimney complex as S97-Sulfide-09. The central ~1-2 cm wide orifice is lined with mm-thin coat of crystallised pyrite (and minor bornite ±sphalerite?). Golden pyrite also occurs as finely dispersed within the grey-white barite-anhydrate matrix. The chimlet is mantled by a mm-thin layer of Fe-hydroxide mostly covered by sub mm black Mn-oxide. S97-Sulfide-11 is a 13*11 cm, relatively heavy chunk of the basal part of an extinct chimney complex. The outside of these chimneys are relatively smooth white to black coat (pine cone-like shaped). Predominant color is of the interior of this sample and dark-grey to white (mm-sized barite and smaller? anhydrite). The outer ~5 cm contain a yellowish-brownish tint, which may represent an (Fe-) oxidation reaction of finely dispersed Fe components with the surrounding seawater. S97-Sulfide-17 is from the active vent orifice of a ~17 m tall chimney named “Redwood” because of its distinct reddish color at the base. Maximum measured vent fluid temperature at the central orifice was 295°C. We recovered a small wall piece (~7*3 cm) of the active vent. The sample consists mainly of a mm-cm thick pyrite-bornite-chalcopyrite lining of the orifice. The central fluid up-flow zone is lined with mm-cm thick grey-white barite-anhydrite?. Sample S97-Sulfide-22 is a ~28cm tall inactive side-chimney (~1m away from 262°C) vent at the top of the “K2” chimney. The sample consists of mm-sized dark-grey to dispersed light-grey to white crystals (barite-anhydrate±sphalerite?). The ≤ 2cm wide central orifice is lined with sub-mm black crystals (hematite-sphalerite-galena?). The outer cm of the chimney looks corroded with brown Fe hydroxides and white patches of anhydrate.

S100 - Mata Ua, northeast flank vent fields

Six sulfide samples were collected during dive S100. The first sample S100-Sulfide-09 recovered during this dive is from the top of an ~7 m tall inactive chimney in between many inactive, partly collapsed spires (dubbed “Amphitheater”). The sampled fragment is ~11*6*5 cm and consists of predominant dark-grey (likely barite with some sphalerite?) matrix. Some minor golden shimmer (possibly pyrite-chalcopyrite) is apparent in patches within the sample marking old linings of small fluid up-flow zones. The outside of the sample is brown and

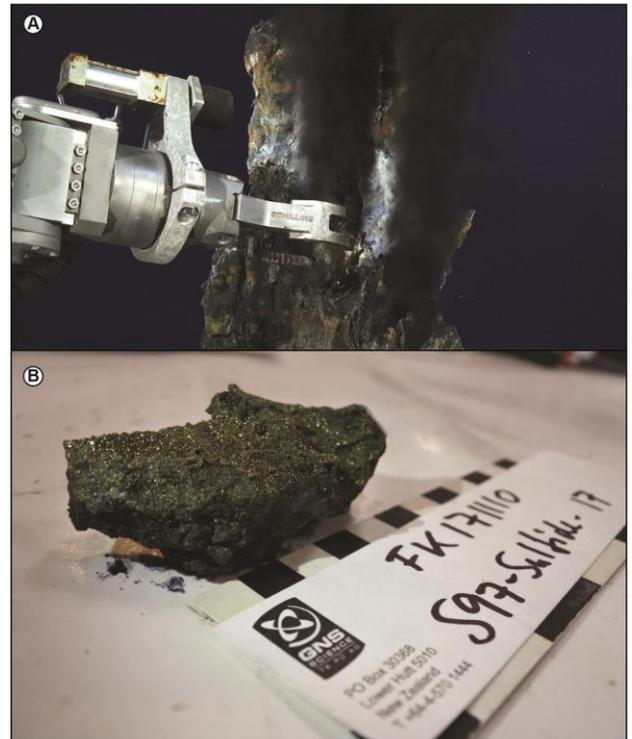


Figure 4.1.2-4 S97-17 A) Sampling sulfides at active vent of the “Redwood” chimney site at Mata Fitu during dive S97. B) Photograph of the sample taken in A).



corroded. Sample S100-Sulfide-15 are two fragments recovered while sampling stalked barnacles (Sample S100-Bio-14) at the side of “Lau Flat-top” smoker. Maximum vent T measured at this smoker is 327°C. Both fragments are predominantly greenish-grey with golden patches suggesting that this sample contains finely dispersed pyrite/chalcopyrite? in a barite-dominated matrix with areas of more concentrated chalcopyrite(?). Red crystals (likely oxidized hematite) line one of the fluid up-flow zones. Brownish seawater-induced oxidation products line the outer

side of the sample. Sample S100-Sulfide-16 has been recovered from the top of the “Lau Flattop” chimney, ~5-10 cm away from the active main vent (vent orifice was too fragile to sample). Although slightly larger, similar color and identifiable mineral composition suggest a similar composition of S100-Sulfide-16 to S100-Sulfide-15. The exception being a slightly higher

Figure 4.1.2-5 S100-21 Sampling the top of the “Big Smoke” vent site.

proportion of golden patches and therefore possibly higher percentage of chalcopyrite. S100-Sulfide-17 are seven partly fragile fragments recovered during 4 sampling attempts from the active vent of the “Voodoo Child” Chimney. Maximum temperature measured here is 322°C. Two of the fragments are from the central high-T venting orifice and up to ~0.5cm thick lining of chalcopyrite-bornite-pyrite?. The predominant color of the remain fragments is greenish-grey suggesting that fine-grained pyrite (±chalcopyrite) as main constituent. Blotchy pyrite-bornite-chalcopyrite (?) is apparent in one of the fragments. S100-Sulfide-21 is a large chunk (25*30*19 cm) with two actively venting orifices ($T_{max} = 324^{\circ}\text{C}$) from the top of a ~14 m tall chimney dubbed “Big Smoke”. The central orifices are lined with cm thick chalcopyrite(?) and/or bornite with finely dispersed pyrite forming the bulk of the remaining sample. Underlying the chalcopyrite are a mm-thick layer of white-purple anhydrate(?) ± barite. Much of the fine-grained pyrite is friable. S100-Sulfide-21b is a broken off part of one of the fluid vent orifices. S100-Sulfide-26 has been recovered from an actively venting side vent of “Big Smoke” which broke off while storing a gastight. Most of the sample consists of friable fine grained pyrite and massive chalcopyrite(?) along fluid up-flow zones.

Dive S101 – Mata Ono, near summit vent field (southern side)

Three sulfide samples were recovered from a newly discovered vent field near the summit of Mata Ono. S101-Sulfide-17 and S101-Sulfide-19 from an active vent lower down on the ~10-12 m tall “Giant Beehive” chimney. Maximum temperature measured at this vent is 299°C.

Both samples largely consist of a cm layer of golden pyrite-chalcopyrite lining the venting orifice. Parts of the golden lining has a blackish tint suggesting the presence of bornite. S101-Sulfide-20 extra has been sampled accidentally ~1-2m below the vent while the ROV ‘parked’ on the “Giant Beehive” chimney and sampled gas and fluids. The sample is multi-colored (Greenish-grey; some minor golden specks; brown-

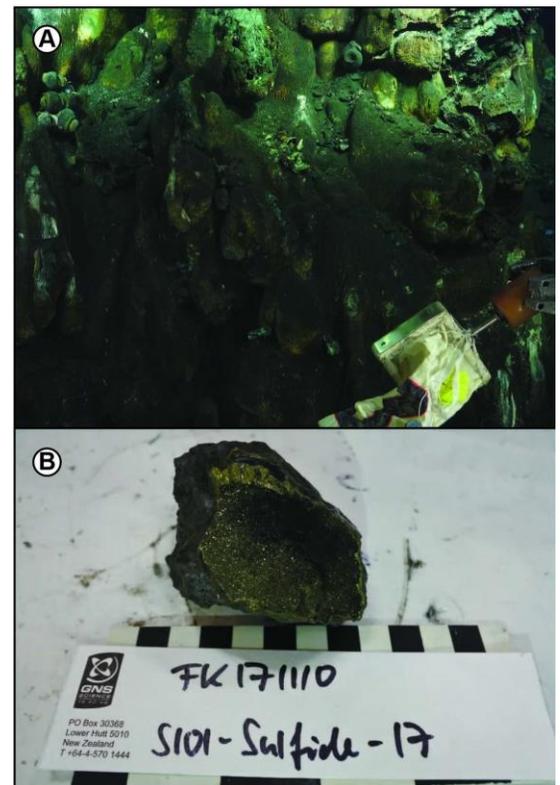
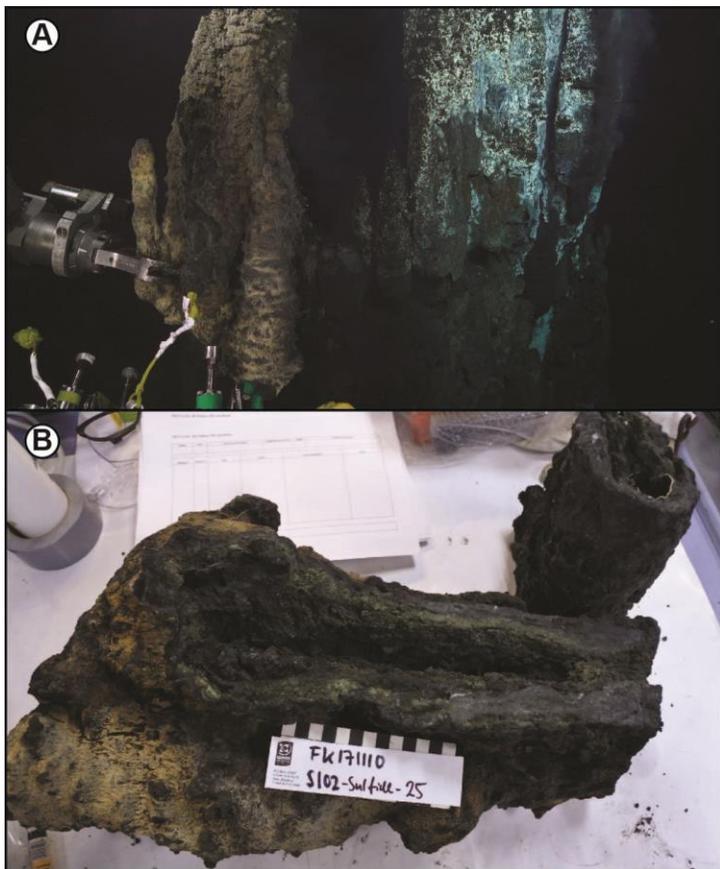


Figure 4.1.2-6 S101-17 A) Sampling sulfides at active vent of the “Giant Beehive” chimney site at Mata Ono during dive S101. B) Photograph of the sample taken in A).

white, black and red), suggesting the presence of pyrite (\pm sphalerite?), barite and anhydrate with some Fe hydroxides lining the outside.



Dive S102 – Mata Ono, near summit vent field (northern side)

During dive S102 three sulfide samples were recovered. Sample S101-Sulfide-17 is a small chimlet from ~10 cm below active top vent ($T_{max} = 235^{\circ}\text{C}$) of the “Rockstar” chimney. Attempts to recover a sample from the active vent failed. The chimlet is heavily corroded, very light and fragile, suggesting anhydrate as main constituent. The largest sulfide sample recovered during FK171110 was a ~70 cm large side chimney (S102-Sulfide-25) ~37 kg total weight) with a central vent orifice up to ~2 cm in diameter from the “Giant Beehive” (now dubbed “B3 – Bodacious Booming Beehive”) chimney discovered the day before. The chimney was sampled while attempting to recover a much smaller side chimlet. Chalcopyrite lines several fluid up-flow zones (three, mm-cm across) with more friable fine-grained pyrite (\pm chalcopyrite) away from the orifices. Further constituents are massive barite and anhydrate with

Fe- and Mn-oxides coating the outside of the sample. Some of the fluid-flow zones are also lined with a ‘top-coat’ of red hematite.

Figure 4.1.2-7 S102-25 A) Sampling side-vent of the “Giant Beehive (or B3)” chimney site at Mata Fitu during dive S102. B) Photograph of the sample taken in A).

Dive S104 – Mata Taha

During dive S104 several up to 11m tall strongly altered chimneys all leaning to one side. All chimneys are covered with corals, sponges and other biota (see biology section). Two samples were recovered from two individual sites. Sample S104-Sulfide-13 is a heavy, mainly white, bulbous side chimney (12 cm across) from a ~7 m tall solitary chimney (dubbed “Leaning Chimney of Taha”). Its heavy weight suggests that this fragment is mainly composed of barite. The predominantly white color of the sample suggests that most of the sulfides are oxidized to sulfates by the surrounding seawater. In addition, rust-brown platy crystals (corroded hematite?) line the outer section of the broken off section. Brownish Fe alteration products also occur throughout the outer $\pm 2\text{cm}$. The surface is lined with a sub-mm thin black Mn-oxide coating (most of has been washed off during sample cleaning process).

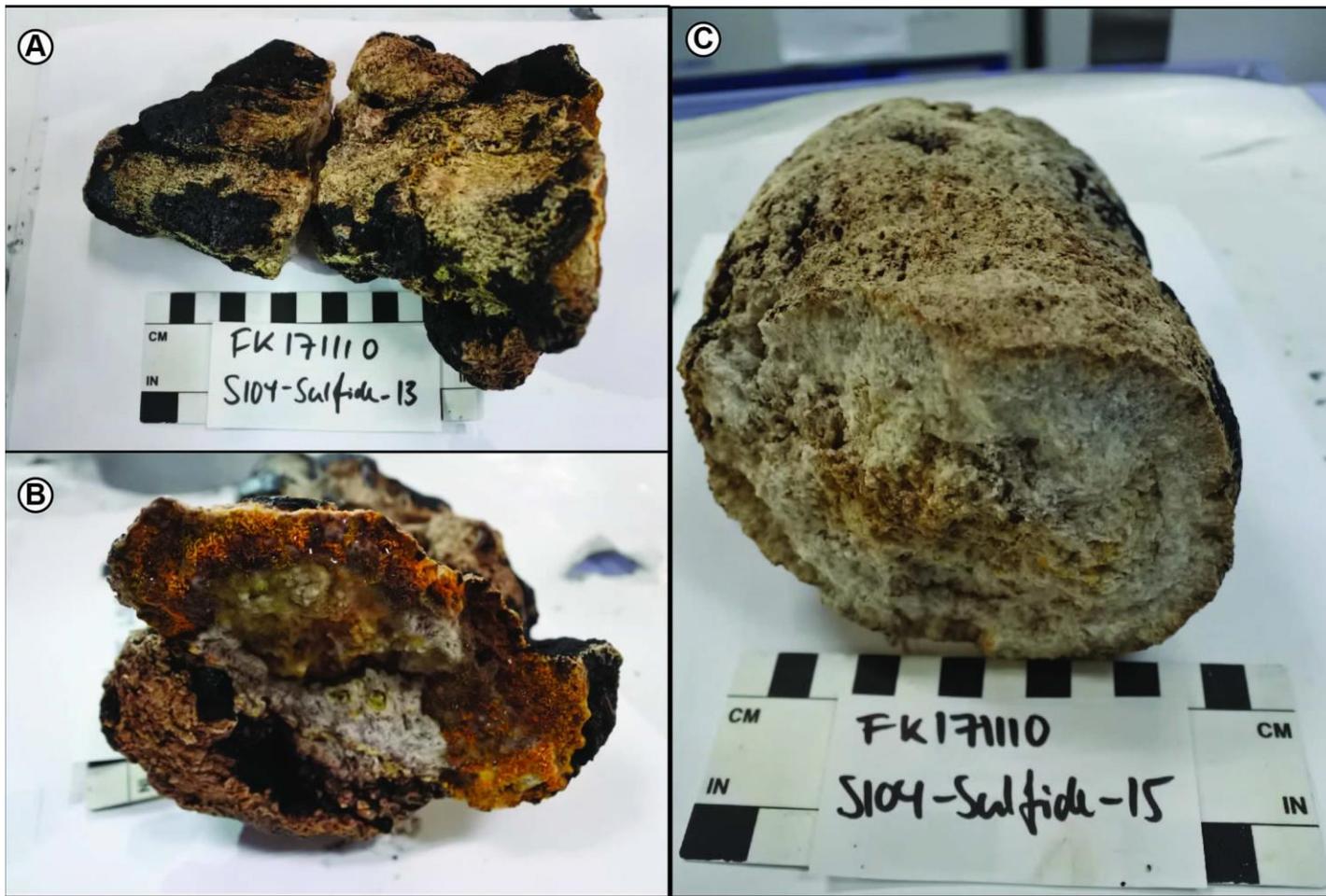


Figure 4.1.2-8 S104 A-C) Photographs of highly corroded and oxidized samples of inactive chimney material at Mata Taha).

The second samples recovered from dive S104 was a piece (S104-Sulfide-15) of a side chimney of a ~11 m tall chimney that is located along a line of old inactive chimneys all leaning to one side (dubbed “Death Valley”). The sample is largely tube-shaped, heavy (mainly barite) and predominantly white. The crystal size varies from mm-sized crystals in the central ~4 cm to sub-mm crystals towards the outer sample section. A brownish Fe-alteration tint is apparent in the central and outer cm of the sample. The surface was originally covered with a sub-mm coat of MnO_2 .

4.2 Hydrothermal Fluid Chemistry

David Butterfield, Kevin Roe

Our goal for the Tongan Fire expedition was to sample as many hydrothermal vents as possible to allow us to understand the character of venting on the Mata chain of boninite volcanoes. This was the second expedition (after 2012 Submarine Ring of Fire ROV Quest 4000) to sample hydrothermal vents from the northern Matas and the third expedition (after 2009 W. Mata response and 2012 SROF) to sample W. Mata. Because of the unusual rock chemistry of the Matas, we are looking for differences in fluid chemistry compared to the nearby hydrothermal areas hosted in basaltic andesite, rhyolite and dacite. This will improve the capability of models to predict how the host rock affects hydrothermal fluid chemistry, and how that in turn affects chemosynthetic ecosystems.

Methods. For this project, we used the simple and compact technology of titanium major samplers (thanks to Geoff Wheat and David Clague for the loan) and titanium gas-tight samplers. With the focus on rock collection and the number of scientists working in the lab, we needed to keep it small and simple. We built a new sampler stand to improve ease of picking up and replacing the major samplers on the front of the ROV. This worked quite well. The ROV configuration varied depending on dive plans, but we had 2 to 4 majors and 2 to 4 gas-tights on nearly every dive. With few samples per dive, we targeted high-quality, high-temperature samples first, and tried to get one or two diffuse fluid samples per vent field to give some characterization of the chemistry of vent fauna habitat. We used ROV-mounted Niskins to sample near-bottom water and hydrothermal plumes.

In the Falkor wet lab, the SRI gas chromatograph was set up (used during the first leg for water column gas measurements). We analyzed dissolved methane and hydrogen on the major samples, unless there was obvious evidence that they leaked before we could sample them. We measured pH (at lab temperature) by glass electrode, hydrogen sulfide, ammonia and dissolved silica by spectrophotometry, and alkalinity by titration. All other chemistry will be done on shore. Samples for major element analysis were filtered through 0.2 micron syringe filters. Trace metal samples were acidified on board with ultrapure HCl stored in I-Chem HDPE bottles. Visible particles left in the major samplers were rinsed into I-Chem bottles for later analysis. Samples for nutrients were filtered, purged with nitrogen to remove excess sulfide, and frozen. Samples for DOC were filtered and frozen. Selected samples for sulfur isotope analysis were preserved with cadmium acetate in glass vials with no headspace. Thanks to Ken and Val for assistance with shipping samples back from Hawaii.

Results. We collected and processed 33 titanium major samples and 6 Niskin samples. Sample metadata, temperature and pH are listed in the table below, and also described in the full sample log. There are enough samples to get endmember compositions at all of the high-temperature sites. Sample quality appears to be good (less dilution of endmembers than the samples collected from the N Matas in 2012). We do not have enough chemistry data to compare endmembers yet, so only limited interpretation is possible now.

This expedition gave us a very good look at the vent fields on Mata Ua, Tolu, Fitu, and Ono and they are truly impressive. There are virtual forests of active chimneys covered with vent fauna that varies between sites. The large size and large number of chimneys in these fields attests to long-lived and well-developed hydrothermal systems.

The high-temperature vent fluids from Matas Ua, Tolu, Ono, and Fitu have typical chemistry acquired in high-temperature reaction zones: high dissolved silica, high H₂S (3 to 9 mmol/L), and moderately low pH (3 to 4 at lab temperature). The lack of native sulfur around the vent sites, the moderately low pH values, and the low-to-moderate total gas contents based on small gas headspace in the majors (and more quantitative data from the gas-tight extractions) indicate a relatively minor role for magma degassing in the chemistry of the North Mata high-temperature vent fields. Consistent with the 2012 results, methane concentrations in Mata vent fluids measured on board Falkor are high (~300 to 1000 μmol/L) relative to most smoker-type fluids. This is the most

obvious chemical signal that sets them apart from other vent sites. High-temperature fluids from the Endeavour segment, Juan de Fuca ridge and from the Jade site in the Okinawa trough, have similar methane concentrations, attributed in those cases to a contribution from sedimentary organic material, which also generates high ammonia concentrations. At the Matas, ammonia is not elevated, and there is no indication of buried sediment in this environment. The high methane concentrations must relate to the rock composition and redox conditions in the reaction zone. The hot fluids from the North Matas have similar pH and methane content to peridotite-influenced fluids from the Mid-Atlantic Ridge (e.g. Rainbow and Logatchev), but they differ in other respects. Geochemical modeling may shed some light on how the orthopyroxene-clinopyroxene-olivine mineralogy of boninites affects hydrothermal fluid composition and sulfide mineral formation.

With the caveat that we have not yet calculated endmembers, it appears that there are differences in the total sulfide content between the Matas. In terms of H₂S concentration, Tolu > Ono ≈ Ua > Fitu (> W. Mata). There may be significant differences in salinity and sulfide-forming metal concentrations also. Laboratory analysis is underway.

Most of the seafloor surveyed at West Mata was on recent lava flows away from the summit and those young lava flows were not hydrothermally active. We took a background, near-bottom sample on the “Muffin” flow at 2710 m depth, but otherwise found nothing to sample. Weak hydrothermal venting continued around the summit of West Mata. To point out the obvious, the intensity of hydrothermal output was many orders of magnitude higher during the observed active eruption in 2009 than in either 2012 or this expedition. Fluids with the lowest pH (3.8) were sampled from Hades Pit (1294 m depth), directly over what we believe was the eruptive conduit. Total sulfide in these fluids was less than 10 μmol/L. No shrimp were observed directly in the venting fluids at this site, with very few shrimp in the surrounding area. Shrimp were present in high abundance on the ridge at ~1190 m depth, where fluid pH (4.8-6.1) and H₂S concentrations were higher (>100 μmol/L). The 8 major samples collected on this expedition, combined with the 6 majors collected in 2012 and the many samples collected in 2009 when West Mata was erupting, provide an excellent time-series showing how fluid chemistry and habitat conditions change between eruptive and inter-eruptive periods.

The seafloor surveyed on two dives at Tafu on the NE Lau Spreading Center was mostly devoid of hydrothermal activity, but did show two interesting and contrasting sites. One was a miniscule site (at 1676 m depth) representing a sulfur habitat in miniature, and the other was an extensive iron-oxide deposit near the summit at 1423 m depth with active venting (5°C sampled) and essentially no vent fauna. We also sampled water from a breccia mound at 1740 m depth with shrimp and squat lobsters, with wispy filamentous microbial mat and no detectable temperature anomaly.

Overall, the vent fluid sampling on this expedition was quite successful. The total number of samples is not large, but the quality is good and the range of sites is excellent. It was truly amazing that we did not miss a single day of ROV diving on this expedition. Kudos to the Falkor and SuBastian team for making that happen!

Table 4.2-1 Hydrothermal fluid samples for FK171110. (Depths in bold-italics have been corrected to PARO depth gauge.)

Site	Date UTC	Time UTC	Sample# Dive	Sample# Lab	Sampler Type	Location Description	Latitude	Longitude	Depth m	Hdg Deg.	Temp °C	pH in lab
W Mata	11/26/2017	23:00	S85-Fluid-07	S85M3	major	SW Hades Pit	-15.09286	-173.74967	1278	190	17.9	4.41
W Mata	11/27/2017	0:49	S85-Fluid-12	S85M4	major	Shrimp Suburbia near Prometheus	-15.09432	-173.74828	1181	295	18	4.81
W Mata	11/28/2017	23:47	S87-Fluid-6	S87M1	major	Hades Pit bottom	-15.09441	-173.74909	1283	81	7	4.90
W Mata	11/29/2017	0:30	S87-Fluid-8	S87M2	major	Hades Pit bottom	-15.09441	-173.74909	1284	81	22	3.78

Site	Date UTC	Time UTC	Sample# Dive	Sample# Lab	Sampler Type	Location Description	Latitude	Longitude	Depth m	Hdg Deg.	Temp °C	pH in lab
W Mata	11/29/2017	2:10	S87-Fluid-11	S87M3	major	Shrimp Plethora summit ridge	-15.09420	-173.74804	1176	49	28.5	5.35
W Mata	11/29/2017	3:46	S87-Fluid-16	S87M4	major	Shrimp Canyon	-15.09461	-173.74635	1266	334	9	6.09
W Mata	12/1/2017	3:31	S88-Fluid-17	S88M2	major	Muffin area background	-15.06468	-173.71107	2681	0	2	7.77
W Mata	12/15/2017	3:18	S103-Fluid-25	S103M1	major	Minor Shrimp	-15.09374	-173.74622	1268	35	6	6.43
Mata Ua	11/30/2017	20:40	S89-Fluid-05	S89M1	major	Temple of Smoke marker 226	-15.01680	-173.78764	2356	194		3.76
Mata Ua	11/30/2017	22:51	S89-Fluid-12	S89M2	major	10cm diam Smoker marker 274	-15.01729	-173.78805	2350	30		4.49
Mata Ua	11/30/2017	23:28	S89-Fluid-15	S89M3	major	10cm diam Smoker marker 274	-15.017897	-173.78805	2350	30		3.66
Mata Ua	12/1/2017	0:22	S89-Fluid-18	S89M4	major	Diffuse snail bed/border of white and dark snails	-15.01773	-173.78852	2359	156		6.23
Mata Ua	12/11/2017	23:58	S100-Fluid-13	S100M3	major	Flattop Stump	-15.01668	-173.78693	2335	118	327	3.82
Mata Ua	12/12/2017	2:03	S100-Fluid-19	S100M2	major	Voodoo Child	-15.01679	-173.78695	2340	107	322	3.84
Mata Ua	12/12/2017	2:55	S100-Fluid-23	S100M1	major	Big Smoke	-15.01675	-173.78597	2318	342	324	3.73
Mata Ua	12/12/2017	3:32	S100-Niskin-27	S100NiskAft	Niskin	Big Smoke	-15.01675	-173.78597	2315	0		8.32
Mata Ua	12/12/2017	3:33	S100-Niskin-28	S100NiskFwd	Niskin	Big Smoke	-15.01675	-173.78597	2310	0		7.70
Mata Tolu	12/3/2017	2:52	S91-Fluid-14	S91M2	major	Saguaro black smoker	-15.004629	-173.7936	1820	0	314	3.39
Mata Tolu	12/3/2017	3:50	S91-Fluid-17	S91M4	major	Lowboy black smoker	-15.004651	-173.79332	1824	142	260	3.64
Mata Tolu	12/6/2017	1:06	S94-Fluid-12	S94M3	major	Snail Alcove	-15.00482	-173.79354	1813	327	201	3.34
Mata Tolu	12/6/2017	3:33	S94-Fluid-21	S94M2	major	North, Tall, Handsome near top	-15.00449	-173.79359	1823	254	204	3.23
Mata Tolu	12/6/2017	2:36	S94-Fluid-17	S94M4	major	Mussels above white mat, diffuse venting, no chimneys	-15.00512	-173.79392	1843	184	20	5.83
Mata Tolu	12/6/2017	1:44	S94-Fluid-15	S94M1	major	Snail Alcove	-15.00482	-173.79354	1813	327	201	5.67
Mata Ono	12/13/2017	4:08	S101-Fluid-16	S101M2	major	Bodacious Booming Beehive lower vent	-14.94058	-173.79956	2362	316	299.4	3.43
Mata Ono	12/13/2017	4:43	S101-Niskin-21	S101NiskFwd	Niskin	Bodacious Booming Beehive	-14.94058	-173.79956	2355	0	3	6.82
Mata Ono	12/14/2017	1:10	S102-Fluid-12	S102M4	major	Summit snail/anemone diffuse on lava	-14.94041	-173.79967	2357	149	12.3	6.25
Mata Ono	12/14/2017	2:17	S102-Fluid16	S102M2	major	Rock Star chimney at summit, top of vent 2350	-14.94054	-173.79938	2354	240	238	3.01
Mata Ono	12/14/2017	2:57	S102-Fluid-19	S102M3	major	Bodacious Booming Beehive massive top vent	-14.94058	-173.79956	2359	0		5.71
Mata Ono	12/14/2017	3:44	S102-Fluid-23	S102M1	major	Bodacious Booming Beehive lower vent	14.94043	-173.77371	2363	322	299.4	3.16
Mata Fitu	12/8/2017	20:51	S97-Fluid-5	S97M4	major	Old Smokey	-14.91545	-173.77371	2758	294	274.5	3.97
Mata Fitu	12/9/2017	1:56	S97-Fluid-15	S97M1	major	Redwood	-14.91356	-173.77910	2616	17	295	3.3

Site	Date UTC	Time UTC	Sample# Dive	Sample# Lab	Sampler Type	Location Description	Latitude	Longitude	Depth m	Hdg Deg.	Temp °C	pH in lab
Mata Fitu	12/9/2017	2:10	S97-Fluid-16	S97M3	major	Redwood	-14.91356	-173.77910	2616	17	295	4.17
Mata Fitu	12/9/2017	3:43	S97-Fluid-21	S97M2	major	mini K2	-14.91339	-173.77910	2630	275	262	4.19
Tafu NELSC	12/9/2017	22:03	S98-Fluid-10	S98Nisk	Niskin	near-bottom slightly cloudy	-15.38236	-174.25264	1873	0	2.6	7.8
Tafu NELSC	12/10/2017	3:25	S98-Fluid-20	S98M2	major	at water/rock interface on volcanic rock next to breccia pillar	-15.37739	-174.24751	1740	0	2.7	7.76
Tafu NELSC	12/11/2017	1:08	S99-Fluid-16	S99M3	major	Contender Cliff	-15.35755	-174.23228	1676	0	2.8	7.8
Tafu NELSC	12/11/2017	3:40	S99-Fluid-22	S99M1	major	Iron vent	-15.36541	-174.23782	1423	0	5	7.07
Tafu NELSC	12/11/2017	3:46	S99-Fluid-23	S99NiskAft	Niskin	2-4m above iron vents, 5m away from sampled vent	-15.36509	-174.23771	1418	0	2.9	7.74
Tafu NELSC	12/11/2017	3:47	S99-Fluid-24	S99NiskFwd	Niskin	2-4m above iron vents	-15.36509	-174.23771	1418	0	2.9	7.75

4.3 Gas Sampling

Tamara Baumberger and Camilla Wilkinson

4.3.1 Leg 1 CTD Helium sampling

Seawater samples obtained from deployed CTD casts and tows were preserved in copper tubes sealed using an air operated copper tube crimper. In order to avoid air contamination or problems due to temperature changes, the samples were collected immediately following recovery of the CTD. Each sample consists of an A and B split, which allows a repeat analysis if necessary. Crimped and washed (in fresh water) copper tubes were bundled together and stored in foam lined boxes for transport.

Samples for helium analyses were collected from both vertical casts and tows. A summary is presented in tables below, and describes the location of each cast/tow. A total of 178 samples were preserved for future helium isotopic analysis. The full sample list is presented in Table 4.3.1-1 and 4.3.1.-2.

Table 4.3.1-1. Description of each CTD cast analyses

Cast	Rosette Position	Sample Identification	Depth (m)	Analyses		
				He	H2	CH4
V17B-02 Vertical cast over Niuatahi (Volcano O) cone	1	V17B-02-17	1242	x	x	x
	3	V17B-02-07	1202	x	x	x
	5	V17B-02-05	1152	x	x	x
	7	V17B-02-03	1125	x	x	x
	9	V17B-02-09	1121	x	x	x
	11	V17B-02-13	1110	x	x	x
	13	V17B-02-27	1062	x	x	x
	15	V17B-02-15	1002	x	x	x
	18	V17B-02-18	953	x	x	x
	19	V17B-02-19	902	x	x	x
V17B-03 Vertical cast over a lava flow found during 2011-2016 mapping NE of West Mata	1	V17B-03-01	2677	x	x	x
	3	V17B-03-07	2600	x	x	x
	5	V17B-03-30	2542	x	x	x
	7	V17B-03-11	2400	x	x	x
	9	V17B-03-26	2100	x	x	x
	11	V17B-03-22	1800	x	x	x
	13	V17B-03-24	1500	x	x	x
	15	V17B-03-15	1300	x	x	x
	17	V17B-03-16	1123	x	x	x
	19	V17B-03-21	900	x	x	x
V17B-04 Vertical cast over a lava flow found during 2011-2016 mapping N of West Mata	1	V17B-04-17	2416	x	x	x
	3	V17B-04-07	2302	x	x	x
	5	V17B-04-27	2152	x	x	x
	7	V17B-04-13	1878	x	x	x
	8	V17B-04-08	1600		x	x
	9	V17B-04-26	1297	x	x	x
	10	V17B-04-10	1199		x	x
	11	V17B-04-22	1101	x	x	x

Cast	Rosette Position	Sample Identification	Depth (m)	Analyses			
				He	H2	CH4	
	12	V17B-04-12	1000		x	x	
	13	V17B-04-24	900	x	x	x	
	14	V17B-04-14	500		x	x	
V17B-05 Vertical cast over basin west of the Matas	1	V17B-05-03	3000	x	x	x	
	2	V17B-05-02	2854		x	x	
		V17B-05-19	2700		x	x	
	5	V17B-05-21	2570	x	x	x	
	6	V17B-05-06	2612	x	x	x	
	7	V17B-05-28	2488	x	x	x	
	8	V17B-05-08	2445	x	x	x	
	9	V17B-05-26	2199		x	x	
	10	V17B-05-10	2133	x	x	x	
	12	V17B-05-12	1850		x	x	
	13	V17B-05-13	1751	x	x	x	
	14	V17B-05-14	1498		x	x	
	15	V17B-05-15	1244	x	x	x	
	17	V17B-05-11	1088	x	x	x	
	18	V17B-05-18	1030	x	x	x	
	19	V17B-05-01	950		x	x	
	V17B-06 Vertical cast over Mata Fitu	1	V17B-06-30	2620	x	x	x
		3	V17B-06-05	2550	x	x	x
		5	V17B-06-24	2522	x	x	x
7		V17B-06-22	2483	x	x	x	
9		V17B-06-26	2454	x	x	x	
11		V17B-06-27	2436	x	x	x	
13		V17B-06-13	2397	x	x	x	
15		V17B-06-21	2199	x	x	x	
16		V17B-06-16	1997	x	x	x	
	V17B-06-11	1093	x	x	x		
V17B-07 Vertical cast over serpentinite ridge	1	V17B-07-17	2781	x	x	x	
	2	V17B-07-02	2764	x	x	x	
	3	V17B-07-09	2700	x	x	x	
	4	V17B-07-04	2669	x	x	x	
	5	V17B-07-01	2612	x	x	x	
	6	V17B-07-06	2535	x	x	x	
	7	V17B-07-19	2447	x	x	x	
	8	V17B-07-08	2350	x	x	x	
	9	V17B-07-03	2249	x	x	x	
	11	V17B-07-15	2128	x	x	x	
	12	V17B-07-12	1948	x	x	x	
	13	V17B-07-05	1850	x	x	x	
	14	V17B-07-14	1648	x	x	x	
	15	V17B-07-21	1179	x	x	x	
	V17B-07-16	1143	x	x	x		

Cast	Rosette Position	Sample Identification	Depth (m)	Analyses		
				He	H2	CH4
	17	V17B-07-11	1098	x	x	x
	18	V17B-07-18	999	x	x	x
	19	V17B-07-28	897		x	x
V17B-08 Vertical cast over Mata Ua (south of ridge)	1	V17B-08-30	2468	x	x	x
V17B-09 Vertical cast north of Mata Ua	1	V17B-09-30	2333	x	x	x
	3	V17B-09-17	2302	x	x	x
	5	V17B-09-9	2256	x	x	x
	6	V17B-09-6	2216	x	x	x
	9	V17B-09-3	2186	x	x	x
	10	V17B-09-10	2173	x	x	x
	13	V17B-09-05	2146	x	x	x
	15	V17B-09-21	2050	x	x	x
	16	V17B-09-16	1960	x	x	x
	18	V17B-09-18	1600	x	x	x
V17B-10 Vertical cast over West Mata	1	V17B-10-99	1258	x	x	x
	3	V17B-10-19	1241	x	x	x
	6	V17B-10-06	1223	x	x	x
	7	V17B-10-22	1197	x	x	x
	9	V17B-10-27	1149	x	x	x
	11	V17B-10-13	1068	x	x	x
	14	V17B-10-14	900	x	x	x
V17B-11 Vertical cast over East Mata	1	V17B-11-05	1277	x	x	x
	3	V17B-11-03	1250	x	x	x
	5	V17B-11-26	1225	x	x	x
	7	V17B-11-09	1211	x	x	x
	9	V17B-11-17	1150	x	x	x
	11	V17B-11-30	1102	x	x	x
	13	V17B-11-24	1001	x	x	x
		V17B-11-15	900		x	x
V17B-12 Vertical cast over West Mata (summit, formerly Hades, now a pit (ca. 1000 m deep))	1	V17B-12-13	1238	x	x	x
	3	V17B-12-27	1214	x	x	x
	5	V17B-12-22	1200	x	x	x
	7	V17B-12-19	1148	x	x	x
	9	V17B-12-99	1085	x	x	x
	11	V17B-12-5	1001	x	x	x
	12	V17B-12-12	900		x	x
V17B-13 Basin cast	1	V17B-13-03	2900	x	x	x
	2	V17B-13-02	2842	x	x	x
	3	V17B-13-26	2752	x	x	x

Cast	Rosette Position	Sample Identification	Depth (m)	Analyses		
				He	H2	CH4
west of West Mata	5	V17B-13-09	2649	x	x	x
	7	V17B-13-17	2503	x	x	x
	9	V17B-13-99	2326	x	x	x
	10	V17B-13-10	2201	x	x	x
	11	V17B-13-05	1500	x	x	x
	12	V17B-13-12	1250	x	x	x
	13	V17B-13-24	1228	x	x	x
	15	V17B-13-21	1145	x	x	x
	17	V17B-13-11	1101	x	x	x
	19	V17B-13-28	1054	x	x	x
	20	V17B-13-20	1000	x	x	x
	21	V17B-13-07	900	x	x	x

Table 4.3.1-2. Description of each CTD tow analyses

Tow	Rosette Position	Sample Identification	Depth (m)	Analyses		
				He	H2	CH4
T17B-01 Tow along the spine of West Mata	1	T17B-01-01	1350	x	x	x
	2	T17B-01-02	1522	x	x	x
	3	T17B-01-03	1282	x	x	x
	4	T17B-01-04	1274	x	x	x
	5	T17B-01-05	1140	x	x	x
	6	T17B-01-06	1230	x	x	x
	7	T17B-01-07	1236		x	x
	8	T17B-01-08	1223	x	x	x
	9	T17B-01-09	1223		x	x
	10	T17B-01-10	1108	x	x	x
	11	T17B-01-13	1220	x	x	x
	12	T17B-01-12	1116	x	x	x
	13	T17B-01-11	1122	x	x	x
	14	T17B-01-14	1404	x	x	x
	15	T17B-01-15	1298	x	x	x
	16	T17B-01-16	1222	x	x	x
	17	T17B-01-17	1205	x	x	x
	18	T17B-01-18	1195	x	x	x
	19	T17B-01-19	1163	x	x	x
	20	T17B-01-20	999	x	x	x
	21	T17B-01-21	950	x	x	x
T17B-02 Tow over Niuatahi (Volcano O). Start in center then	1	T17B-02-01	1139	x	x	x
	2	T17B-02-02	1737	x	x	x
	3	T17B-02-24	1704	x	x	x
	4	T17B-02-04	1399	x	x	x
	5	T17B-02-05	1303	x	x	x
	6	T17B-02-06	1303		x	x

Tow	Rosette Position	Sample Identification	Depth (m)	Analyses		
				He	H2	CH4
cut the cone towards rim	7	T17B-02-22	1216	x	x	x
	9	T17B-02-26	1207	x	x	x
	11	T17B-02-13	1159	x	x	x
	13	T17B-02-27	1106	x	x	x
	14	T17B-02-14	1067	x	x	x
	15	T17B-02-15	1005	x	x	x
	16	T17B-02-16	953	x	x	x
T17B-03 Tow over Mata Ua and Mata Tolu	1	T17B-03-30	2188	x	x	x
	2	T17B-03-02	2258	x	x	x
	3	T17B-03-07	2143	x	x	x
	4	T17B-03-04	2237	x	x	x
	5	T17B-03-27	2336	x	x	x
	6	T17B-03-06	2321	x	x	x
	7	T17B-03-05	2311	x	x	x
	8	T17B-03-08	2277	x	x	x
	9	T17B-03-26	2199	x	x	x
	10	T17B-03-10	2025	x	x	x
	11	T17B-03-22	1794	x	x	x
	12	T17B-03-12	1833	x	x	x
	13	T17B-03-24	1806	x	x	x
	14	T17B-03-14	1744	x	x	x
	15	T17B-03-15	1896	x	x	x
	16	T17B-03-16	2123	x	x	x
	17	T17B-03-11	2005	x	x	x
	18	T17B-03-18	1900	x	x	x
	19	T17B-03-01	1803	x	x	x
	20	T17B-03-20	1700	x	x	x
	21	T17B-03-09	1599	x	x	x
T17B-04 Tow over Mata Fitu	1	T17B-04-03	3273	x	x	x
	2	T17B-04-02	2429	x	x	x
	3	T17B-04-19	2569	x	x	x
	4	T17B-04-04	2470	x	x	x
	5	T17B-04-24	2361	x	x	x
	6	T17B-04-06	2585	x	x	x
	7	T17B-04-22	2448	x	x	x
	8	T17B-04-08	2300	x	x	x
	9	T17B-04-26	2154	x	x	x
	10	T17B-04-10	2005	x	x	x
	12	T17B-04-12	1499	x	x	x
	13	T17B-04-13	1199		x	x
	14	T17B-04-14	1150	x	x	x
	15	T17B-04-15	1112	x	x	x
	16	T17B-04-16	1055	x	x	x
11	T17B-04-11	895	x	x	x	

4.3.2 Leg 1 CTD Methane and Hydrogen Sampling

Analyses were conducted by Tamara Baumberger on Dave Butterfield's SRI GC. A total of 195 samples were measured for dissolved methane and hydrogen (CH₄ and H₂) collected from 4 tow-yo's and 13 vertical casts during leg 1 of cruise FK171110. To determine the dissolved gas concentrations, 100 ml of bubble-free seawater was drawn directly into 140 ml syringes followed by the addition of 40 ml headspace gas of ultra-pure helium. The sample was vigorously shaken and allowed to warm to room temperature to reach equilibrium for H₂ and CH₄ between the water and gas phase. After equilibration, the headspace gas was injected into a SRI 8610C gas chromatograph. H₂ concentrations were determined with a highly sensitive pulsed discharge detector (PDD) and CH₄ concentrations were measured with a flame ionization detector (FID). The H₂ concentrations for T17B-02 and V17B-02 are recalculated from the slope of the plotted standard curve because the internal formula in the program did not work. Background H₂ concentrations are between 0.5 and 1 nM.

T17B-01 West Mata. Tow along the West Mata spine with start over the 2016 lava flow. Two distinct plume layers were observed. The deeper layer was located between 1205 and 1236 m water depth with maximum CH₄ and H₂ concentrations of 83.9 nM and 3.7 nM at 1223 m water depth (55 m above seafloor). The shallower plume layer was between 1108 m and 1122 m water depth with CH₄ concentrations up to 17.7 nM (1122 m). Hydrogen concentrations in this layer were 3.5 nM at maximum. (21 samples)

T17B-02 Niuatahi (Volcano O). Tow at Niuatahi, former Volcano O, with start in the center of the caldera. The center cone was accidentally only hit on its side while towing towards the rim. This tow was stopped early because the ship was following a wrong track (wrong end of tow WP in system). Methane concentrations were between 2.0 and 3.0 nM deeper than 2200 m and between 0.9 and 1.5 nM shallower than 2200 m. Re-evaluated H₂ concentrations range from 0.5 to 1.5 nM. (13 samples)

V17B-02 Niuatahi (Volcano O). Vertical cast over the cone of Niuatahi (Volcano O). Maximum CH₄ concentration of 2.7 nM at 1121 m water depth. Re-evaluated H₂ concentrations range from 0.2 to 1.5 nM. (10 samples)

V17B-03 "the muffin". Vertical cast over a lava flow NE of West Mata found by difference mapping between 2012 and 2016, called "the muffin". Small CH₄ elevation between 1800 and 2600 m with a maximum of 6.4 nM at 2400 m. The H₂ concentration was highest closest to the seafloor at 2677 m with 5.7 nM. (10 samples)

V17B-04 New lava flow N of West Mata. Vertical cast over a lava flow N of West Mata found by difference mapping between 2012 and 2016. Elevated CH₄ concentrations from seafloor and up to 300 m above seafloor. The highest value of 8.4 nM was measured at 2302 m. Uniform H₂ concentrations between 2.4 and 2.8 nM. (11 samples)

T17B-03 Tow over Mata Ua and Mata Tolu. The highest CH₄ concentration was measured at the beginning of the tow over Mata Ua with 263.1 nM at a depth of 2143m. The H₂ maximum was measured at the same depth with a concentration of 8.5 nM. The plume reaches from 2188 to 2258 m. A second, much smaller, plume was found later in the tow with CH₄ values up to 30.8 nM at a depth of 1896 m. (21 samples)

V17B-05 Basin cast W of Matas. A vertical cast over the basin west of the Mata volcanoes. Two distinct CH₄ layers were found. A concentration of 12.8 nM at 2570 m and 21.7 nM 2488 m. Hydrogen was uniformly low. (16 samples)

T17B-04 Mata Fitu. Tow over Mata Fitu. Maximum CH₄ concentration of 242.1 nM at 2429 m water depth. The H₂ maximum was found in the same layer with a concentration of 4.5 nM. (16 samples)

V17B-06 Mata Fitu. Vertical cast over vent field at Mata Fitu. Two distinct plume layers were observed. The deeper one was characterized by a maximum CH₄ concentration of 222.6 nM at 2550 m and a maximum H₂

concentration of 3.1 nM at 2522 m. The 100 m shallower plume layer had a maximum CH₄ concentration of 262.6 nM and a maximum H₂ value of 7.4 nM at 2454 m. (10 samples)

V17B-07 Serpentinite Ridge. Vertical cast over the serpentinite ridge east of the Matas. Two plume layers were observed higher up in the water column. A smaller anomaly at 2447 m water depth with 11.7 nM CH₄ and background seawater H₂ concentrations. A stronger plume was found at 2128 m with a CH₄ concentration of 51.9 nM and 2.0 nM H₂. These plumes most likely come in from the Matas. (18 samples)

V17B-08 S of Mata Ua. Only one sample was collected near the seafloor at 2468 m. Methane concentration was 15.2 nM. Hydrogen did not show elevated values over background seawater concentration. (1 sample)

V17B-09 N of Mata Ua. Vertical cast north of Mata Ua. Elevated CH₄ concentrations from the seafloor (2333 m) up to 2146 m water depth with a strong hydrothermal plume maximum at 2173 m water depth. Methane concentrations in this layer reach up to 378.8 nM and H₂ concentrations up to 16.5 nM. These are the highest values measured during this cruise. (11 samples)

V17B-10 West Mata. Vertical cast over West Mata. Elevated CH₄ concentrations from the seafloor at 1258 m (49.0 nM) and up to 1197 m (32.8 nM). Slightly elevated H₂ concentrations up to 1.9 nM. (7 samples)

V17B-11 East Mata. Vertical cast over East Mata summit. Elevated CH₄ concentration from the seafloor at 1277 m up to 1211 m (around 10 nM). A distinct plume layer at 1225 m with a CH₄ concentration of 98.7 nM. Background H₂ concentrations. (8 samples)

V17B-12 West Mata summit. Vertical cast over what was formerly Hades and is now a pit. Elevated CH₄ concentrations from the seafloor (1238 m) up to 1200 m water depth. Plume maximum at 1214 m with a concentration of 25.0 nM CH₄. (7 samples)

V17B-13 Basin cast. Basin cast west of West Mata. Two distinct hydrothermal plume layers with elevated CH₄ concentrations. The deeper layer had a maximum CH₄ concentration of 6.0 nM at 2503 m water depth. The shallower plume layer had a CH₄ maximum of 8.7 nM at 1145 m water depth. Background H₂ concentrations. (15 samples)

4.3.3 Leg 2 ROV Gas Sampling

The samples for gas analysis were collected in titanium gas-tight bottles with internal volumes of about 150 to 167 ml. ROV SuBastian carried up to 3 gas-tight samplers in the basket in each fluid dive. A total of 24 gas-tight samples were collected during Leg 2 of FK171110. However, sample S99-gas-27-GT17 was lost due to a gas-tight sampler that broke during dive S99 (pulled trigger lead to oil leak) and S85-gas-09-GT6 and S97-gas-14-GT2 were accidentally triggered in the basket. Once the samplers were retrieved from the seafloor, they were processed on the seagoing vacuum line and subsampled in 3 cc aluminosilicate ampules for shore-based noble gas analysis and in 35 cc Pyrex ampules for shore-based total gas and isotope analysis. Table 4.3.3-1 summarizes all the gas-tight samples.

S85 – West Mata summit traverse

First dive was conducted at West Mata summit. The background water temperature was 2.9 deg C. We landed on the SW slope of the volcano and did a traverse along the ridge. We took a gas-tight sample in the **SW Hades Pit (S85-gas-06)**. While we were sampling, the second sampler got accidentally triggered in the basket by the manipulator arm (**S85-gas-09**). These samples were collected in the area where Hades was active in 2009. Hades is now a large pit with lots of diffuse venting going on. **GT 2** was triggered at **12:42** in the SW of this pit at a depth of 1288 m.

Table 4.3.3-1 Gas-tight samples.

#	Sample ID	GT #	tape color	Vent field/Chimney	Lat deg	Long deg	Depth m	fluid wt. (g)	Vent T deg C	[gas] mmol/kg
1	S85-gas-09-GT6	6	yellow	West Mata, SW Hades Pit, basket trip	-15.0950	-173.7496	1288	169.55	2.9	4.4
2	S85-gas-06-GT2	2	green	West Mata, SW Hades Pit	-15.0950	-173.7496	1288	157.85	17.9	20.9
3	S87-gas-07-GT12	12	yellow-green	West Mata, Hades Pit	-15.0944	-173.7491	1294	164.85	6.9	7.3
4	S87-gas-10-GT6	6	yellow	West Mata, Former Prometheus	-15.0942	-173.7480	1185	163.85	27.6	13.7
5	S87-gas-15-GT2	2	green	West Mata, Shrimpy Canyon	-15.0946	-173.7463	1276	157.60	6.5	12.5
6	S89-gas-04-GT6	6	yellow	Mata Ua, Temple of Smoke, Marker 226	-15.0168	-173.7876	2356	150.60	n/a	123.9
7	S89-gas-13-GT17	17	white	Mata Ua, Marker 274	-15.0173	-173.7881	2350	137.50	n/a	133.0
8	S89-gas-19-GT2	2	green	Mata Ua, Snail Fusion	-15.0177	-173.7885	2360	160.50	n/a	7.2
9	S91-gas-13-GT6	6	yellow	Mata Tolu, Saguaro	-15.0046	-173.7937	1821	145.30	314	58.4
10	S91-gas-18-GT12	12	yellow-green	Mata Tolu, Low Smoker	-15.0046	-173.7939	1823	165.75	260	4.4
11	S94-gas-10-GT6	6	yellow	Mata Tolu, Low Smoker	-15.0046	-173.7939	1823	162.00	230	33.6
12	S94-gas-11-GT2	2	green	Mata Tolu, Snail Alcove	-15.0048	-173.7935	1813	141.95	201	69.2
13	S94-gas-22-GT12	12	yellow-green	Mata Tolu, North, Tall & Handsome	-15.0045	-173.7936	1822	167.75	204	4.9
14	S97-gas-04-GT16	16	orange	Mata Fitu, Old Smokey	-14.9155	-173.7737	2758	17.8	274.5	n/a
15	S97-gas-13-GT6	6	yellow	Mata Fitu, Redwood	-14.9136	-173.7791	2616	167.45	295	37.0
16	S97-gas-14-GT2	2	green	Mata Fitu, Redwood, basket trip	-14.9136	-173.7791	2616	160.4	1.9	4.0
17	S99-gas-27-GT17	17	white	NELSC, N of Tafu, broken bottle, oil leak	n/a	n/a	n/a	n/a	n/a	n/a
18	S100-gas-12-GT16	16	orange	Mata Ua, Lau-Flatop	-15.0167	-173.7869	2335	137.85	327	139.5
19	S100-gas-18-GT6	6	yellow	Mata Ua, Voodoo Child	-15.0168	-173.7870	2340	165.15	322	32.1
20	S100-gas-22-GT2	2	green	Mata Ua, Big Smoke	-15.0168	-173.7860	2318	155.8	323	72.7
21	S101-gas-15-GT12	12	yellow-green	Mata Ono, B3 Beehive, lower orifice	-14.9406	-173.7996	2362	167.45	299	4.4
22	S102-gas-15-GT6	6	yellow	Mata Ono, Rockstar	-14.9405	-173.7994	2354	152.1	238	76.3
23	S102-gas-20-GT16	16	orange	Mata Ono, B3 Beehive	-14.9406	-173.7996	2359	159.2	299	12.7
24	S102-gas-24-GG2	2	green	Mata Ono, B3 Beehive, lower orifice	-14.9406	-173.7996	2362	151.15	299	42.1

S87- West Mata summit

This dive visited the active eruption sites from 2009 (Hades and Prometheus) in the West Mata summit area. Three gas samples were collected: **Old Hades Pit** (S87-gas-07, GT12), **Old Prometheus** (S87-gas-10, GT6), and **Shrimpy Canyon** (S87-gas-15, GT 2). The **Hades Pit** was characterized by the presence of a lot of shrimp, volcanic breccias and lava fragments. Shimmering water and orange and white bacterial mats was observed too. The white mat was hotter (16.9 deg C) than the orange one (10.8 deg C). The diffuse fluid flow rate was higher at the white mat. **GT 12** collected at **00:00** was triggered in a white mat with diffuse flow from below a rock. $T_{max} = 6.1$ deg C. Deployed Marker 224. **Old Prometheus** is a diffuse fluid site where the old Prometheus eruption site was. The maximum temperature measured at this site was 28.4 deg C. Many shrimp at this diffuse site, not much else. **GT 6** was fired at **1:57** at a depth of 1185 in this diffuse vent close to where the temperature was measured. The third gas-tight sample was collected at the **Shrimpy Canyon**. This is an elongated diffuse fluid site with lots of shrimp. The maximum temperature measured was 9.5 deg C. We were moving along the crack with the temperature probe. The temperature was uniform over the whole opening with diffuse flow. **GT 2** was triggered at **3:37** in a tiny mound.

S89 – Mata Ua vent field

Diving from the flank to the summit from North. The vent field is located at the NW flank of Mata Ua. Three gas samples were collected during this dive: **Temple of Smoke** (S89-gas-04, GT 6), **Ua Marker** (S89-gas-13, GT17), and **Snail Fusion** (S89-gas-19, GT2). About 100 chimneys (estimated) were observed at Mata Ua. When approaching the big vent field, huge amounts of barnacles were seen on the rocks. Many chimneys/spires were venting black smoke. A very active vent field with lots of smoke in the water. Visibility was locally reduced by plenty smoke in the water. At one chimney structure Malachite was observed (at 20:08:20). The temperature probe unfortunately did not work during this dive, hence no venting temperatures are available. **Temple of Smoke** is about 10 m high. **GT 6** got fired at **20:34**. Deployment of Marker 226. **Ua Marker** was collected at a very strong venting black smoker chimney between WP6 and WP8 at a water depth 2350 m. Boiling. **GT 17** was fired at **23:06** in the middle of a strong smoking orifice with a diameter of about 10 cm. Marker deployed. **Snail Fusion** was collected in a diffuse venting area characterized by white hairy snails and by black non-hairy ones. The area was packed with snails, anemones and shrimp. **GT2** was fired next to snail fusion in diffuse vent at **00:33**. Marker 250 deployed.

S91 – Mata Tolu summit vent fields

Diving from the West Rift to the summit from North. The vent field is located at the top of the summit. Two chimneys were sampled for vent fluids: **Saguaro (S91-gas-13, GT 6)** and **Low Smoker (S91-gas-18, GT12)**. **Saguaro** is located towards the Northern end of the vent field. The Northern part of Saguaro had a black smoking orifice and was the strongest smoking chimney in this area. Temperature measurements varied with a $T_{max} = 314$ deg C. The GT sample was taken in the orifice where the highest temperature measurement was taken. **GT 6** was fired at **02:40**. Deployed Marker 277. The second gas sample was collected at **Low Smoker**. It was smoking black smoke and had a $T_{max} = 260$ deg C. It was very difficult to see if the snorkel was placed properly in the orifice. Even the use of the manipulator camera did not provide a better view. The setup of the gas-tight in the chimney took about 30 minutes. **GT 12** was fired at **04:23**, even though we were not sure if the snorkel was in. Turns out that the sample was only slightly above seawater gas concentrations. Repetition of the sample in dive S94.

S94 – Mata Tolu summit vent fields

The dive track covered the Mata Tolu West rift to the summit approaching from the North. The hydrothermal vent field was located at the summit of Mata Tolu. Three chimneys were sampled for vent fluids during dive S94: **Low Smoker (S94-gas-10, GT 6)**, **Snail Alcove (S94-gas-11, GT2)** and **North, Tall & Handsome (S94-gas-22, GT12)**. **Low Smoker** was already sampled in dive S91, but visibility of the snorkel position was poor during sampling. The final gas content in the sample was only slightly above seawater. When arriving back at the Low Smoker chimney, a freshly grown beehive structure was

observed on the orifice where the sample was taken in dive S91. The grow rate of the beehive was about 40 to 50 cm in the 3 days between the two dives. The base of Low Smoker was covered with hairy white snails, dark not hairy snails, crab, shrimp and an eel was swimming around close to the vent fluid. There were several pink scale worms on the chimney. To sample fluids, the freshly grown beehive was removed. Again, the visibility for GT sampling was low, even though the manipulator camera was used to get a better view. **GT 6** was triggered at **00:09** in the front orifice. The temperature readings were unstable with a $T_{max} = 230$ deg C. Marker 203 deployed. The second GT of this dive was fired at **Snail Alcove**. This chimney was located at the highest point of this summit vent field. Snail Alcove had at least three chimney openings that were smoking. Temperature measurements at one of the orifices venting a clear fluid. The temperature was 201 deg C at the top of the snail covered chimney. The venting was thin, but pretty strong. **GT 2** was fired at **01:06**. Deployed Marker 296 at this site. The last chimney we sampled during this dive was **North, Tall & Handsome**, a tall chimney located at the Northern end of this vent field. Clear fluid was venting from at least 4 different small spires on the chimney. The very top of this chimney with a clear venting fluid was sampled. The maximum measured temperature was 204 deg C. ROV free fly during sampling. The chimney was too high to park the vehicle for sampling. **GT 12** was triggered at **03:44**. When the bottle got triggered, the snorkel moved slightly out of the flow. Hence, the gas content was close to seawater concentrations. Marker 253 deployed.

S97 Mata Fitu from base to summit

This dive started at the base of Mata Fitu with a main focus on the hydrothermal vent fields on Fitu. Three gas samples were taken during S97: **Old Smokey (S97-gas-04, GT16)**, **Redwood (S97-gas-13, GT6)** and a **Redwood basket trip (S97-gas-14, GT12)**.

Shortly after arriving at the seafloor, a new vent field at the SE base of Mata Fitu at about 2765 m was discovered. A very old and solid looking chimney structure was called **Old Smokey**. The chimney had an old and solid base formed of many spires grown together. It was about 8 m high from base to the top. The chimney was venting grey to black smoke from several openings. Scale worms, shrimp, and some orange-color-coated crab were observed on it. The maximum measured temperature was 274.5 deg C. **GT16** was triggered with two arms at **20:36** in the same orifice as the temperature was measured. The trigger did not go very far in. A Marker was deployed at this site. After sampling this active chimney, the ROV was moving along an area with many inactive chimneys still at the base of Mata Fitu. SuBastian then climbed upslope to the known vent field located 2012. There was not much time for exploring in 2012. Many tall chimneys with a height of up to 17 m were located. A 17 m tall chimney with a uniform diameter over the whole length got named **Redwood**. No flanges, or outlets along the chimney, but very strong black smoke venting from two orifices from the top. Maximum temperature measured was 295 deg C. **GT6** was fired at **01:39**. The snorkel moved out of position when bottle got triggered. **GT2** got accidentally **fired in the basket** when trying to pick it up for a repeat sample at Redwood.

S100 Mata Ua NE flank traverse and vent fields

This dive started with a NE flank traverse and arrived at the Mata Ua flank vent fields at around half time. Three gas samples were taken during S100: **Lau-Flattop (S100-gas-12, GT16)**, **Voodoo Child (S100-gas-18, GT6)** and **Big Smoke (S100-gas-22, GT2)**.

Entering the vent field area from the NE. While moving upslope from the NE, a tiny extinct chimney was first encountered. The further upslope SuBastian traveled, the cloudier was the water. Additionally, sulfide chimney debris increased until the ROV reached an area with orange and white staining and sulphide chimney chunks at a depth of 2363 m. When moving further upslope, lots of extinct chimneys were observed at 2354 m depth. At 2242 m many chimneys with barnacles on them were located and actively venting chimneys in the background were seen. This turned out to be a huge vent field at the base of Mata Ua. While moving around in this forest of chimneys to check out the area, a large chimney got accidentally knocked over. This provided the perfect orifice to sample fluids venting from the remaining stump. The chimney was called **Lau-Flattop**. It had one orifice with a diameter of about 10 cm and was venting black smoke. It was located at a depth of 2334 m. Highest measured temperature was 327 deg C. **GT 16** was fired at **23:47**. This site got Marker 297. About 20 m away, SuBastian set up for the next

chimney to be sampled. **Voodoo Child** was at a depth of 2340 m. It was a small chimney with intense smoking and a max temperature of 322 deg C. **GT 6** was fired at **01:50**. This site got Marker 229. The last gas-tight sample of this dive was collected at a 14 m tall chimney at a water depth of 2318 m. It had a temperature of 324 deg C and was named **Big Smoke**. **GT 2** was fired at 02:45. The site got Marker 206.

S101 Mata Ono Geo-traverse and vent field search

A new vent field was discovered on the summit of Mata Ono. This is the first vent field located at Mata Ono. The methane/hydrogen ratio measured in the water column in 2010 suggested a high temperature vent field at Ono. The vent field was located at the end of the dive. Not much time was left to explore the vent field. However, three big chimneys were located at the summit of Ono. Two were very tall and the third one was smaller with a lot of white mat on it. One of the tall chimneys was sampled for gas. It was over 12 m high and was venting very strongly from a big beehive that was over 40 cm wide. It was located at a water depth of 2362 m depth and we measured a temperature of 299 deg C. **GT 12** was triggered at 03:59, but turned out to be full of seawater.

S102 Mata Ono Geo-traverse and summit vent fields

This dive was designed to find a deeper located vent field according to the plume found in a CTD tow over Ono in 2010. The Northern flank was searched systematically, but no other vent field was located. So, SuBastian went back to the summit vent field and sample those chimneys again. Three gas samples were collected: **Rock Star (S102-gas-15-GT6)**, **B3 Beehive (S102-gas-20-GT16)**, and **B3 below beehive (S102-gas-24-GT2)**. The first chimney sampled was the one at the very top. It got named **Rock Star**. The chimney was about 15 meters high. The orifices at the top of the chimney were very thin resulted in sampling an orifice about 7 meters above seafloor instead. The maximum temperature measured was 238 deg C. Venting was observed from two a few centimeter wide openings. The front opening had a little easier access and got thus sampled. **GT 6** got fired at **02:01**. The next chimney sampled was the **Bodacious Booming Beehive B3** just next to it. First fluid was collected from the huge beehive (about 40 cm diameter) in a free-fly ROV mode. The sampler was held as close as possible to the venting beehive and then fired. **GT16** was fired at **03:09**. The last sample was taken in the same orifice as the sample collected in dive S101 a few meters below the beehive. **GT 2** was fired at **03:55**.

4.4 CTD and MAPR Water Column Studies

Plume mapping operations: Summary

Sharon Walker

4.4.1 CTD Operations

Water column surveys were conducted during Leg 1 of cruise FK171110 by AUV *Sentry* dives, CTD tows and vertical casts. Additional full water column profiles were collected during the ROV descents/ascents of Leg 2. (See summary map Figure 1-1.)

Table 4.4-1 CTD Operations Leg 1

Cast	Station Name	Lat (deg) -S	Lat (min)-S	Long (deg)-W	Long (min)-W	Start time	End time	bottom depth (m)
1	V17B-01	-15	5.3811	-173	44.2671	10-Nov-2017 08:26	10-Nov-2017 08:55	~1550
2	T17B-01(start)	-15	5.3784	-173	44.3329	11-Nov-2017 16:40		
	T17B-01(end)	-15	6.5005	-173	46.3216		11-Nov-2017 20:58	
3	T17B-02(start)	-15	21.6310	-174	0.6702	13-Nov-2017 00:08		
	T17B-02(end)	-15	23.1388	-174	0.3870		13-Nov-2017 02:43	
4	V17B-02	-15	22.5400	-174	0.1436	13-Nov-2017 05:57	13-Nov-2017 06:49	1252
5	V17B-03	-15	3.9443	-173	42.5823	13-Nov-2017 19:04	13-Nov-2017 21:32	2687
6	V17B-04	-15	4.3070	-173	44.1407	14-Nov-2017 00:03	14-Nov-2017 02:22	2456
7	T17B-03(start)	-15	1.5209	-173	47.0702	14-Nov-2017 05:45		
	T17B-03(end)	-14	59.2044	-173	48.4475		14-Nov-2017 10:49	
8	V17B-05	-15	2.5330	-173	51.2568	14-Nov-2017 23:46	15-Nov-2017 03:23	3070
9	T17B-04(start)	-14	56.1001	-173	46.5133	16-Nov-2017 00:00		
	T17B-04(end)	-14	53.2579	-173	46.8630		16-Nov-2017 06:10	
10	V17B-06	-14	54.8041	-173	46.7490	16-Nov-2017 23:19	17-Nov-2017 02:26	2634
11	V17B-07	-15	0.3013	-173	42.9903	17-Nov-2017 05:43	17-Nov-2017 08:34	2792
12	V17B-08	-15	1.6493	-173	47.2612	18-Nov-2017 03:12	18-Nov-2017 05:22	2485
13	V17B-09	-15	1.0279	-173	47.3012	18-Nov-2017 06:02	18-Nov-2017 08:36	2346
14	V17B-10	-15	5.6330	-173	44.8306	18-Nov-2017 20:06	18-Nov-2017 21:36	1270
15	V17B-11	-15	6.1006	-173	40.6565	18-Nov-2017 23:14	19-Nov-2017 00:44	1287
16	V17B-12	-15	5.6872	-173	44.9561	19-Nov-2017 05:36	19-Nov-2017 07:03	1250
17	V17B-13	-15	7.1819	-173	47.5256	19-Nov-2017 19:41	19-Nov-2017 22:57	2912

A PMEL Miniature Autonomous Plume Recorder (MAPR) mounted on AUV *Sentry* and ROV *SuBastian* measured temperature, pressure, turbidity (optical backscatter) and oxidation-reduction potential (ORP). The turbidity and ORP sensors on the MAPR were identical to those integrated with the CTD (see below). While *Sentry* also has the same turbidity and ORP sensors integrated into its sensor suite, the MAPR provides much better data quality; MAPR sensors are powered independently and isolated from the *Sentry* power system while data from sensors integrated directly into *Sentry* can be subject to unpredictable effects of the *Sentry* power management system that cause additional noise and background drift. The data shown below (for *Sentry* and ROV dives) are from the MAPR sensors.

Deep particle plume layers were widely observed around the flanks and base of West Mata during this expedition, especially towards the northeast. Deep particle layers have, in the past, been associated with active eruptions and have completely lacked chemical indicators of hydrothermal fluids, which has been interpreted as syneruptive generation and remobilization of ash from the summit of these volcanoes downslope via gravity flows (i.e., Kavachi, NW Rota, West Mata, NELSC 2008 eruption, and Monowai). While an active eruption was not observed at West Mata during FK171110 (Leg 2) ROV operations, the presence of these deep particle plumes, the rapid diminishment of the deep plume particle concentrations between Leg 1 and Leg 2, and the presence of a new lava flow (2016-2017) on the northeast rift suggest eruptive activity may have been occurring very recently (possibly on the order of weeks) prior to our expedition. ORP signals did occur within the downslope particle layers over some of the new (2011-2017) lava flows, however the source of these anomalies may be dissociated from that of the particle plumes, instead originating from diffuse venting associated with still-cooling lava on the flanks and around the base of the volcano. It is also possible that some deep particulates are coming from hydrothermal sources on the 2011-2017 lava flows, however the most recent eruptive activity (2016-2017) formed deposits on the south side of the NE rift from near the top of the ridge (1550 m) all the way to the volcano's base (2335 m), and the distribution of the deep plume layers is consistent with downslope turbidity flows initiated by this activity.

The hydrothermal plume from the summit of West Mata was seen throughout the study area in the 1000-1300 m depth range, with a distribution that suggests local currents at this depth were primarily trending towards the southwest.

CTD operations:

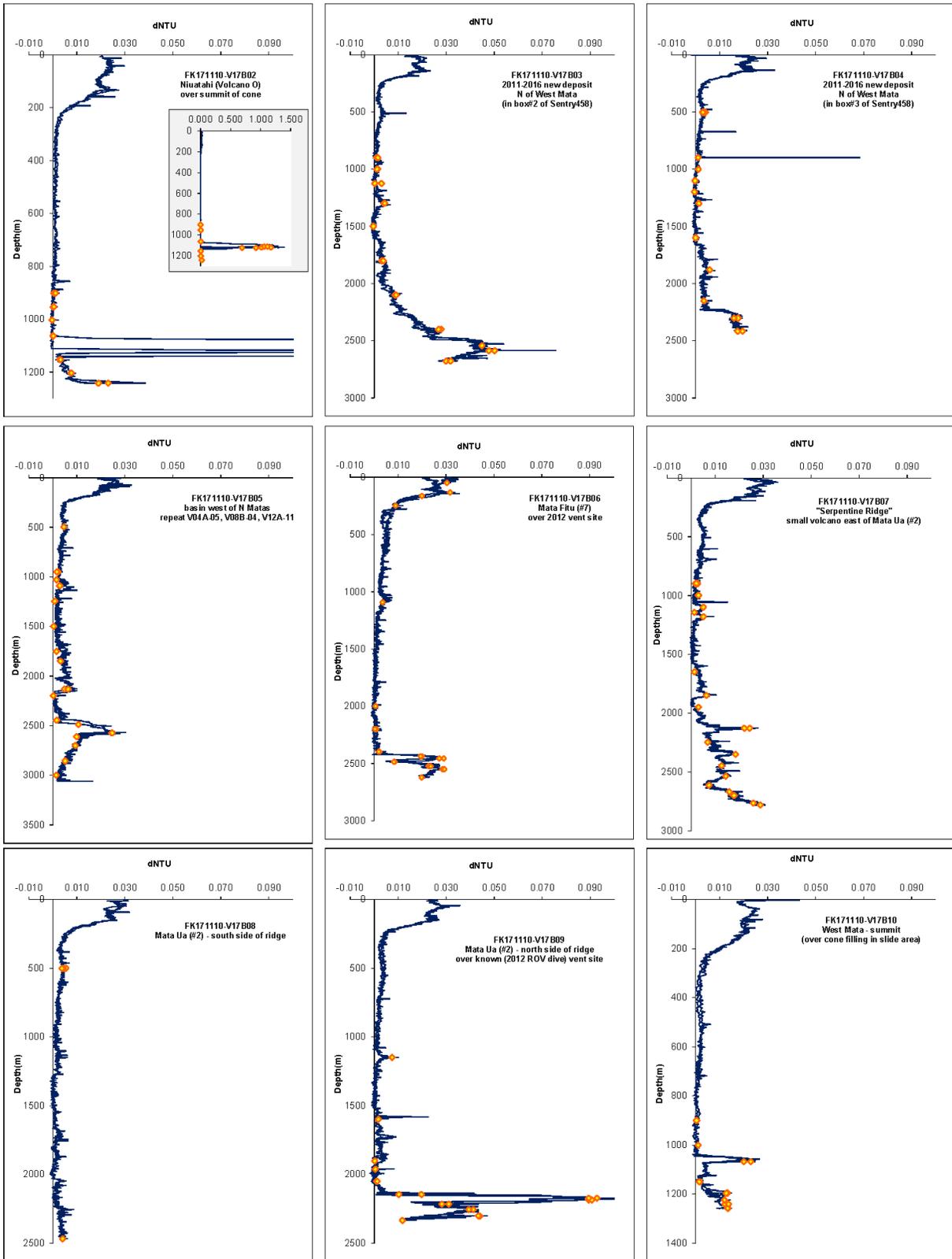
Four (4) CTD tows and thirteen (13) vertical casts were completed during cruise FK171110 (Table 4.4-1) using a Seabird 9plus CTD with auxiliary sensors for turbidity (optical backscatter), oxidation-reduction potential (ORP), and altitude above the seafloor. The system included two high sensitivity Seapoint turbidity meters (0-5 NTU), one PMEL ORP sensor (-500 to +500 mv), and one Valeport VA-500 altimeter (0-100 m range).

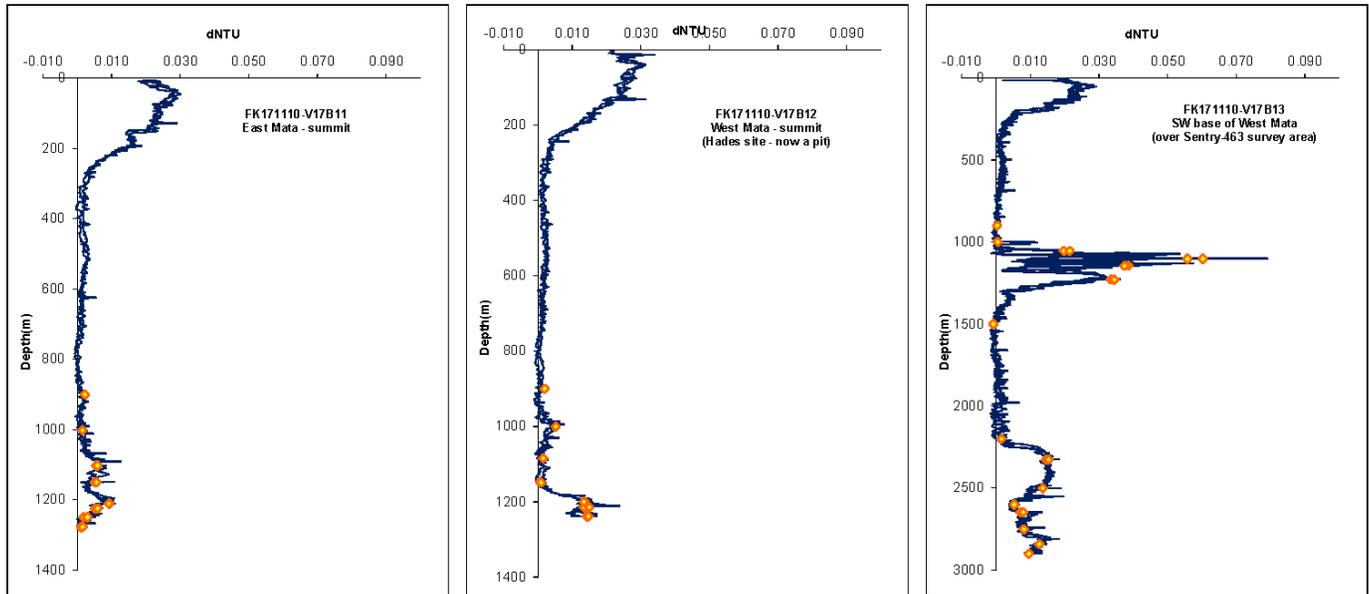
Only one failure occurred during the cruise - the CTD data signal was lost at 272 m during the downcast of V17B-01 (over the summit of West Mata); the cast was aborted. It was determined there was water in the sea cable, the ship's technicians re-terminated it, and everything functioned well after that.

The four CTD tows were completed over the following sites: West Mata, Niutahi, Mata Ua/ Tolu, and Mata Fitu. Thirteen (13) vertical casts provided detailed vertical profiles and discrete water samples through the plumes at these sites. The rest of the vertical casts were completed over some of the new (2011-2017) flank/base lava flows, at East Mata, at a previously unexplored ridge east of Mata Ua ("Serpentine Ridge"), and in the basin west of the North Matas (at the same location where previous casts V04A-05, V10B-04 and V12A-11 were located). All vertical cast Δ NTU profiles are shown in Figure 4.4-1. Table 4.4-2 lists how many samples from tripped bottles were taken.

Figure 4.4.-1 Δ NTU profiles

V17B-01 - aborted
(sea cable required retermination)

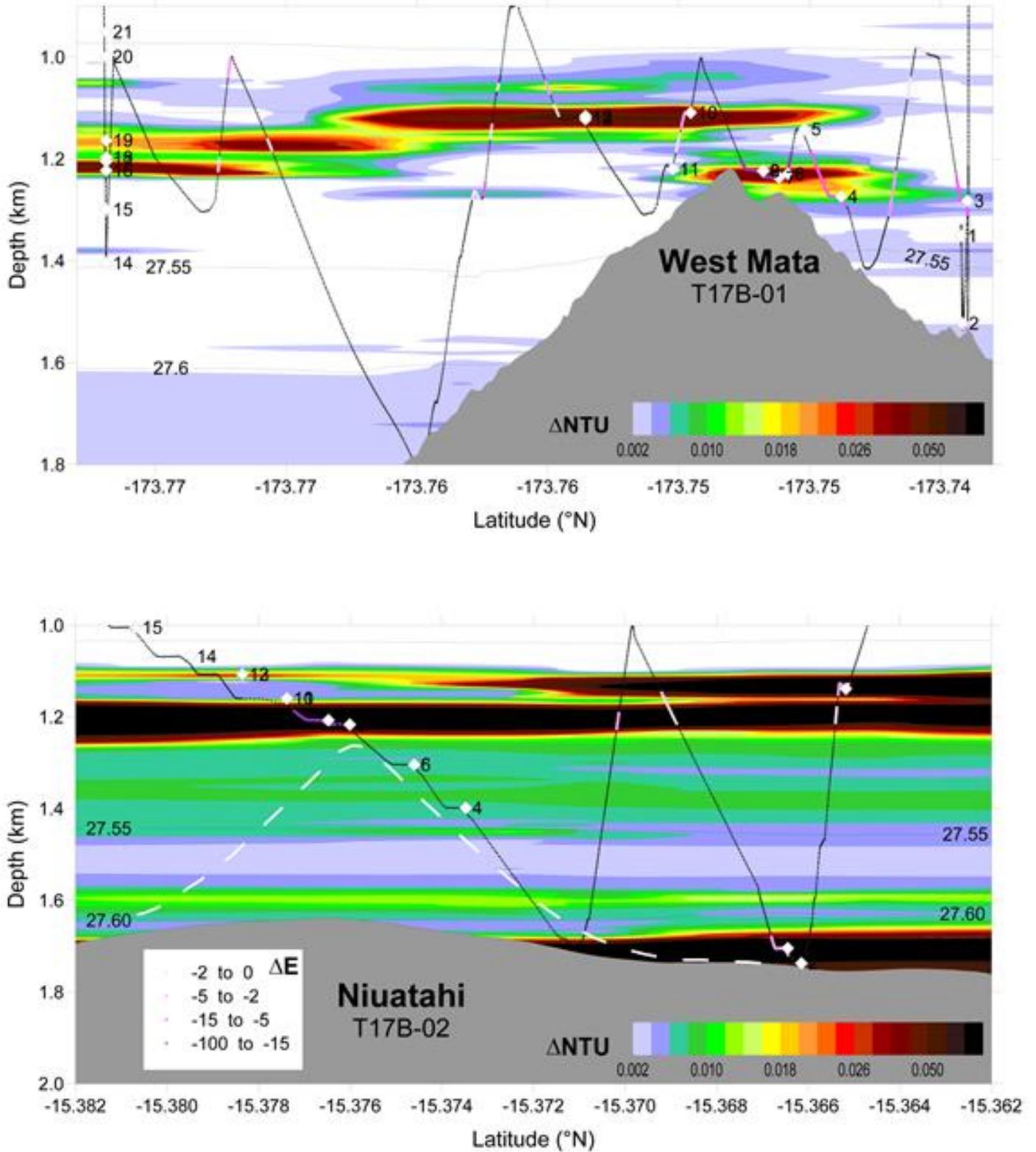




West Mata: West Mata was not observed to be actively erupting during our survey, but hydrothermal activity continues. Plumes over the summit were found in multiple layers between 1000 and 1300 m. Maximum turbidity values were seen during tow T17B-01 ($\Delta\text{NTU} = 0.07$ to 0.09) at 1122 m and 1217 m, respectively (Figure 4.4-2). Compared to 2012 when plumes over the summit were centered ~ 1200 - 1250 m, the plumes in 2017 had a higher rise height, were more widespread horizontally, with a more intense ORP anomaly, but had lower maximum turbidity anomaly values. Five (5) of the vertical casts were located over the new (2011-2017) deposits on the summit, flanks, and around the base of West Mata. Increased turbidity was widespread around the base of West Mata during this cruise, especially towards the northeast. Only one vertical CTD cast (over “the muffin” flow NE of the West Mata summit) had an ORP anomaly within the deep particle maximum (V17B-03; $\Delta\text{NTU} > 0.07$, $\Delta E \sim -1$ - 3 mv, at depth ~ 2550 m). This cast was located within box#2 of the *Sentry-458* survey.

Niuatahi: Tow T17B-02 was located within the caldera of Niuatahi volcano. An incorrect position was inadvertently entered for the endpoint of the tow, so this tow did not cross over the cone as intended and was ended early (Figure 4.4-2). A vertical cast (V17B-02) was located over the cone within the Niuatahi caldera to obtain a vertical profile and water samples through the plume. Maximum values were $\Delta\text{NTU} \sim 1.4$ and $\Delta E = -182$ mv at a depth of 1120 m over the cone.

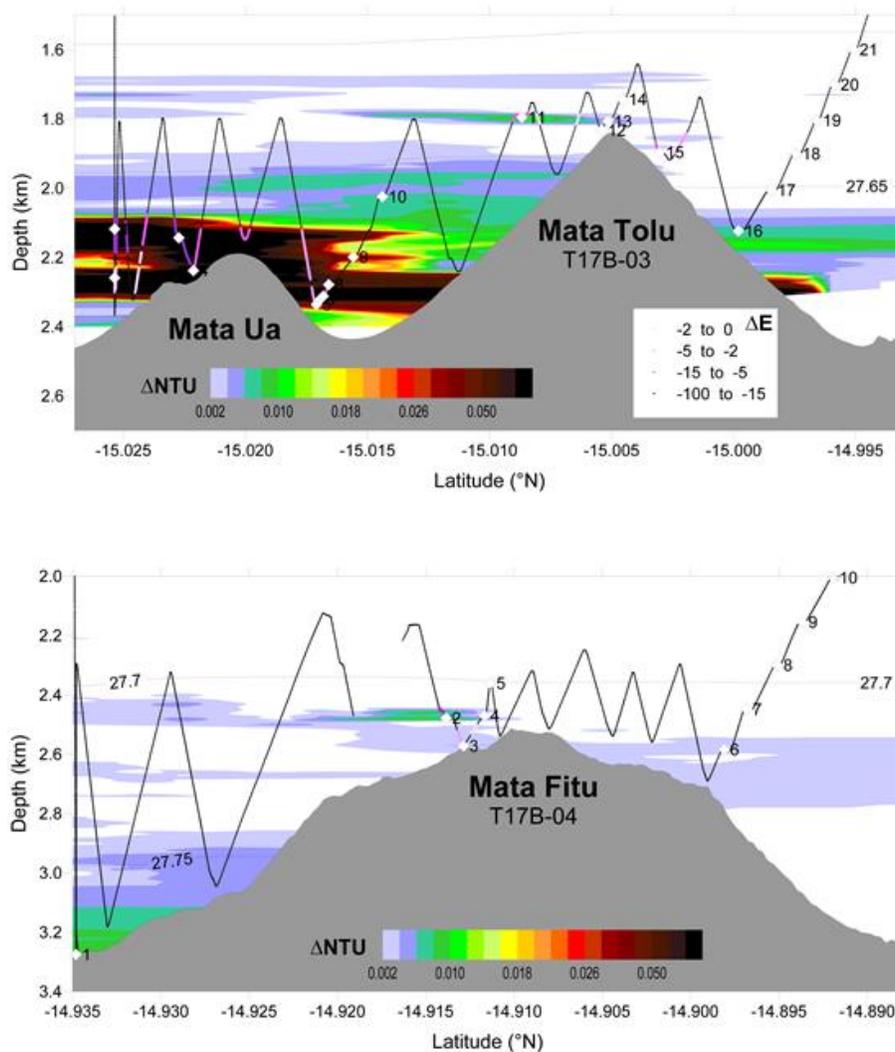
Figure 4.4-2 West Mata and Niuatahi Plumes



Mata Ua/Tolu: Known vent sites on the north side of Mata Ua generate plumes that spread throughout the valley between Mata Ua and Mata Tolu. Tow T17B-03 crossed both Mata Tolu and Mata Ua to the west of each summit (Figure 4.4-3). The plume from the previously-known site at the summit of Mata Tolu was seen at ~1800 m with modest maximum turbidity and ORP anomalies ($\Delta NTU = 0.016$, $\Delta E \sim -5$ mv). The plume from the Mata Ua site was more intense and extensive (maximum $\Delta NTU \sim 0.2$, $\Delta E \sim -50$ mv) with some layering of the plume between depths of 2085-2330 m apparent both north and south of the Mata Ua ridge. Less intense particle enrichment was seen between 2085-1900 m south of Mata Tolu. It is unclear from this data alone if the shallower plume layers originate at Mata Tolu or Mata Ua, or somewhere else. Two vertical casts were placed north and south of Mata Ua close to where the T17B-03 trackline crossed the ridge, which was near the location of the known vent site on the north side. The strongest plume indicators were seen in the cast on the north side (V17B-09) with no compelling evidence of additional nearby sources on the south side of the ridge (V17B-08).

Mata Fitu: One CTD tow crossed Mata Fitu from south to north, passing over the previously-known vent site to the east of the summit. A relatively weak particle anomaly ($\Delta NTU = 0.029$) coincident with an intense ORP signal ($\Delta E > -100$ mv) was present in a thin layer (2420-2475 m) over the known vent site (Figure 4.4-3.)

Figure 4.4-3 Mata Tolu and Mata Fitu Plumes



Other locations: Vertical CTD casts were also completed at East Mata (V17B-11), “Serpentine Ridge” (V17B-07; an unexplored edifice to the east of Mata Ua), and in the basin west of the North Matas (V17B-05; at the same location as previous casts V04A-05, V10B-04 and V12A-11). Traces of the deep particle layers around West Mata and the ~1100 m plume from the summit of West Mata were seen in each of these casts. The cast at East Mata also had a significant ORP anomaly ($\Delta E \sim -80$ mv through the 1180-1250 m particle layer) indicating hydrothermal venting is still active there.

Table 4.4-2 Bottle samples (CTD tow-yo’s are in green).

Cast	StaName	3He	H2&CH4	pH	DIC	TDMe	DM	XRF	SEM	ligand	Comments
1	V17B-01	no samples									West Mata - over new deposit (+67m) seen during 2017 mapping (cast aborted - lost signal @ 272m; 08:30)
2	T17B-01	19	21	21	6	21	5	5	2		West Mata - tow over summit along ridge starting over new (2016-2017) +67 m deposit (sort of repeated T12A-03)
3	T17B-02	12	13	15	6	11	4	5	3		Niuatahi W->E (Volcano O) start mid-caldera then over cones to E rim (stopped early - ship heading to wrong waypoint)
4	V17B-02	10	10	16	6	8	6	6	1	6	Niuatahi (Volcano O) - over cone
5	V17B-03			10		10	3	3	3		2011-2016 new deposit north of West Mata (during Sentry-458, and within "box2" of this dive)
6	V17B-04	7	11	10		10	2	2	2		2011-2016 new deposit north of West Mata (during Sentry-458, and within "box3" of this dive)
7	T17B-03			21	10	18	6	6	3		Tow S->N across Mata Ua (#2) and Mata Tolu (#3) - over vent sites seen in 2012 ROV dives
8	V17B-05		16	20	3	16	4	4	2		Basin west of N Matas (repeat of V04A-05, V10B-04 and V12A-11)
9	T17B-04	15	16	17	7	15	5	5	2	11	Tow S->N across Mata Fitu (#7) - over vent site seen in 2012 ROV dives
10	V17B-06	10	10	17	7	20	7	7	2	11	over vent site (2012 ROV dive) on Mata Fitu (#7)

Cast	StaName	3He	H2&CH4	pH	DIC	TDMe	DM	XRF	SEM	ligand	Comments
11	V17B-07			18	1	17	4	4	2		"Serpentine Ridge" - small volcano east of Mata Ua (#2)
12	V17B-08	1	1			3	3	3			Mata Ua (#2) - south side of ridge
13	V17B-09			16	6	13	7	7	2	9	Mata Ua (#2) - north side of ridge (over vent site seen in 2012 ROV dive)
14	V17B-10	7	7	12	4	6	6	5	1		West Mata - summit (near cone filling in prior slide area)
15	V17B-11	7	7	14	4	8	6	6	1	8	East Mata - summit
16	V17B-12			12	4	7	4	4			West Mata - summit (over the former Hades site, now a pit)
17	V17B-13			20	8	20	9	9	3	8	West Mata - at base to SW - over Sentry dive 463

4.4.2 MAPR Operations:

A PMEL MAPR was attached to AUV *Sentry* on every dive during Leg 1 (dives 457 through 463), and on most ROV *SuBastian* dives during Leg 2. Turbidity anomaly (Δ NTU) distributions at West Mata, Mata Ua/Tolu and Mata Fitu are shown in Figure 4.4.-1 through Figure 4.4-3. Turbidity anomalies were widespread around the base of West Mata, especially towards the northeast. The near-bottom turbidity over "the muffin" site and the "NE pillow ridge" decreased significantly between Leg 1 and Leg 2 (maximum Δ NTU decreased by as much as 0.03-0.04 over the two week interval; Figure 4.4-7), and even though an above-bottom turbidity maximum was still present at ~2425 m on Nov 30, this too was diminished by Dec 05, indicating an episodic source for these plume layers.

Figure 4.4-1 West Mata MAPR turbidity anomalies

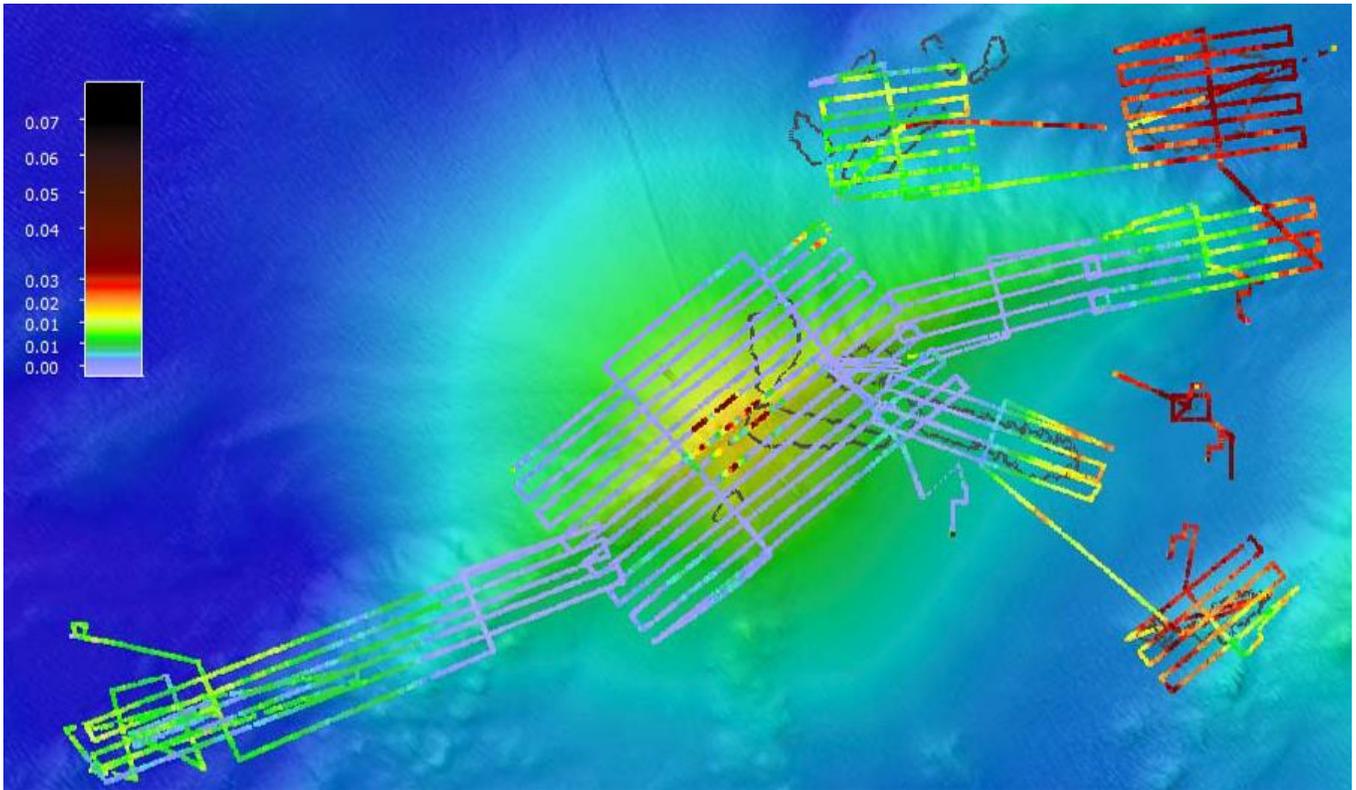


Figure 4.4-2 Mata Ua/Tolu MAPR turbidity anomalies

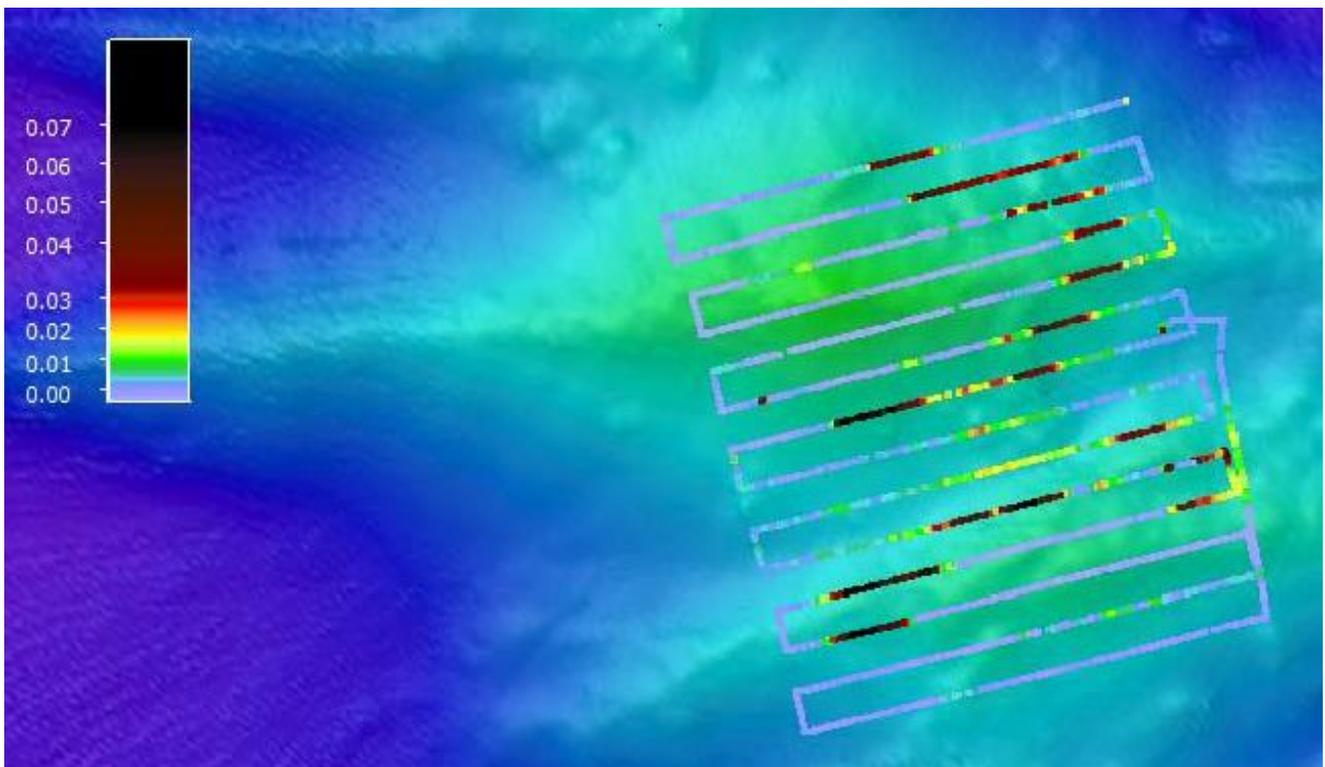
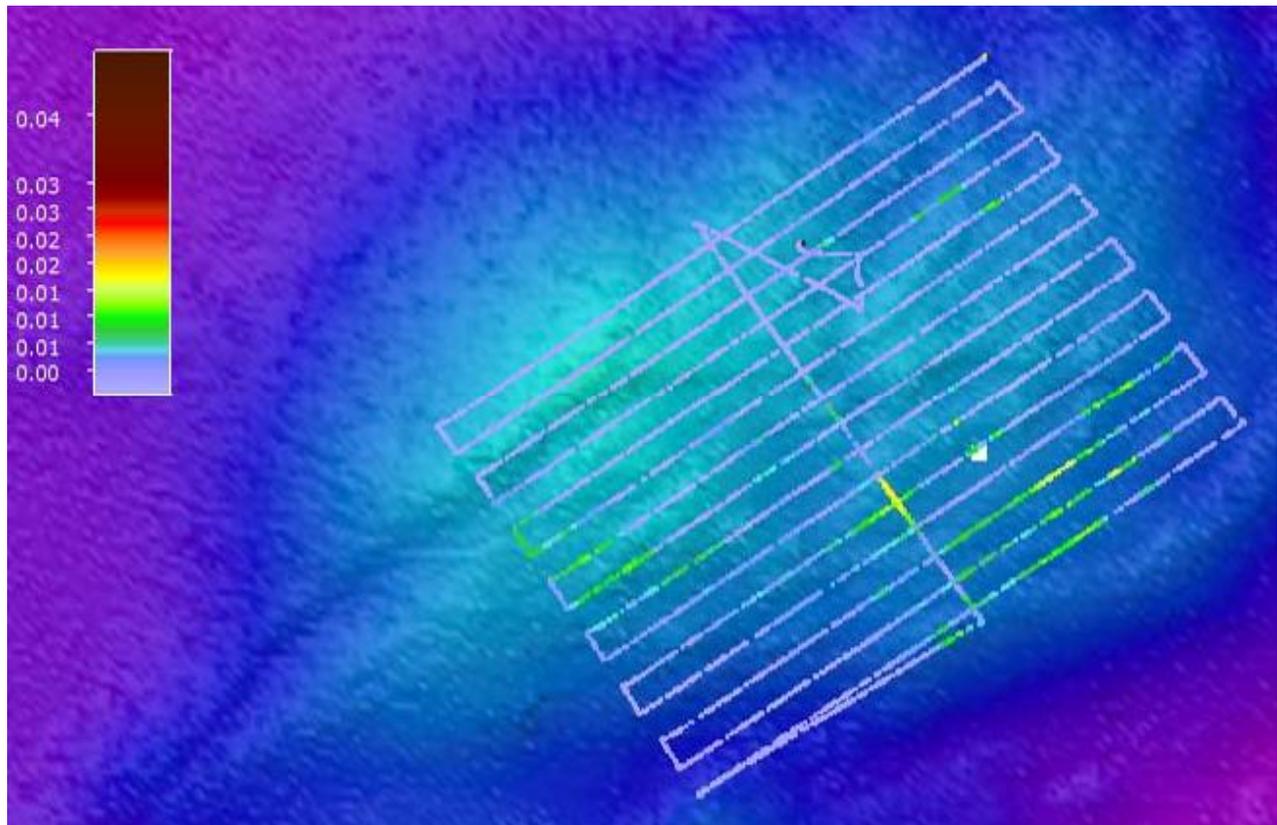
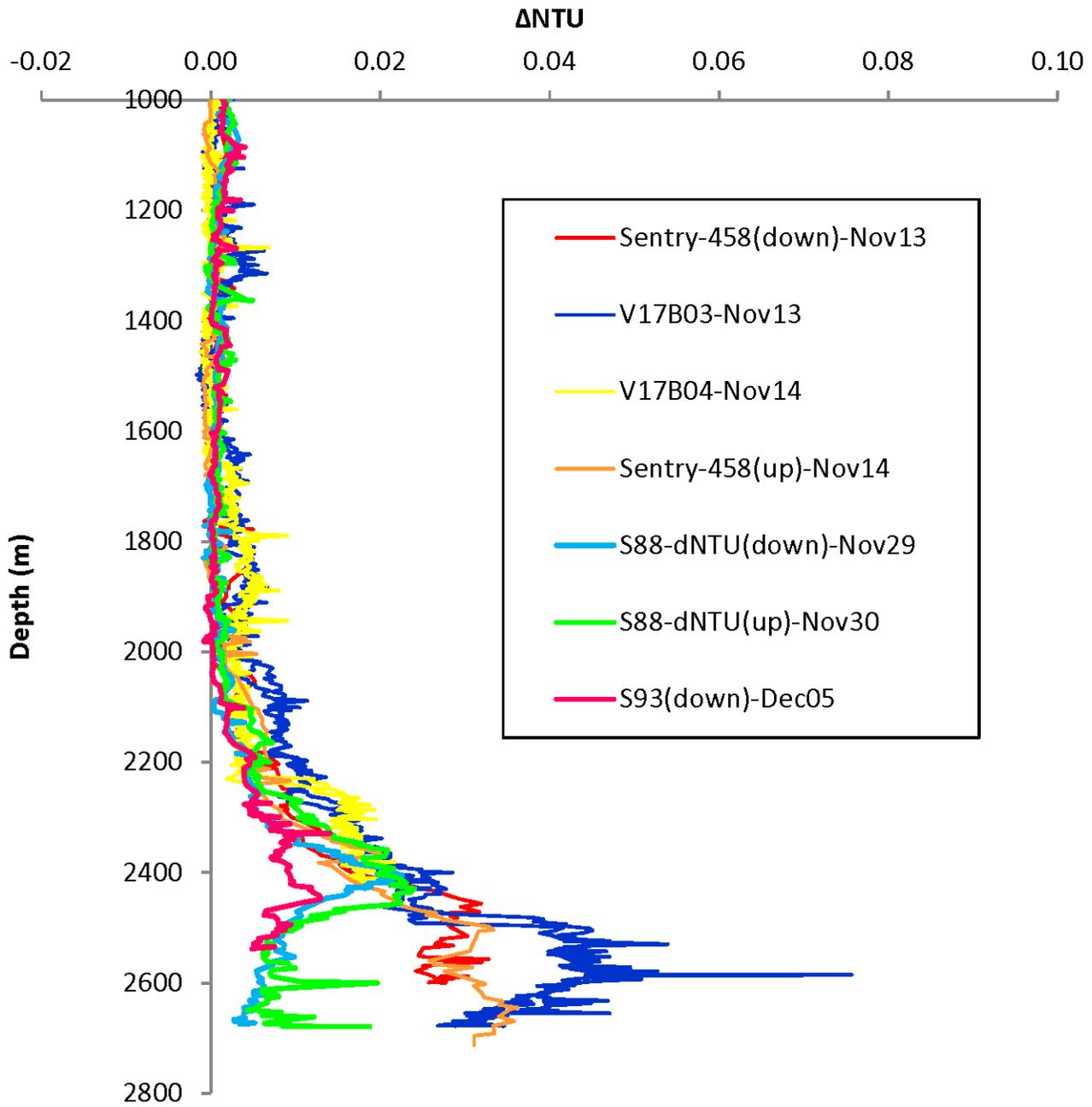


Figure 4.4-3 Mata Fitu MAPR turbidity anomalies



ORP anomalies were most intense over the summit of West Mata, and near the previously-known vent sites at Mata Ua, Mata Tolu and Mata Fitu. In the Mata Ua/Tolu survey, plumes were located within two distinct depth ranges (1825-1900 m and 2100-2300 m), similar to results from CTD tow T17B-03, and consistent with the known vent sites at the summit of Mata Tolu and on the north side of Mata Ua. The horizontal distribution of turbidity and ORP anomalies suggested additional sources, but could well be the result of an intense plume from the Mata Ua vent field being advected around the flanks of Mata Tolu. The turbidity and ORP anomalies during the *Sentry-461* survey were more widespread and occurred at varying depths, suggesting additional unidentified sources at Mata Fitu.

Figure 4.4-4 Δ NTU Profiles



4.5 Macrobiology: Observations and Sampling during Underwater Fire (FK171110)

Walter Cho and Tim Shank

The overarching macro-biological objectives of the program were to investigate the benthic faunal community composition, distribution, and biogeographic character of the rear arc volcanoes, arc volcanoes and backarc spreading center volcanoes, specifically, the Mata volcanoes. This was undertaken via *in situ* visual observation, biological sampling, and post-cruise comparative analysis. This work follows on from our activities in the region since 2008 via bottom sampling and towed camera surveys (on R/V *Kilo Moana* cruises KM1008, KM1024, KM1129a), plus ROV observation and sampling (on R/V *Thompson* cruise TN234, R/V Roger Revelle cruise RR1211).

The comparative results of ROV SuBastian field observations on FK171110 and post-cruise laboratory studies of the biological samples are seeking **to understand the composition, distribution, diversity, associated geochemical and geological settings and habitats, and in some cases, to understand the temporal changes in biological community structures** taking place on the revisited target volcanoes (e.g., West Mata). As such, our post-cruise analysis will include the coincident relationship of vent fluid chemistry and biological community structure at each study site, and correlations to the geological controls (settings) on hydrothermal activity at these sites.

The biological program was fully integrated into the overall FK171110 program objectives to discover and observe hydrothermal vent sites and to sample fluids, mineral deposits, and biota associated with them. In general, biological observations were made throughout each dive, including transits in and around the vent sites.

A total of 86 numbered biological samples were taken at 7 volcanoes on the FK171110 expedition (see Table 4.5-1). Additional sites included two dacite flows, two sites at the NE and SW base of West Mata, and two sites at Tafu. These collections yielded a total of 1,232 individual specimens collected.

All bio-sample specimens (Table 4.5-2) are curated at the Woods Hole Oceanographic Institution. Each sample has been assigned a unique ID and registered in the Shank laboratory, a sample database managed by Molecular Ecology and Evolution Lab, Biology Department.

There are several preliminary biological findings to date:

- There was an apparent change in the density and location of *Opaepele* sp. and *Alvinocaris* sp. shrimp populations on West Mata relative to when they were last visited in 2012. The sites that previously had high densities of shrimp, such as “Creamsicle” and “Shrimp City” had significantly less or a complete lack of shrimp. In addition, the sites with higher abundance of shrimp were observed on the southern side of the ridge at the peak of West Mata whereas in 2012 the high-density sites were on the northern side of the ridge. In addition, overall density of shrimp appeared to be lower than in 2012.
- The differences in faunal composition among the volcanic seamounts were significant. Striking differences include the apparent abundance of *Vulcanolepas* sp. stalked barnacles at Mata Ua and Mata Fitu, but their notable absence from Mata Tolu, the volcano adjacent to and in-between Mata Ua and Mata Fitu. This may be due to factors related to depth as the hydrothermal vent sites on Mata Ua and Mata Fitu occurred at approximately 2300 m and 2600 m, respectively, while those at Mata Tolu

occurred at a depth of approximately 1800 m.

- Distinct faunal assemblages were observed in correlation with the apparent age and/or intensity of volcanic activity in a particular area. The Mata volcanoes provide a unique perspective as sites relatively close together host such distinct and diverse fauna. Vent-associated organisms dominate in areas of high-temperature and diffuse-flow venting while typical deep-sea fauna can be observed in inactive areas. However, the stark boundaries and close proximity of these identifiable communities are quite striking.
- Ongoing research will be focused on population connectivity studies of the sampled fauna to understand the connectivity and population structure of these communities on both a species and community level. In addition, phylogenetic studies will continue to investigate the evolutionary history of the fauna. We will also continue the temporal analysis of the Mata faunal communities, studying the relationship between the changes in the biological communities with changes in the chemical & geological processes in the area.
- The collection of a total of 1,232 individual organisms yielded 47 species.

Table 4.5-1 Numbered Biological Samples

Site	# of indiv. collected
Mata Fitu	133
Mata Ono	87
Mata Fa	8
Mata Tolu	183
Mata Ua	445
Mata Taha	14
West Mata	344
NE Base of West Mata	1
SW Base of West Mata	3
Northern Dacite Flow	2
Southern Dacite Flow	2
North Tafu	8
South Tafu	2

Site Specific (Preliminary) Observations, by Dive Number

Dive S85 – West Mata (Figure 6.4-1). The ROV landed in an area with typical non-vent, deep-sea fauna, including *Anthomastus* sp. corals, some whip corals, and anemones. We transited to an area of diffuse flow and collected nearby *Opaepele* sp. shrimp. We moved on to a ridge and saw larger aggregations of shrimp, dominated by *Opaepele* sp. shrimp but with some *Alvinocaris* sp. as well. Additionally, we observed some zoarcid fish, large polynoids, squat lobsters (possibly *Munidopsis lauensis*), and brachyuran crabs. We observed large aggregations of shrimp at the peak, with fewer observed in a nearby pit. Collections included a total of 248 individuals: *Alvinocaris* sp. (2), Brachyuran crab (1), *Munidopsis lauensis* (4), *Opaepele* sp. (238), Polynoid (3).

Dive S86 – West Mata (Figure 6.4-2). This was a geology focused dive. We observed depressions filled with yellow sediment and a mixture of pteropod shells and possibly pieces of exoskeletons of crustaceans (called “spicules” in the event log). No diffuse flow or biological sample collections were taken during this dive. Towards the end of the dive, we entered an area with “older”, inactive features and observed a more typical deep-sea fauna including yellow anemones, hydroids, bamboo and *chrysogorgia*-like corals along with invertebrate associates. We collected a chrysogorgid coral with 2 chirostylid crab associates. Collections included a total of 13 individuals: Amphipod (2), Bamboo coral (1), Chirostylid crabs associated with a *Chrysogorgia* sp. coral (2), *Chrysogorgia* sp. (1), Hydroid (1), Polynoid (1), stalked sponges (3), yellow anemone (1).

Dive S87 – West Mata (Figure 6.4-3). The dive started in an area with hard substrate with multiple *Paragorgia* sp., bamboo corals, and *Anthomastus* sp. corals observed. Many of the *Paragorgia* sp. corals had a single ophiuroid (brittle star) associate on them (1 associate per colony). We collected a *Paragorgia* sp. coral with its ophiuroid associate. Additionally, we observed anemones, crinoids, and brisingid sea stars. We then transited over a sedimented area to get to the summit. Within this area we observed a few rocky outcrops with *Anthomastus* sp. corals. As we got closer to the summit, we observed more shrimp with some Alvinocarids and a few zoarcids. We then moved on to an area with more *Opaepele* sp., but there was no visible diffuse flow. We ended the dive on the north side of the summit where old “Shrimp City” and “Creamsicle” sites were. There were very few shrimp and less diffuse flow. We observed an increase in both as we neared the “Creamsicle” site and then came around to the south side of ridge where we saw more shrimp as in S085. We then moved the ROV off bottom to quickly transit to and explore a feature off to the south and in deeper water. We found a diffuse flow site named “Shrimp Canyon” and took paired major, gas tight, and biological slurp sample. Collections included a total of 53 individuals: *Asteroschema* sp. ophiuroid associated with *Paragorgia* sp. coral (1), Gastropod (5), *Opaepele* sp. shrimp (40), *Paragorgia* sp. (1), Polychaete (3), Polynoid (2), Zoarcid (1).

Dive S88 – NE base of West Mata, “Muffin” feature (Figure 6.4-4). This dive explored the “muffin” feature at the NE base of West Mata, at a depth of ~2600 m. The ROV came down in a sedimented area and then moved on to a rocky outcrop. We observed a few whip-like soft corals and a possible rattail fish. Not a lot of fauna was observed. Faunal observations included a sponge and an anemone on the edge of West Mata and about 3 clumps of algae/kelp wrack on the seafloor. A single ophiuroid brittle star was observed on the sediment. Most of the exposed substrate seemed to be bare of any sessile fauna. Collections included a single individual: Hydroid (1).

Dive S89 – Mata Ua (Figure 6.4-5). The dive explored a new hydrothermal vent site with large areas covered with *Vulcanolepas* sp. stalked barnacles. In areas on the periphery of active hydrothermal vent sites, galatheids and a large whelk that looked similar to ones seen in the Marianas was observed. We moved through a large active vent site, and observed galatheid squat lobsters, polynoids some paralvinellid worms, saw a few *Ifremeria nautiliei* snails at the hydrothermal vents and potentially a new species of fuzzy crab. We then continued on to a site visited previously and took coordinated chemistry

and biology samples. This site appears to be a smaller vent field than the first one visited during this dive. We then moved on to a site with diffuse flow which had a patch of *Ifremeria nautilei* snails and *Alviniconcha* sp. snails where we took additional coordinated chemistry and biology samples. The last part of the dive was spent exploring the geology, moving to a dike feature where we observed more abundant stalked barnacles. Collections included a total of 324 individuals: *Alviniconcha* sp. (6), *Vulcanolepas* sp. barnacle (8), *Bathymodiolus brevior* mussel (1), *Eochionelasmus* sp. barnacle (7), Gastropod (4), *Ifremeria nautilei* snail (22), Limpet sp. 1 (10), Limpet sp. 2 (97), mixed polychaetes (15), *Opaepele* sp. shrimp (15), *Paralvinella* sp. worm (1), Polychaete (18), polychaetes and limpets (30), Polynoid (2), Polynoid Large (2), Polynoid Small (2), stalked barnacle (3), unknown part of crab? (1), *Vulcanolepas* sp. (80).

Dive S90 – Mata Fitu (Figure 6.4-6). This dive was an exploratory dive that conducted a geology transect. Most of the dive focused on geological observations and collections. We observed non-vent deep-sea organisms, including several Isidids (bamboo coral colonies – both single whip and multi-branching colonies). In the early part of the dive, we saw branching Isidids, then toward the latter half of the dive we entered an area with *Lepidisis*-like bamboo corals and whip corals. We collected a small whip coral on a rock. Around Waypoints 7 and 8 we started observing several dead colony stalks. We also observed a single *Iridogorgia* colony, but without any invertebrate associate. Additional biological observations included multiple pinkish holothurians, a few green sea urchins, and non-vent shrimp. Collections included a total of 3 individuals: Sponge (1), Whip coral (2).

Dive S91 – Mata Tolu (Figure 6.4-7). The ROV landed in a region with a few whip, bamboo corals present. During the transit over hard substrate we observed a few holothurians, yellow-green sea urchins, *Lepidisis*-like bamboo corals and a few chrysogorgids. Additionally, we observed a stalked coral with 3 branches at the top, which may be a black coral. We observed possible hydrothermal sedimentation at ~2006m and then entered an active venting area that was visited before. We surveyed the whole area, visiting multiple chimney sites with varying amounts of flow. The vent communities were dominated by snails, primarily *Ifremeria nautilei*, but some *Alviniconcha* sp. also seem to be present. *Opaepele* sp. shrimp and possibly *Alvinocaris* sp. shrimp seemed to be present along with galatheid squat lobsters and brachyuran crabs. *Paralomis* sp. (?) crabs were also present. At the hydrothermal vent chimneys we observed paralvinellid worms on the active chimneys in white bacterial mats and the vent snails appeared more at the base of the chimneys or on surrounding, inactive chimneys. It is interesting to note the differences in the fauna at Mata Tolu versus the fauna at Mata Ua, which is geographically close. There was a complete lack of stalked barnacles at Mata Tolu, while Mata Ua had dense aggregations of them. Additionally, the *Bathymodiolus* sp. mussels at Mata Tolu occurred along the periphery of the vent field at Mata in small clumps and appeared to be smaller and darker than the Mata Ua mussels that occurred singly. Collections included a total of 41 individuals: Barnacle (1), Brachyuran crab (4), Coral (1), Gastropod (1), *Ifremeria nautilei* (7), Limpet sp. 1 (7), Limpet sp. 2 (3), *Opaepele* sp. shrimp (1), Polychaetes (5), Polynoid Large (2), Polynoid Medium (1), Polynoid Small (8).

Dive S092 – Large Dacite flows (Figure 6.4-8). This dive was focused on exploring large dacite glows. The bottom was heavily sedimented. We observed occasional bamboo corals, sponges on exposed hard substrate, occasional holothurians scattered along bottom, a few grenadier fish, and a few ophiuroid brittle stars on the sediment, which were large and had distinct spines on the arms. We also observed a squidworm, *Teuthidodrilus* sp. Collections included a total of 2 individuals: ophiuroid (1), whip coral (1).

Dive S093 – Lava flows along West Mata (Figure 6.4-9). The dive started at a deeper feature and then ran over a sedimented area with distinct ripples. The fauna in this area was dominated by tubed worms or possibly tubed anemones. There also appeared to be stalked carnivorous sponges which appeared to be

bent by the current. As the ROV moved into a lumpier sedimented area, we occasionally observed *Chrysogorgia* and bamboo corals, stalked crinoids, and non-stalked crinoids. There were no biological collections made during this dive.

Dive S094 – Mata Tolu (Figure 6.4-10). The dive started on a broken-up lava field. We observed a few bamboo corals (*Lepidisis*-like), yellow-green sea urchins, and holothurians (*Stichypus*-like?). After we transited over the top of the feature, we entered a more sedimented area with orange (possibly iron?) staining. We observed glass sponges and multiple *Chrysogorgia* corals with galatheid squat lobster associates. As we entered a new area with more mounds and rubble, we observed a *Chrysogorgia* coral that was fan-shaped. We saw less corals in this area, a few bamboo skeletons, sea urchins, and a deep-sea red shrimp. Collections included a total of 142 individuals: *Alviniconcha* sp. snail (4), *Alvinocaris* sp. shrimp(1), Barnacle (5) *Bathymodiolus brevior* mussel (4), Brachyuran crab (1), Gastropod (1), *Ifremeria nautiliei* snail (9), Limpet sp. 1 (6), Limpet sp. 2 (31), *Nautilocaris* sp. shrimp (1), *Opaepele* sp. shrimp (67), Polynoid (11), Polynoid Large (1).

Dive S095 – SW Base of West Mata (Figure 6.4-11). This was a geology-focused dive and we did not observe much biology. We saw, a few anemones, a crinoid, a stalked crinoid, two swimming holothurians, and a coral on a rock near the rippled sediment. Collections included a total of 3 individuals: pennatulid sea pen (1), stalked sponge (1), worm in a tube (1).

Dive S096 – Mata Fa (Figure 6.4-12). This was an exploration dive. The ROV came down on a rocky area where there was not much biology to note. There was an anemone on loose rocks. As the dive progressed and we approached the middle mound area we began to observe more branching bamboo corals, like *Keratoisis* sp. coral, a small *Iridigorgia* sp. coral, and some single stalked bamboo corals (*Lepidisis* sp.). Additionally, we observed holothurians and sea urchins. We also observed a sea star eating a branched bamboo coral. We collected a bamboo skeleton with ophiuroid brittle stars on it. The tops of the summits seem to be sedimented area with corals growing on them. *Ophiomusium*-like brittle stars were observed on the sedimented areas. Near the end of dive we saw off impressions in a thin layer of sediment on a hard rock. The layer had a distinct pattern of impressions, similar to *Paleodictyon nodosum*. Collections included a total of 8 individuals: bamboo coral skeleton (1), Chirostylid crab (1), *Chrysogorgia* sp. coral (1), Hydroid (2), *Ophiomusium* brittle star (1), *Ophioplinthaca* sp. brittle star (2).

Dive S097 – Mata Fitu (Figure 6.4-13). This dive started with a geology transect before returning to a hydrothermal vent site visited in 2012. We came upon an active hydrothermal chimney at a greater depth than expected in an area with inactive chimneys. We observed bacterial mats, some shrimps, polynoids, brachyuran crabs (some were coated and covered and appeared dark and black), and a few galatheid squat lobsters. These vent-associated fauna were observed very near an area with brisingid sea stars. We then transited to a sedimented area with ophiuroid brittle stars, some whip corals, hydroids, and xenophyophores. We continued to move through an area of extinct chimneys. There were no observations of living organisms except for a single brisingid sea star, which was usually located on the highest chimney. We continued on to the larger hydrothermal vent field visited in 2012 and surveyed the area. The black smokers were very tall with many of them not having a wide base at the bottom. We observed small clusters of *Opaepele* sp. shrimp, clumps of *Vulcanolepas* sp. barnacles along the edges of chimneys, a few *Ifremeria nautiliei* snails (some of which very close to chimney tops), large polynoids, and brachyuran crabs. We also observed holothurians, similar to *Chiridota hydrothermica*, vent-associated holothurians previously described at Manus Basin, North Fiji Basin, and the South East Pacific Rise. Collections included a total of 130 individuals: Gastropod (6), Hydroid (2), *Ifremeria nautiliei* snail (2),

Opaepele sp. shrimp (17), Polychaete (1), Polynoid (2), Polynoid Small (1), stalked barnacle (1), *Vulcanolepas* sp. stalked barnacle (98).

Dive S098 – NELSC (Northeast Lau Spreading Center) South Tafu (Figure 6.4-14). The ROV came down into a sedimented area. Faunal observations were rare, but we did see a deep-sea red shrimp and a grenadier. We also observed swimming polychaetes throughout the dive. We observed a sedimented area with rocks and passed an area of a lot of yellow flocculent material. We did see cloudy water at different points along the top of the ridge, as well as possible vent-related shrimp (possibly *Nautilocaris* sp.), galatheid squat lobsters, and eel-pout fish. However, there was no visible shimmering water or any large bacterial mats. We slurped a few of the shrimp. Collections included a total of 2 individuals: *Nautilocaris* sp. shrimp (2).

Dive S099 - North Tafu (Figure 6.4-15). The ROV entered a hard substrate area with bamboo corals (branched and unbranched forms), anemones, grenadier fish, and galatheid squat lobsters. We observed small areas with shimmering water with bacterial mats, polynoids, galatheid squat lobsters, possibly *Alvinocaris* sp. shrimp with nodules on them (possibly parasites?), and whelks. The ROV also came to the top of a feature and saw a lot of orange staining, seeming to indicate that it was dominated by iron. We also observed a lot of shimmering water, but no fauna. Collections included a total of 8 individuals: *Alvinocaris* sp. shrimp (2), Bivalve (1), Chirostylid crab (1), *Chrysogorgia* sp. coral (1) *Munidopsis lauensis* squat lobster (1), Polynoid (1), Whelk (1).

Dive S100 – Mata Ua (Figure 6.4-16). Biological observations during this dive include a few sea urchins and cusk eels as we were entering a new hydrothermal vent field. The hydrothermal vent areas were dominated by stalked barnacles on inactive chimneys that were located near active chimneys. Active chimneys had *Alviniconcha* sp. shrimp, *Ifremeria nautilei* snails, some individual large mussels (probably *Bathymodiolus brevior*), some *Opaepele* sp. shrimp, brachyuran crabs, galatheid squat lobsters, large polynoids, and paralvinellid worms. Collections included a total of 121 individuals: *Alviniconcha* sp. shrimp (5), *Bathymodiolus brevior* mussel (1), *Eochionelasmus* sp. barnacle (6), Gastropod (1), *Ifremeria nautilei* snail (2), Limpet sp. 2 (8), *Opaepele* sp. shrimp (11), *Paralvinella* sp. worm (4), polychaetes (2), polynoid Large (6), polynoid Small (2), *Vulcanolepas* sp. stalked barnacle (73).

Dive S101 – Mata Ono (Figure 6.4-17). The ROV came down on a sedimented area over cooled lavas. The biological observations appeared to mainly be typical non-vent deep-sea fauna. We made several observations of the bony-eared assfish (*Acanthonus armatus*), a large *Chrysogorgia* sp. coral with a galatheid squat lobster associates and multiple individuals of platyctenida (benthic ctenophores). We also observed an echiuran on a rock, a large anemone, scattered holothurians. We came upon an area with diffuse flow dominated by anemones. We also observed a lot of cusk eels gathering in this area. We entered an active venting site at the summit of Mata Ono with high temperature vents dominated by snails. We observed both *Ifremeria nautilei* and *Alviniconcha* sp. snails as well as polynoids, brachyuran crabs, some galatheid squat lobsters and some shrimp (probably *Opaepele* sp.). Collections included a total of 25 individuals: Brachyuran crab (1), Hydroid (1), *Ifremeria nautilei* snail (6), Limpet sp. 1 (3), *Opaepele* sp. shrimp (1), polynoid worm (13).

Dive S102 – Mata Ono (Figure 6.4-18). This dive was focused on exploring Mata Ono in an attempt to identify more hydrothermal vent sites. There were not many more high temperature sites observed. The *Opaepele* sp. shrimp were less apparent and appeared to stay within snail clusters. We collected both *Alviniconcha* sp. and *Ifremeria nautiliei* sp. snails. Collections included a total of 62 individuals: *Alviniconcha* sp. snail (3), Anemone (3), Brachyuran crab (1), Hydroid (2), *Ifremeria nautiliei* snail (7), Limpet (14), Limpet sp. 1 (6), Limpet sp. 1? (5), Limpet sp. 2 (7), *Opaepele* sp. shrimp (11), Polynoid Large (2).

Dive S103 – West Mata, Upper East Rift (Figure 6.4-19). The ROV landed in a sedimented area with old lava flows. We observed bamboo corals, anemones, cusk eels, and deep-sea shrimp. We also observed small *Chrysogorgia* sp. corals. As we neared the summit we entered areas with vent fauna including galatheid squat lobsters, brachyuran crabs, and shrimp. There appeared to be multiple species of shrimp including *Opaepele* sp. and *Alvinocaris* sp., and potentially a few different kinds as well. It seemed that some areas had more *Alvinocaris* sp. than before. However, there was no real apparent diffuse flow, except when we got closer to the summit. As we did so, the shrimp increased in density and we began observing shimmering water around cracked lava flows, but no concentrated flows. Collections included a total of 30 individuals: *Alvinocaris* sp. shrimp (1), Bacteria sac? (2), Gastropod (1), *Opaepele* sp. shrimp (13), Polynoid Large (1), Polynoid Small (12).

Dive S104 – Mata Taha (Figure 6.4-20). When the ROV first landed we observed ophiuroid brittle stars on sediment. We observed old hydrothermal vent chimney structures that had a mix of branching bamboo corals, *Chrysogorgia* sp. corals with galatheid squat lobster associates, and possibly *Stichopathes* sp. whip corals. Collections included a total of 14 individuals: Amphipod (1), Barnacle (1), Chirostylid crab (1), *Chrysogorgia* sp. coral (1), Coral (1), Hydroid (4), Polychelida crustacean (1), Sponge 1 (1), Sponge 2 (3).

Dive S105 – Northern Dacite (Figure 6.4-21). This dive was focused on exploring a deep dacite flow near the Mata volcanoes. The biological observations were of non-vent fauna and included brittle stars, burrows, and stalked corals. Many typical deep-sea fauna were observed on a field of blocky talus including crinoids, *Chrysogorgia* sp. corals, branching bamboo corals, and whip corals. Some corals were observed with associates, such as ophiuroid brittle stars on a branching corals and galatheid squat lobsters. Sponges were observed on pillow structures as well as additional corals growing on broken pillow debris including *Chrysogorgia* sp. and whip corals. Additional biological observations included large sponges, holothurians, rattail fish, glass sponges and another observation of the fossil pattern of *Paleodictyon nodosum*, similar to what was observed on Dive S096 at Mata Fa. The pattern occurred on a very thin layer of sediment. We next entered an area of sediment-talus contact and observed some stalked corals and sponges including more *Chrysogorgia* sp. corals. We also observed more holothurians, hydroids, brisingid sea stars, stalked crinoids and a few sea urchins. We then moved into a relatively flat area with bigger blocks and observed brisingid sea stars, corals, sponges, crinoids, shrimp, and a few sea urchins. The area appeared to be dominated by relatively old lava as we observed relatively larger corals here than in earlier parts of the dive. Collections included a total of 2 individuals: Chirostylid crab (1), *Pseudochrysogorgia* sp. coral (1).

Table 4.5-2 Macrobiological Samples

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
1	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
2	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
3	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
4	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
5	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
6	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR6	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
7	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR7	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
8	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR8	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
9	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR9	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
10	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR10	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
11	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR11-30	20	Opaepele shrimp	Frozen (bulk)	Shrimp
12	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR31-50	20	Opaepele shrimp	Frozen (bulk)	Shrimp
13	West Mata	11/26/2017	23:08:00	S085	S85-bio-08	SW Hades Pit	-15.09497	-173.74956	1284.4	S085-bio08-SHR51	105	Opaepele shrimp	Frozen (bulk)	Shrimp
14	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
15	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
16	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
17	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
18	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
19	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR6	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
20	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR7	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
21	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR8	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
22	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR9	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
23	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR10	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
24	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR11-30	20	Opaepele shrimp	Frozen (bulk)	Shrimp
25	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR31-50	20	Opaepele shrimp	Frozen (bulk)	Shrimp
26	West Mata	11/27/2017	0:35:03	S085	S85-bio-11	10m NE of Marker 139	-15.09434	-173.74829	1189.1	S085-bio11-SHR51-75	25	Opaepele shrimp	Frozen (bulk)	Shrimp
27	West Mata	11/27/2017	1:27:00	S085	S85-bio-13	East edge of summit ridge	-15.09396	-173.74766	1189.9	S085-bio13-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
28	West Mata	11/27/2017	1:27:00	S085	S85-bio-13	East edge of summit ridge	-15.09396	-173.74766	1189.9	S085-bio13-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
29	West Mata	11/27/2017	1:27:00	S085	S85-bio-13	East edge of summit ridge	-15.09396	-173.74766	1189.9	S085-bio13-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
30	West Mata	11/27/2017	1:27:00	S085	S85-bio-13	East edge of summit ridge	-15.09396	-173.74766	1189.9	S085-bio13-GAL1	1	Munidopsis lauensis	frozen	Galatheid
31	West Mata	11/27/2017	1:27:00	S085	S85-bio-13	East edge of summit ridge	-15.09396	-173.74766	1189.9	S085-bio13-GAL2	1	Munidopsis lauensis	frozen	Galatheid
32	West Mata	11/27/2017	1:27:00	S085	S85-bio-13	East edge of summit ridge	-15.09396	-173.74766	1189.9	S085-bio13-GAL3	1	Munidopsis lauensis	frozen	Galatheid
33	West Mata	11/26/2017	23:41:00	S085	S85-bio-10	WP10	-15.09433	-173.74960	1265.5	S085-bio10-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
34	West Mata	11/26/2017	23:41:00	S085	S85-bio-10	WP10	-15.09433	-173.74960	1265.5	S085-bio10-CRB1	1	Brachyuran crab	frozen	Crab
35	West Mata	11/26/2017	23:41:00	S085	S85-bio-10	WP10	-15.09433	-173.74960	1265.5	S085-bio10-POL1	1	Polynoid	frozen	Polynoid
36	West Mata	11/26/2017	23:41:00	S085	S85-bio-10	WP10	-15.09433	-173.74960	1265.5	S085-bio10-POL2	1	Polynoid	frozen	Polynoid
37	West Mata	11/27/2017	2:37:00	S085	S85-bio-16	near summit, close to WP17	-15.09404	-173.74595	1272.8	S085-bio16-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
38	West Mata	11/27/2017	2:37:00	S085	S85-bio-16	near summit, close to WP17	-15.09404	-173.74595	1272.8	S085-bio16-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
39	West Mata	11/27/2017	2:37:00	S085	S85-bio-16	near summit, close to WP17	-15.09404	-173.74595	1272.8	S085-bio16-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
40	West Mata	11/27/2017	2:37:00	S085	S85-bio-16	near summit, close to WP17	-15.09404	-173.74595	1272.8	S085-bio16-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
41	West Mata	11/27/2017	2:37:00	S085	S85-bio-16	near summit, close to WP17	-15.09404	-173.74595	1272.8	S085-bio16-SHR5	1	Alvinocaris sp.	95% EtOH; RNALater; frozen	Shrimp
42	West Mata	11/27/2017	2:37:00	S085	S85-bio-16	near summit, close to WP17	-15.09404	-173.74595	1272.8	S085-bio16-SHR6	1	Alvinocaris sp.	95% EtOH; RNALater; frozen	Shrimp

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
43	West Mata	11/27/2017	2:37:00	S085	S85-bio-16	near summit, close to WP17	-15.09404	-173.74595	1272.8	S085-bio16-POL1	1	Polynoid	frozen	Polynoid
44	West Mata	11/27/2017	2:37:00	S085	S85-bio-16	near summit, close to WP17	-15.09404	-173.74595	1272.8	S085-bio16-GAL1	1	Munidopsis lauensis	frozen	Galatheid
45	West Mata	11/28/2017	2:50:00	S086	S86-bio-17	WP14	-15.08952	-173.74050	1513.9	S086-bio17-COR1	1	Bamboo coral	95% EtOH; RNALater; frozen	Coral
46	West Mata	11/28/2017	03:18:42	S086	S86-bio-21	20m west from WP14	-15.08943	-173.74070	1507.0	S086-bio21-SPO1	1	stalked sponge	frozen	Sponge
47	West Mata	11/28/2017	3:02:00	S086	S86-bio-19	10 m from WP14	-15.08949	-173.74060	1508.6	S086-bio19-COR1	1	Chrysogorgia	95% EtOH; RNALater; dried	Coral
48	West Mata	11/28/2017	3:02:00	S086	S86-bio-19	10 m from WP14	-15.08949	-173.74060	1508.6	S086-bio19-GAL1	1	Chirostylid crab	95% EtOH; RNALater; frozen	Galatheid
49	West Mata	11/28/2017	3:02:00	S086	S86-bio-19	10 m from WP14	-15.08949	-173.74060	1508.6	S086-bio19-GAL2	1	Chirostylid crab	95% EtOH; RNALater; frozen	Galatheid
50	West Mata	11/28/2017	3:13:00	S086	S86-bio-20	20m west from WP14	-15.08943	-173.74070	1507.0	S086-bio20-ANM1	1	yellow anemone	95% EtOH; RNALater; frozen	Anemone
51	West Mata	11/28/2017	3:13:00	S086	S86-bio-20	20m west from WP14	-15.08943	-173.74070	1507.0	S086-bio20-ANM2	1	yellow anemone	95% EtOH; RNALater; frozen	Anemone
52	West Mata	11/28/2017	3:13:00	S086	S86-bio-20	20m west from WP14	-15.08943	-173.74070	1507.0	S086-bio20-SPO1	1	stalked sponge	frozen	Sponge
53	West Mata	11/28/2017	3:13:00	S086	S86-bio-20	20m west from WP14	-15.08943	-173.74070	1507.0	S086-bio20-SPO2	1	stalked sponge	frozen	Sponge
54	West Mata	11/28/2017	3:13:00	S086	S86-bio-20	20m west from WP14	-15.08943	-173.74070	1507.0	S086-bio20-POL1	1	polynoid	frozen	Polynoid
55	West Mata	11/28/2017	1:21:51	S086	S86-bio-13	very close to WP13	-15.08818	-173.73881	1565.5	S086-bio13-HYD1	1	Hydroid	frozen	Hydroid
56	West Mata	11/28/2017	1:21:51	S086	S86-bio-13	very close to WP13	-15.08818	-173.73881	1565.5	S086-bio13-AMP1	1	Amphipod	frozen	Amphipod
57	West Mata	11/28/2017	1:21:51	S086	S86-bio-13	very close to WP13	-15.08818	-173.73881	1565.5	S086-bio13-AMP2	1	Amphipod	frozen	Amphipod
58	West Mata	11/28/2017	19:01:00	S087	S87-bio-02	50 m north of WP1	-15.10199	-173.74852	1618.1	S086-bio2-COR1	1	Paragorgia	95% EtOH; RNALater; frozen	Coral
59	West Mata	11/28/2017	19:01:00	S087	S87-bio-02	50 m north of WP1	-15.10199	-173.74852	1618.1	S086-bio2-OPH1	1	Asteroschema ?	95% EtOH; RNALater; frozen	Ophiuroid
60	West Mata	11/29/2017	0:52:00	S087	S87-bio-09	10 m south of WP13	-15.09405	-173.74814	1198.6	S087-bio9-FSH1	1	Zoarcid	Frozen	Fish
61	West Mata	11/29/2017	0:52:00	S087	S87-bio-09	10 m south of WP13	-15.09405	-173.74814	1198.6	S087-bio9-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
62	West Mata	11/29/2017	0:52:00	S087	S87-bio-09	10 m south of WP13	-15.09405	-173.74814	1198.6	S087-bio9-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
63	West Mata	11/29/2017	0:52:00	S087	S87-bio-09	10 m south of WP13	-15.09405	-173.74814	1198.6	S087-bio9-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
64	West Mata	11/29/2017	0:52:00	S087	S87-bio-09	10 m south of WP13	-15.09405	-173.74814	1198.6	S087-bio9-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
65	West Mata	11/29/2017	0:52:00	S087	S87-bio-09	10 m south of WP13	-15.09405	-173.74814	1198.6	S087-bio9-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
66	West Mata	11/29/2017	0:52:00	S087	S87-bio-09	10 m south of WP13	-15.09405	-173.74814	1198.6	S087-bio9-SHR6	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
67	West Mata	11/29/2017	0:52:00	S087	S87-bio-09	10 m south of WP13	-15.09405	-173.74814	1198.6	S087-bio9-SHR7	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
68	West Mata	11/29/2017	0:52:00	S087	S87-bio-09	10 m south of WP13	-15.09405	-173.74814	1198.6	S087-bio9-SHR8	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
69	West Mata	11/29/2017	0:52:00	S087	S87-bio-09	10 m south of WP13	-15.09405	-173.74814	1198.6	S087-bio9-SHR9	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
70	West Mata	11/29/2017	0:52:00	S087	S87-bio-09	10 m south of WP13	-15.09405	-173.74814	1198.6	S087-bio9-SHR10	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
71	West Mata	11/29/2017	0:52:00	S087	S87-bio-09	10 m south of WP13	-15.09405	-173.74814	1198.6	S087-bio9-SHR11-SHR16	6	Opaepele shrimp	bulk frozen	Shrimp
72	West Mata	11/29/2017	1:50:16	S087	S87-bio-12	Midway between WP16 and WP16; Prometheus site	-15.09420	-173.74804	1184.9	S087-bio12-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
73	West Mata	11/29/2017	1:50:16	S087	S87-bio-12	Midway between WP16 and WP16; Prometheus site	-15.09420	-173.74804	1184.9	S087-bio12-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
74	West Mata	11/29/2017	1:50:16	S087	S87-bio-12	Midway between WP16 and WP16; Prometheus site	-15.09420	-173.74804	1184.9	S087-bio12-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
75	West Mata	11/29/2017	1:50:16	S087	S87-bio-12	Midway between WP16 and WP16; Prometheus site	-15.09420	-173.74804	1184.9	S087-bio12-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
76	West Mata	11/29/2017	1:50:16	S087	S87-bio-12	Midway between WP16 and WP16; Prometheus site	-15.09420	-173.74804	1184.9	S087-bio12-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
77	West Mata	11/29/2017	1:50:16	S087	S87-bio-12	Midway between WP16 and WP16; Prometheus site	-15.09420	-173.74804	1184.9	S087-bio12-SHR6	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
78	West Mata	11/29/2017	1:50:16	S087	S87-bio-12	Midway between WP16 and WP16; Prometheus site	-15.09420	-173.74804	1184.9	S087-bio12-SHR7	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
79	West Mata	11/29/2017	1:50:16	S087	S87-bio-12	Midway between WP16 and WP16; Prometheus site	-15.09420	-173.74804	1184.9	S087-bio12-SHR8	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
80	West Mata	11/29/2017	1:50:16	S087	S87-bio-12	Midway between WP16 and WP16; Prometheus site	-15.09420	-173.74804	1184.9	S087-bio12-SHR9	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
81	West Mata	11/29/2017	1:50:16	S087	S87-bio-12	Midway between WP16 and WP16; Prometheus site	-15.09420	-173.74804	1184.9	S087-bio12-SHR10	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
82	West Mata	11/29/2017	1:50:16	S087	S87-bio-12	Midway between WP16 and WP16; Prometheus site	-15.09420	-173.74804	1184.9	S087-bio12-SHR11-21	11	Opaepele shrimp	bulk frozen	Shrimp
83	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
84	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
85	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
86	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-GAS1	1	Gastropod	frozen	Gastropod
87	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-GAS2	1	Gastropod	frozen	Gastropod
88	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-GAS3	1	Gastropod	frozen	Gastropod
89	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-GAS4	1	Gastropod	frozen	Gastropod
90	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-GAS5	1	Gastropod	frozen	Gastropod
91	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-POL1	1	Polynoid	frozen	Polynoid
92	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-POL2	1	Polynoid	frozen	Polynoid

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
93	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-PLY1	1	Polychaete	frozen	Polychaete
94	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-PLY2	1	Polychaete	frozen	Polychaete
95	West Mata	11/29/2017	3:25:29	S087	S87-bio-17	20 m NW of WP19	-15.09461	-173.74635	1276.0	S087-bio17-PLY3	1	Polychaete	frozen	Polychaete
96	"Muffin"	11/29/2017	21:55:36	S088	S88-rock-06	80 m NE of WP5	-15.07141	-173.71264	2707.4	S088-rock6-HYD1	1	Hydroid	frozen	Hydroid
97	Mata Ua	11/30/2017	20:18:00	S089	S89-Sulfide-03	~50 m SE of WP1	-15.01680	-173.78764	2356.1	S89-Sulfide3-BAR1	1	Vulcanolepas	frozen	stalked barnacle
98	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR1	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
99	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR2	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
100	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR3	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
101	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR4	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
102	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR5	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
103	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR6	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
104	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR7	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
105	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR8	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
106	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR9	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
107	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR10	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
108	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR11	20	Vulcanolepas	bulk frozen	stalked barnacle
109	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR12	49	Vulcanolepas	bulk frozen	stalked barnacle
110	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-GAS1-3	3	gastropod	frozen	Gastropod
111	Mata Ua	11/30/2017	23:46:00	S089	S89-bio-17	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio17-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
112	Mata Ua	11/30/2017	23:46:00	S089	S89-bio-17	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio17-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
113	Mata Ua	11/30/2017	23:46:00	S089	S89-bio-17	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio17-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
114	Mata Ua	11/30/2017	23:46:00	S089	S89-bio-17	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio17-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
115	Mata Ua	11/30/2017	23:46:00	S089	S89-bio-17	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio17-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
116	Mata Ua	11/30/2017	23:46:00	S089	S89-bio-17	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio17-POL1	1	Polynoid	frozen	Polynoid

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117	Mata Ua	11/30/2017	23:46:00	S089	S89-bio-17	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio17-PLY1	1	Polychaete	frozen	Polychaete
118	Mata Ua	11/30/2017	23:46:00	S089	S89-bio-17	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio17-CRB1	1	unknown part of crab?	frozen	Gastropod
119	Mata Ua	11/30/2017	22:08:00	S089	S89-sulfide-11	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-sulfide11-PLY1	14	Polychaete	frozen	Polychaete
120	Mata Ua	11/30/2017	22:02:00	S089	S89-bio-09	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-bio9-GAS1	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
121	Mata Ua	11/30/2017	22:02:00	S089	S89-bio-09	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-bio9-GAS2	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
122	Mata Ua	11/30/2017	22:02:00	S089	S89-bio-09	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-bio9-GAS3	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
123	Mata Ua	11/30/2017	22:02:00	S089	S89-bio-09	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-bio9-GAS4	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
124	Mata Ua	11/30/2017	22:02:00	S089	S89-bio-09	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-bio9-GAS5	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
125	Mata Ua	11/30/2017	22:02:00	S089	S89-bio-09	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-bio9-GAS6	2	Limpet 1	frozen	Gastropod
126	Mata Ua	11/30/2017	22:02:00	S089	S89-bio-09	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-bio9-GAS7	11	Limpet 2	frozen	Gastropod
127	Mata Ua	11/30/2017	22:02:00	S089	S89-bio-09	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-bio9-BAR1	3	stalked barnacle	frozen	stalked barnacle
128	Mata Ua	11/30/2017	22:02:00	S089	S89-bio-09	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-bio9-PLY1	1	polychaete	frozen	Polychaete
129	Mata Ua	11/30/2017	20:46:00	S089	S89-bio-06	~50 m SE of WP1	-15.01680	-173.78764	2356.0	S089-bio6-BAR13	7	Eochionelasmus barnacle	frozen	Barnacle
130	Mata Ua	11/30/2017	22:06:00	S089	S89-bio-10	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-bio10-MUS1	1	Bathymodiolus brevior	piece of gill and foot each 95% EtOH; RNALater; frozen; viscera frozen; shell dried	Mussel
131	Mata Ua	11/30/2017	22:06:00	S089	S89-bio-10	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-bio10-GAS1	15	Limpet 2	frozen	Gastropod
132	Mata Ua	11/30/2017	22:06:00	S089	S89-bio-10	5-10 m SW of WP5	-15.01659	-173.78767	2355.9	S089-bio10-BAR1	8	Barnacle	frozen	Barnacle
133	Mata Ua	11/30/2017	21:56:00	S089	S89-bio-08	5-10 m SW of WP5	-15.01659	-173.78767	2356.0	S089-bio8-POL1-2	2	Polynoid Large	frozen	Polynoid
134	Mata Ua	11/30/2017	21:56:00	S089	S89-bio-08	5-10 m SW of WP5	-15.01659	-173.78767	2356.0	S089-bio8-POL3-4	2	Polynoid Small	frozen	Polynoid
135	Mata Ua	11/30/2017	21:56:00	S089	S89-bio-08	5-10 m SW of WP5	-15.01659	-173.78767	2356.0	S089-bio8-PLY1	2	Polychaete	frozen	Polychaete
136	Mata Ua	11/30/2017	21:56:00	S089	S89-bio-08	5-10 m SW of WP5	-15.01659	-173.78767	2356.0	S089-bio8-GAS1	1	Gastropod	frozen	Gastropod
137	Mata Ua	11/30/2017	21:56:00	S089	S89-bio-08	5-10 m SW of WP5	-15.01659	-173.78767	2356.0	S089-bio8-WRM1	1	Paralvinella worm	frozen	Polychaete
138	Mata Ua	11/30/2017	20:51:00	S089	S89-bio-07	~50 m SE of WP1	-15.01659	-173.78767	2355.4	S089-bio7-GAS1	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod

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139	Mata Ua	11/30/2017	20:51:00	S089	S89-bio-07	~50 m SE of WP1	-15.01659	-173.78767	2355.4	S089-bio7-GAS2	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
140	Mata Ua	11/30/2017	20:51:00	S089	S89-bio-07	~50 m SE of WP1	-15.01659	-173.78767	2355.4	S089-bio7-GAS3	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
141	Mata Ua	11/30/2017	20:51:00	S089	S89-bio-07	~50 m SE of WP1	-15.01659	-173.78767	2355.4	S089-bio7-POL1-5	1	Polynoid	frozen	Polynoid
142	Mata Ua	11/30/2017	20:51:00	S089	S89-bio-07	~50 m SE of WP1	-15.01659	-173.78767	2355.4	S089-bio7-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
143	Mata Ua	11/30/2017	20:51:00	S089	S89-bio-07	~50 m SE of WP1	-15.01659	-173.78767	2355.4	S089-bio7-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
144	Mata Ua	11/30/2017	20:51:00	S089	S89-bio-07	~50 m SE of WP1	-15.01659	-173.78767	2355.4	S089-bio7-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
145	Mata Ua	11/30/2017	20:51:00	S089	S89-bio-07	~50 m SE of WP1	-15.01659	-173.78767	2355.4	S089-bio7-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
146	Mata Ua	11/30/2017	20:51:00	S089	S89-bio-07	~50 m SE of WP1	-15.01659	-173.78767	2355.4	S089-bio7-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
147	Mata Ua	11/30/2017	20:51:00	S089	S89-bio-07	~50 m SE of WP1	-15.01659	-173.78767	2355.4	S089-bio7-SHR6	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
148	Mata Ua	11/30/2017	20:51:00	S089	S89-bio-07	~50 m SE of WP1	-15.01659	-173.78767	2355.4	S089-bio7-SHR7	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
149	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-GAS1	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
150	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-GAS2	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
151	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-GAS3	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
152	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-GAS4	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
153	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-GAS5	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
154	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-GAS6	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
155	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-GAS7	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
156	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-GAS8	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
157	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-GAS9	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
158	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-GAS10	8	Limpet 1	frozen	Gastropod
159	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-GAS11	71	Limpet 2	frozen	Gastropod
160	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-PLY1	15	mixed ploychaetes	frozen	Polychaete
161	Mata Ua	11/30/2017	0:52:00	S089	S89-bio-20	25 m NE of WP3	-15.01773	-173.78852	2360.1	S089-bio20-SHR1	3	Opaepele shrimp	frozen	Shrimp
162	Mata Ua	11/30/2017	23:35:00	S089	S89-bio-16	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio16-GAS1	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
163	Mata Ua	11/30/2017	23:35:00	S089	S89-bio-16	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio16-GAS2	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
164	Mata Ua	11/30/2017	23:35:00	S089	S89-bio-16	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio16-GAS3	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
165	Mata Ua	11/30/2017	23:35:00	S089	S89-bio-16	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio16-GAS4	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
166	Mata Ua	11/30/2017	23:35:00	S089	S89-bio-16	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio16-GAS5	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
167	Mata Ua	11/30/2017	23:35:00	S089	S89-bio-16	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio16-GAS6	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
168	Mata Ua	11/30/2017	23:35:00	S089	S89-bio-16	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio16-GAS7	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
169	Mata Ua	11/30/2017	23:35:00	S089	S89-bio-16	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio16-GAS8	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
170	Mata Ua	11/30/2017	23:35:00	S089	S89-bio-16	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio16-GAS9	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
171	Mata Ua	11/30/2017	23:35:00	S089	S89-bio-16	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio16-GAS10	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
172	Mata Ua	11/30/2017	23:35:00	S089	S89-bio-16	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio16-GAS11	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
173	Mata Ua	11/30/2017	23:35:00	S089	S89-bio-16	20 m east of WP6	-15.01729	-173.78805	2350.3	S089-bio16-MIX	30	polychaetes and limpets	frozen	Polychaetes and Gastropod
174	Mata Fitu	12/2/2017	2:06:00	S090	S90-rock-12	~1 m to north	-14.90962	-173.78844	2459.0	S90-rock12-COR1	1	whip coral	frozen	Coral
175	Mata Fitu	12/2/2017	2:06:00	S090	S90-rock-12	~1 m to north	-14.90962	-173.78844	2459.0	S90-rock12-SPO1	1	sponge	frozen	Sponge
176	Mata Fitu	12/1/2017	19:25:00	S090	S90-rock-02	near WP2	-14.91652	-173.79852	2521.1	S90-rock2-COR1	1	whip coral	frozen	Coral
177	Mata Tolu	12/2/2017	20:50:00	S091	S91-bio-03	at WP3	-15.00566	-173.80150	2058.4	S91-bio3-COR1	1	Coral	95% EtOH; RNALater; frozen	Coral
178	Mata Tolu	12/3/2017	3:01:00	S091	S91-bio-15	Saguaro active chimney	-15.00465	-173.79366	1821.1	S91-bio15-GAS1	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
179	Mata Tolu	12/3/2017	3:01:00	S091	S91-bio-15	Saguaro active chimney	-15.00465	-173.79366	1821.1	S91-bio15-GAS2, 3	2	Limpet 2	frozen	Gastropod
180	Mata Tolu	12/2/2017	20:43:00	S091	S91-rock-04	WP3	-15.00566	-173.80150	2058.3	S91-rock4-BAR1	1	Barnacle	frozen	Barnacle
181	Mata Tolu	12/3/2017	3:01:00	S091	S91-bio-15	Saguaro active chimney	-15.00465	-173.79366	1821.1	S91-bio15-POL1	1	Polynoid Large	frozen	Polynoid
182	Mata Tolu	12/3/2017	3:01:00	S091	S91-bio-15	Saguaro active chimney	-15.00465	-173.79366	1821.1	S91-bio15-POL2	1	Polynoid Small	frozen	Polynoid
183	Mata Tolu	12/3/2017	3:01:00	S091	S91-bio-15	Saguaro active chimney	-15.00465	-173.79366	1821.1	S91-bio15-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
184	Mata Tolu	12/3/2017	3:01:00	S091	S91-bio-15	Saguaro active chimney	-15.00465	-173.79366	1821.1	S91-bio15-CRB1	1	Brachyuran crab	95% EtOH; RNALater; frozen	Crab
185	Mata Tolu	12/3/2017	3:01:00	S091	S91-bio-15	Saguaro active chimney	-15.00465	-173.79366	1821.1	S91-bio15-CRB2	1	Brachyuran crab	95% EtOH; RNALater; frozen	Crab
186	Mata Tolu	12/3/2017	3:01:00	S091	S91-bio-15	Saguaro active chimney	-15.00465	-173.79366	1821.1	S91-bio15-POL3	1	Polynoid Large	frozen	Polynoid
187	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-GAS1	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
188	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-GAS2	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
189	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-GAS3	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
190	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-GAS4	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
191	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-GAS5	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
192	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-GAS6	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
193	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-GAS7	1	Limpet 2	frozen	Gastropod
194	Mata Tolu	12/3/2017	1:41:00	S091	S91-sulfide-12B	Base of Beehive chimney	-15.00478	-173.79362	1821.4	S91-sulfide12B-PLY1	5	Polychaetes	frozen	Polychaetes
195	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-CRB1	1	Brachyuran crab	95% EtOH; RNALater; frozen	Crab
196	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-CRB2	1	Brachyuran crab	95% EtOH; RNALater; frozen	Crab
197	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-GAS8	7	Limpet 1	frozen	Gastropod
198	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-GAS9	1	gastropod	frozen	Gastropod
199	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-POL2	1	Polynoid Medium	frozen	Polynoid
200	Mata Tolu	12/3/2017	4:32:18	S091	S91-bio-19	Low Smoker	-15.00466	-173.79390	1824.6	S91-bio19-POL3	7	Polynoid Small	frozen	Polynoid
201	Dacite Flow	12/4/2017	23:46:00	S092	S92-bio-12	300 m SW of WP3	-15.18942	-173.91598	2508.6	S92-bio12-COR1	1	whip coral	95% EtOH; RNALater; frozen	Coral
202	Dacite Flow	12/5/2017	0:30:00	S092	S92-bio-15	70 m SW of Sample 13	-15.19112	-173.91717	2495.8	S92-bio15-OPH1	1	Ophiuroid	95% EtOH; RNALater; frozen	Ophiuroid
203	Mata Tolu	12/5/2017	23:37:00	S094	S94-bio-08	Low Smoker	-15.00457	-173.79389	1823.4	S94-bio8-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
204	Mata Tolu	12/5/2017	23:37:00	S094	S94-bio-08	Low Smoker	-15.00457	-173.79389	1823.4	S94-bio8-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
205	Mata Tolu	12/5/2017	23:37:00	S094	S94-bio-08	Low Smoker	-15.00457	-173.79389	1823.4	S94-bio8-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
206	Mata Tolu	12/5/2017	23:37:00	S094	S94-bio-08	Low Smoker	-15.00457	-173.79389	1823.4	S94-bio8-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
207	Mata Tolu	12/5/2017	23:37:00	S094	S94-bio-08	Low Smoker	-15.00457	-173.79389	1823.4	S94-bio8-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
208	Mata Tolu	12/5/2017	23:37:00	S094	S94-bio-08	Low Smoker	-15.00457	-173.79389	1823.4	S94-bio8-SHR6	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
209	Mata Tolu	12/5/2017	23:37:00	S094	S94-bio-08	Low Smoker	-15.00457	-173.79389	1823.4	S94-bio8-SHR7	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
210	Mata Tolu	12/5/2017	23:37:00	S094	S94-bio-08	Low Smoker	-15.00457	-173.79389	1823.4	S94-bio8-SHR8	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
211	Mata Tolu	12/5/2017	23:37:00	S094	S94-bio-08	Low Smoker	-15.00457	-173.79389	1823.4	S94-bio8-SHR9	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
212	Mata Tolu	12/5/2017	23:37:00	S094	S94-bio-08	Low Smoker	-15.00457	-173.79389	1823.4	S94-bio8-SHR10	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
213	Mata Tolu	12/5/2017	23:37:00	S094	S94-bio-08	Low Smoker	-15.00457	-173.79389	1823.4	S94-bio8-SHR11	11	Opaepele shrimp	bulk frozen	Shrimp
214	Mata Tolu	12/5/2017	23:37:00	S094	S94-bio-08	Low Smoker	-15.00457	-173.79389	1823.4	S94-bio8-SHR12	1	Alvinocaris sp.	95% EtOH; RNALater; frozen	Shrimp
215	Mata Tolu	12/6/2017	1:13:00	S094	S94-bio-13	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio13-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
216	Mata Tolu	12/6/2017	1:13:00	S094	S94-bio-13	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio13-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
217	Mata Tolu	12/6/2017	1:13:00	S094	S94-bio-13	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio13-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
218	Mata Tolu	12/6/2017	1:13:00	S094	S94-bio-13	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio13-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
219	Mata Tolu	12/6/2017	1:13:00	S094	S94-bio-13	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio13-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
220	Mata Tolu	12/6/2017	1:13:00	S094	S94-bio-13	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio13-SHR6	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
221	Mata Tolu	12/6/2017	1:13:00	S094	S94-bio-13	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio13-SHR7	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
222	Mata Tolu	12/6/2017	1:13:00	S094	S94-bio-13	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio13-SHR8	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
223	Mata Tolu	12/6/2017	1:13:00	S094	S94-bio-13	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio13-SHR9	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
224	Mata Tolu	12/6/2017	1:13:00	S094	S94-bio-13	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio13-SHR10	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
225	Mata Tolu	12/6/2017	1:13:00	S094	S94-bio-13	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio13-SHR11	10	Opaepele shrimp	bulk frozen	Shrimp
226	Mata Tolu	12/6/2017	2:56:00	S094	S94-bio-19	in SE pit at Mussel patch	-15.00512	-173.79392	1842.8	S94-bio19-GAS1	1	Ifremeria nautilei	95% EtOH; RNALater; frozen	Gastropod
227	Mata Tolu	12/6/2017	2:56:00	S094	S94-bio-19	in SE pit at Mussel patch	-15.00512	-173.79392	1842.8	S94-bio19-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
228	Mata Tolu	12/6/2017	2:56:00	S094	S94-bio-19	in SE pit at Mussel patch	-15.00512	-173.79392	1842.8	S94-bio19-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
229	Mata Tolu	12/6/2017	2:56:00	S094	S94-bio-19	in SE pit at Mussel patch	-15.00512	-173.79392	1842.8	S94-bio19-POL1-4	4	Polynoid	frozen	Polynoid

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
230	Mata Tolu	12/6/2017	3:50:00	S094	S94-bio-23	North, Tall, Handsome	-15.00449	-173.79359	1822.5	S94-bio23-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
231	Mata Tolu	12/6/2017	3:50:00	S094	S94-bio-23	North, Tall, Handsome	-15.00449	-173.79359	1822.5	S94-bio23-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
232	Mata Tolu	12/6/2017	3:50:00	S094	S94-bio-23	North, Tall, Handsome	-15.00449	-173.79359	1822.5	S94-bio23-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
233	Mata Tolu	12/6/2017	3:50:00	S094	S94-bio-23	North, Tall, Handsome	-15.00449	-173.79359	1822.5	S94-bio23-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
234	Mata Tolu	12/6/2017	3:50:00	S094	S94-bio-23	North, Tall, Handsome	-15.00449	-173.79359	1822.5	S94-bio23-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
235	Mata Tolu	12/6/2017	3:50:00	S094	S94-bio-23	North, Tall, Handsome	-15.00449	-173.79359	1822.5	S94-bio23-SHR6	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
236	Mata Tolu	12/6/2017	3:50:00	S094	S94-bio-23	North, Tall, Handsome	-15.00449	-173.79359	1822.5	S94-bio23-SHR7	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
237	Mata Tolu	12/6/2017	3:50:00	S094	S94-bio-23	North, Tall, Handsome	-15.00449	-173.79359	1822.5	S94-bio23-SHR8	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
238	Mata Tolu	12/6/2017	3:50:00	S094	S94-bio-23	North, Tall, Handsome	-15.00449	-173.79359	1822.5	S94-bio23-SHR9	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
239	Mata Tolu	12/6/2017	3:50:00	S094	S94-bio-23	North, Tall, Handsome	-15.00449	-173.79359	1822.5	S94-bio23-SHR10	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
240	Mata Tolu	12/6/2017	3:50:00	S094	S94-bio-23	North, Tall, Handsome	-15.00449	-173.79359	1822.5	S94-bio23-SHR11	8	Opaepele shrimp	bulk frozen	Shrimp
241	Mata Tolu	12/6/2017	3:50:00	S094	S94-bio-23	North, Tall, Handsome	-15.00449	-173.79359	1822.5	S94-bio23-GAS1	1	Gastropod	frozen	Gastropod
242	Mata Tolu	12/6/2017	3:52:00	S094	S94-bio-24	North, Tall, Handsome	-15.00449	-173.79359	1821.3	S94-bio24-POL1-2	2	Polynoid	frozen	Polynoid
243	Mata Tolu	12/6/2017	3:52:00	S094	S94-bio-24	North, Tall, Handsome	-15.00449	-173.79359	1821.3	S94-bio24-GAS1	1	Limpet 1	frozen	Gastropod
244	Mata Tolu	12/6/2017	3:52:00	S094	S94-bio-24	North, Tall, Handsome	-15.00449	-173.79359	1821.3	S94-bio24-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
245	Mata Tolu	12/6/2017	3:52:00	S094	S94-bio-24	North, Tall, Handsome	-15.00449	-173.79359	1821.3	S94-bio24-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
246	Mata Tolu	12/6/2017	3:52:00	S094	S94-bio-24	North, Tall, Handsome	-15.00449	-173.79359	1821.3	S94-bio24-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
247	Mata Tolu	12/6/2017	3:52:00	S094	S94-bio-24	North, Tall, Handsome	-15.00449	-173.79359	1821.3	S94-bio24-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
248	Mata Tolu	12/6/2017	3:52:00	S094	S94-bio-24	North, Tall, Handsome	-15.00449	-173.79359	1821.3	S94-bio24-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
249	Mata Tolu	12/6/2017	2:46:00	S094	S94-bio-18	in SE pit at Mussel patch	-15.00512	-173.79392	1842.7	S94-bio18-MUS1	1	Bathymodiolus brevior	piece of gill and foot each 95% EtOH; RNALater; frozen; viscera frozen; shell dried	Mussel
250	Mata Tolu	12/6/2017	2:46:00	S094	S94-bio-18	in SE pit at Mussel patch	-15.00512	-173.79392	1842.7	S94-bio18-MUS2	1	Bathymodiolus brevior	piece of gill and foot each 95% EtOH; RNALater; frozen; viscera frozen; shell dried	Mussel

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
251	Mata Tolu	12/6/2017	2:46:00	S094	S94-bio-18	in SE pit at Mussel patch	-15.00512	-173.79392	1842.7	S94-bio18-MUS3	1	Bathymodiolus brevior	piece of gill and foot each 95% EtOH; RNALater; frozen; viscera frozen; shell dried	Mussel
252	Mata Tolu	12/6/2017	2:46:00	S094	S94-bio-18	in SE pit at Mussel patch	-15.00512	-173.79392	1842.7	S94-bio18-MUS4	1	Bathymodiolus brevior	piece of gill and foot each 95% EtOH; RNALater; frozen; viscera frozen; shell dried	Mussel
253	Mata Tolu	12/6/2017	2:46:00	S094	S94-bio-18	in SE pit at Mussel patch	-15.00512	-173.79392	1842.7	S94-bio18-BAR1-2	2	Barnacle	frozen	Barnacle
254	Mata Tolu	12/6/2017	2:46:00	S094	S94-bio-18	in SE pit at Mussel patch	-15.00512	-173.79392	1842.7	S94-bio18-GAS1	18	Limpet 2	frozen	Gastropod
255	Mata Tolu	12/6/2017	2:46:00	S094	S94-bio-18	in SE pit at Mussel patch	-15.00512	-173.79392	1842.7	S94-bio18-BAR3-5	3	Barnacle	frozen	Barnacle
256	Mata Tolu	12/6/2017	2:46:00	S094	S94-bio-18	in SE pit at Mussel patch	-15.00512	-173.79392	1842.7	S94-bio18-GAS2	5	Limpet 2	frozen	Gastropod
257	Mata Tolu	12/6/2017	2:46:00	S094	S94-bio-18	in SE pit at Mussel patch	-15.00512	-173.79392	1842.7	S94-bio18-GAS3	3	Limpet 2	frozen	Gastropod
258	Mata Tolu	12/6/2017	2:46:00	S094	S94-bio-18	in SE pit at Mussel patch	-15.00512	-173.79392	1842.7	S94-bio18-GAS4	1	Limpet 2	frozen	Gastropod
259	Mata Tolu	12/5/2017	23:50:00	S094	S94-sulfide-09	Low Smoker	-15.00457	-173.79389	1823.9	S94-sulfide9-CRB1	1	Brachyuran crab	frozen	Crab
260	Mata Tolu	12/6/2017	1:54:00	S094	S94-sulfide-16	Active vent chimney	-15.00493	-173.79351	1813.1	S94-sulfide16-GAS1	1	Ifremeria nautilei	95% EtOH; RNALater; frozen	Gastropod
261	Mata Tolu	12/6/2017	3:52:00	S094	S94-bio-24	North, Tall, Handsome	-15.00449	-173.79359	1821.3	S94-bio24-POL3	1	Polynoid Large	frozen	Polynoid
262	Mata Tolu	12/6/2017	3:52:00	S094	S94-bio-24	North, Tall, Handsome	-15.00449	-173.79359	1821.3	S94-bio24-SHR6	1	Opaepele shrimp	frozen	Shrimp
263	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS1	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
264	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS2	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
265	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS3	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
266	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS4	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
267	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS5	1	Ifremeria nautilei	95% EtOH; RNALater; frozen	Gastropod
268	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS6	1	Ifremeria nautilei	95% EtOH; RNALater; frozen	Gastropod
269	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS7	1	Ifremeria nautilei	95% EtOH; RNALater; frozen	Gastropod
270	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS8	1	Ifremeria nautilei	95% EtOH; RNALater; frozen	Gastropod
271	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS9	1	Ifremeria nautilei	95% EtOH; RNALater; frozen	Gastropod

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
272	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS10	1	Ifremeria nautiliei	95% EtOH; RNALater; frozen	Gastropod
273	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS11	1	Ifremeria nautiliei	95% EtOH; RNALater; frozen	Gastropod
274	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS12	4	Limpet 1	frozen	Gastropod
275	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-GAS13	4	Limpet 2	frozen	Gastropod
276	Mata Tolu	12/6/2017	1:25:00	S094	S94-bio-14	Snail Alcove	-15.00482	-173.79354	1813.3	S94-bio14-POL1	5	Polynoid	frozen	Polynoid
277	Mata Tolu	12/6/2017	3:52:00	S094	S94-bio-24	North, Tall, Handsome	-15.00449	-173.79359	1821.3	S94-bio24-SHR7	1	Nautilocaris shrimp	frozen	Shrimp
278	Mata Tolu	12/6/2017	3:52:00	S094	S94-bio-24	North, Tall, Handsome	-15.00449	-173.79359	1821.3	S94-bio24-GAS2	1	Limpet 1	frozen	Shrimp
279	SW Base of West Mata	12/7/2017	0:25:00	S095	S95-rock-11	just east of last sample	-15.11804	-173.78911	2885.9	S95-rock11-SPO1	1	stalked sponge	frozen	Sponge
280	SW Base of West Mata	12/7/2017	2:20:00	S095	S95-bio-18	~50 m further from WP5	-15.11704	-173.78661	2863.5	S95-bio18-WRM1	1	worm in tube	frozen	Polychaete
281	SW Base of West Mata	12/7/2017	2:34:00	S095	S95-bio-19	close by	-15.11715	-173.78642	2853.7	S95-bio19-PEN1	1	Pennatulid?	95% EtOH; RNALater; whole specimen in 95% EtOH	Pennatulid
282	Mata Fa	12/8/2017	1:36:00	S096	S96-bio-16	80 m SW of WP6	-14.98946	-173.79979	2341.0	S96-bio16-COR1	1	Chrysogorgia	95% EtOH; RNALater; dried	Coral
283	Mata Fa	12/8/2017	1:36:00	S096	S96-bio-16	80 m SW of WP6	-14.98946	-173.79979	2341.0	S96-bio16-GAL1	1	Chirostylid crab	95% EtOH; RNALater; frozen	Galatheid
284	Mata Fa	12/7/2017	21:21:00	S096	S96-rock-05	40 m NW of WP2	-14.99127	-173.80790	2482.1	S96-rock05-HYD1	1	Hydroid	frozen	Hydroid
285	Mata Fa	12/7/2017	23:16:00	S096	S96-rock-10	40 m NW of 5	-14.99020	-173.80116	2329.1	S96-rock10-HYD1	1	Hydroid	frozen	Hydroid
286	Mata Fa	12/8/2017	2:32:00	S096	S96-bio-18	~10 m ahead of Sed-17	-14.98821	-173.79703	2340.0	S96-bio18-OPH1	1	Ophiomusium?	95% EtOH; RNALater; frozen	Ophiuroid
287	Mata Fa	12/7/2017	23:29:00	S096	S96-bio-11	WP5	-14.99039	-173.80089	2320.5	S96-bio11-COR1	1	bamboo coral skeleton	frozen	Coral
288	Mata Fa	12/7/2017	23:29:00	S096	S96-bio-11	WP5	-14.99039	-173.80089	2320.5	S96-bio11-OPH1	1	Ophioplinthaca sp.	95% EtOH; RNALater; frozen	Ophiuroid
289	Mata Fa	12/7/2017	23:29:00	S096	S96-bio-11	WP5	-14.99039	-173.80089	2320.5	S96-bio11-OPH2	1	Ophioplinthaca sp.	95% EtOH; RNALater; frozen	Ophiuroid
290	Mata Fitu	12/9/2017	2:57:00	S097	S97-bio-19	~15 m North of WP4	-14.91348	-173.77912	2626.0	S97-bio19-BAR1	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
291	Mata Fitu	12/9/2017	2:57:00	S097	S97-bio-19	~15 m North of WP4	-14.91348	-173.77912	2626.0	S97-bio19-BAR2	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
292	Mata Fitu	12/9/2017	2:57:00	S097	S97-bio-19	~15 m North of WP4	-14.91348	-173.77912	2626.0	S97-bio19-BAR3	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
293	Mata Fitu	12/9/2017	2:57:00	S097	S97-bio-19	~15 m North of WP4	-14.91348	-173.77912	2626.0	S97-bio19-BAR4	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
294	Mata Fitu	12/9/2017	2:57:00	S097	S97-bio-19	~15 m North of WP4	-14.91348	-173.77912	2626.0	S97-bio19-BAR5	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
295	Mata Fitu	12/9/2017	2:57:00	S097	S97-bio-19	~15 m North of WP4	-14.91348	-173.77912	2626.0	S97-bio19-BAR6	20	Vulcanolepas	bulk frozen	stalked barnacle
296	Mata Fitu	12/9/2017	2:57:00	S097	S97-bio-19	~15 m North of WP4	-14.91348	-173.77912	2626.0	S97-bio19-GAS1	6	Gastropod	frozen	Gastropod
297	Mata Fitu	12/9/2017	3:07:00	S097	S97-bio-20	at Eiffel Tower	-14.91348	-173.77912	2624.0	S97-bio20-GAS1	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
298	Mata Fitu	12/9/2017	3:07:00	S097	S97-bio-20	at Eiffel Tower	-14.91348	-173.77912	2624.0	S97-bio20-GAS2	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
299	Mata Fitu	12/9/2017	3:07:00	S097	S97-bio-20	at Eiffel Tower	-14.91348	-173.77912	2624.0	S97-bio20-POL1	1	Polynoid small	frozen	Polynoid
300	Mata Fitu	12/8/2017	22:23:00	S097	S97-bio-08	120 m SE of WP13	-14.91683	-173.77509	2734.1	S97-bio8-BAR1	1	stalked barnacle	95% EtOH; RNALater; frozen	stalked barnacle
301	Mata Fitu	12/8/2017	19:21:00	S097	S97-sulfide-02	~20 m NE of WP1; Old Smokey	-14.91559	-173.77340	2766.6	S97-sulfide2-HYD1	2	Hydroid	frozen	Hydroid
302	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
303	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
304	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-BAR1	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
305	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-BAR2	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
306	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-BAR3	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
307	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-BAR4	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
308	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-BAR5	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
309	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-BAR6	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
310	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-BAR7	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
311	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-BAR8	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
312	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-BAR9	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
313	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-BAR10	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
314	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-BAR11	20	Vulcanolepas	bulk frozen	stalked barnacle
315	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-BAR12	43	Vulcanolepas	bulk frozen	stalked barnacle
316	Mata Fitu	12/9/2017	2:32:00	S097	S97-bio-18	At WP4	-14.91356	-173.77910	2626.1	S97-bio18-PLY1	1	Polychaete	frozen	Polychaete

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
317	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S97-bio6-POL1	1	Polynoid	frozen	Polynoid
318	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S97-bio6-POL2	1	Polynoid	frozen	Polynoid
319	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S96-bio6-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
320	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S96-bio6-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
321	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S96-bio6-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
322	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S96-bio6-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
323	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S96-bio6-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
324	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S96-bio6-SHR6	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
325	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S96-bio6-SHR7	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
326	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S96-bio6-SHR8	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
327	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S96-bio6-SHR9	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
328	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S96-bio6-SHR10	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
329	Mata Fitu	12/8/2017	21:03:00	S097	S97-bio-06	Old Smokey	-14.91545	-173.77371	2757.0	S96-bio6-SHR11	5	Opaepele shrimp	bulk frozen	Shrimp
330	South Tafu	12/10/2017	3:16:00	S098	S98-bio-19	near WP9	-15.37739	-174.24751	1741.8	S98-bio19-SHR1	1	Nautilocaris? shrimp	95% EtOH; RNALater; frozen	Shrimp
331	South Tafu	12/10/2017	3:16:00	S098	S98-bio-19	near WP9	-15.37739	-174.24751	1741.8	S98-bio19-SHR2	1	Nautilocaris? shrimp	95% EtOH; RNALater; frozen	Shrimp
332	North Tafu	12/11/2017	2:05:00	S099	S99-bio-19	near WP6	-15.36036	-174.23415	1641.9	S99-bio19-COR1	1	Chrysogorgia	95% EtOH; RNALater; dried	Coral
333	North Tafu	12/11/2017	2:05:00	S099	S99-bio-19	near WP6	-15.36036	-174.23415	1641.9	S99-bio19-GAL1	1	Chirostylid crab	95% EtOH; RNALater; frozen	Galatheid
334	North Tafu	12/11/2017	1:20:00	S099	S99-bio-17	along track	-15.35755	-174.23228	1675.8	S99-bio17-GAL1	1	Munidopsis lauensis	frozen	Galatheid
335	North Tafu	12/11/2017	1:20:00	S099	S99-bio-17	along track	-15.35755	-174.23228	1675.8	S99-bio17-POL1	1	Polynoid	frozen	Polynoid
336	North Tafu	12/11/2017	1:20:00	S099	S99-bio-17	along track	-15.35755	-174.23228	1675.8	S99-bio17-BIV1	1	Bivalve	frozen	Bivalve
337	North Tafu	12/11/2017	1:20:00	S099	S99-bio-17	along track	-15.35755	-174.23228	1675.8	S99-bio17-GAS1	1	Whelk	frozen	Gastropod
338	North Tafu	12/11/2017	1:20:00	S099	S99-bio-17	along track	-15.35755	-174.23228	1675.8	S99-bio17-SHR1	1	Alvinocaris sp. ?	95% ethanol	Shrimp
339	North Tafu	12/11/2017	1:20:00	S099	S99-bio-17	along track	-15.35755	-174.23228	1675.8	S99-bio17-SHR2	1	Alvinocaris sp. ?	95% EtOH; RNALater; frozen	Shrimp
340	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR1	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
341	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR2	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
342	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR3	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
343	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR4	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
344	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR5	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
345	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR6	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
346	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR7	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
347	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR8	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
348	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR9	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
349	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR10	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
350	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR11	8	Vulcanolepas	bulk frozen	stalked barnacle
351	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR12	5	Eochionelasmus barnacle	bulk frozen	Barnacle
352	Mata Ua	12/12/2017	0:08	S100	S100-bio-14	Low Flat Top Smoker	-15.01668	-173.78693	2334.9	S100-bio14-BAR13	13	Vulcanolepas	bulk frozen	stalked barnacle
353	Mata Ua	12/12/2017	0:13	S100	S100-sulfide-16	Low Flat Top Smoker	-15.01668	-173.78693	2335.0	S100-sulfide16-BAR1	1	Eochionelasmus barnacle	frozen	Barnacle
354	Mata Ua	12/12/2017	0:13	S100	S100-sulfide-16	Low Flat Top Smoker	-15.01668	-173.78693	2335.0	S100-sulfide16-PLY1	2	Polychaetes	frozen	Polychaete
355	Mata Ua	12/11/2017	23:24	S100	S100-bio-11	Low Flat Top Smoker	-15.01668	-173.78693	2334.7	S100-bio11-MUS1	1	Bathymodiolus brevior	piece of gill and foot each 95% EtOH; RNALater; frozen; viscera frozen; shell dried	Mussel
356	Mata Ua	12/11/2017	23:17	S100	S100-bio-10	Low Flat Top Smoker	-15.01668	-173.78693	2334.7	S100-bio10-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
357	Mata Ua	12/11/2017	23:17	S100	S100-bio-10	Low Flat Top Smoker	-15.01668	-173.78693	2334.7	S100-bio10-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
358	Mata Ua	12/11/2017	23:17	S100	S100-bio-10	Low Flat Top Smoker	-15.01668	-173.78693	2334.7	S100-bio10-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
359	Mata Ua	12/11/2017	23:17	S100	S100-bio-10	Low Flat Top Smoker	-15.01668	-173.78693	2334.7	S100-bio10-GAS1	1	Ifremeria nautiliei	95% EtOH; RNALater; frozen	Gastropod
360	Mata Ua	12/11/2017	23:17	S100	S100-bio-10	Low Flat Top Smoker	-15.01668	-173.78693	2334.7	S100-bio10-POL1	1	Polynoid Large	frozen	Polynoid
361	Mata Ua	12/11/2017	23:17	S100	S100-bio-10	Low Flat Top Smoker	-15.01668	-173.78693	2334.7	S100-bio10-POL2	1	Polynoid small	frozen	Polynoid
362	Mata Ua	12/11/2017	23:17	S100	S100-bio-10	Low Flat Top Smoker	-15.01668	-173.78693	2334.7	S100-bio10-GAS2	7	Limpet 2	frozen	Gastropod

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
363	Mata Ua	12/12/2017	2:08	S100	S100-bio-20	Low Flat Top Smoker	-15.01679	-173.78695	2340.0	S100-bio20-POL1	1	Polynoid Large	frozen	Gastropod
364	Mata Ua	12/12/2017	2:08	S100	S100-bio-20	Low Flat Top Smoker	-15.01679	-173.78695	2340.0	S100-bio20-POL2	1	Polynoid Large	frozen	Gastropod
365	Mata Ua	12/12/2017	2:08	S100	S100-bio-20	Low Flat Top Smoker	-15.01679	-173.78695	2340.0	S100-bio20-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
366	Mata Ua	12/12/2017	2:08	S100	S100-bio-20	Low Flat Top Smoker	-15.01679	-173.78695	2340.0	S100-bio20-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
367	Mata Ua	12/12/2017	2:08	S100	S100-bio-20	Low Flat Top Smoker	-15.01679	-173.78695	2340.0	S100-bio20-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
368	Mata Ua	12/12/2017	2:08	S100	S100-bio-20	Low Flat Top Smoker	-15.01679	-173.78695	2340.0	S100-bio20-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
369	Mata Ua	12/12/2017	2:08	S100	S100-bio-20	Low Flat Top Smoker	-15.01679	-173.78695	2340.0	S100-bio20-POL3	1	Polynoid small	frozen	Polynoid
370	Mata Ua	12/12/2017	2:08	S100	S100-bio-20	Low Flat Top Smoker	-15.01679	-173.78695	2340.0	S100-bio20-POL3	1	Gastropod	frozen	Gastropod
371	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Low Flat Top Smoker	-15.01675	-173.78597	2317.9	S100-bio24-BAR1	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
372	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Low Flat Top Smoker	-15.01675	-173.78597	2317.9	S100-bio24-BAR2	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
373	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Low Flat Top Smoker	-15.01675	-173.78597	2317.9	S100-bio24-BAR3	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
374	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Low Flat Top Smoker	-15.01675	-173.78597	2317.9	S100-bio24-BAR4	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
375	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Low Flat Top Smoker	-15.01675	-173.78597	2317.9	S100-bio24-BAR5	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
376	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Low Flat Top Smoker	-15.01675	-173.78597	2317.9	S100-bio24-BAR6	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
377	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Low Flat Top Smoker	-15.01675	-173.78597	2317.9	S100-bio24-BAR7	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
378	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Low Flat Top Smoker	-15.01675	-173.78597	2317.9	S100-bio24-BAR8	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
379	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Low Flat Top Smoker	-15.01675	-173.78597	2317.9	S100-bio24-BAR9	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
380	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Low Flat Top Smoker	-15.01675	-173.78597	2317.9	S100-bio24-BAR10	1	Vulcanolepas	95% EtOH; RNALater; frozen	stalked barnacle
381	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Low Flat Top Smoker	-15.01675	-173.78597	2317.9	S100-bio24-BAR11	32	Vulcanolepas	bulk frozen	stalked barnacle

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382	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Big Smoke	-15.01675	-173.78597	2317.9	S100-bio24-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
383	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Big Smoke	-15.01675	-173.78597	2317.9	S100-bio24-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
384	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Big Smoke	-15.01675	-173.78597	2317.9	S100-bio24-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
385	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Big Smoke	-15.01675	-173.78597	2317.9	S100-bio24-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
386	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Big Smoke	-15.01675	-173.78597	2317.9	S100-bio24-GAS1	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
387	Mata Ua	12/12/2017	2:08 or 3:12	S100	S100-bio-24	Probably Big Smoke	-15.01675	-173.78597	2317.9	S100-bio24-GAS2	1	Limpet 2	frozen	Gastropod
388	Mata Ua	12/12/2017	3:16	S100	S100-bio-25	Big Smoke	-15.01675	-173.78597	2317.9	S100-bio25-POL1	3	Polynoid Large	frozen	Polynoid
389	Mata Ua	12/12/2017	3:16	S100	S100-bio-25	Big Smoke	-15.01675	-173.78597	2317.9	S100-bio25-PLY1	4	Paralvinella worm	frozen	Polychaete
390	Mata Ua	12/12/2017	3:16	S100	S100-bio-25	Big Smoke	-15.01675	-173.78597	2317.9	S100-bio25-GAS1	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
391	Mata Ua	12/12/2017	3:16	S100	S100-bio-25	Big Smoke	-15.01675	-173.78597	2317.9	S100-bio25-GAS2	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
392	Mata Ua	12/12/2017	3:16	S100	S100-bio-25	Big Smoke	-15.01675	-173.78597	2317.9	S100-bio25-GAS3	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
393	Mata Ua	12/12/2017	3:16	S100	S100-bio-25	Big Smoke	-15.01675	-173.78597	2317.9	S100-bio25-GAS4	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
394	Mata Ua	12/12/2017	3:16	S100	S100-bio-25	Big Smoke	-15.01675	-173.78597	2317.9	S100-bio25-GAS5	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
395	Mata Ono	12/12/2017	23:13	S101	S101-rock-05	50 m SW of WP2	-14.94501	-173.79875	2601.6	S101-rock5-HYD1	1	Hydroid	frozen	Hydroid
396	Mata Ono	12/13/2017	4:23	S101	S101-bio-18	Dark Castle Vent	-14.94058	-173.79956	2360.0	S101-bio18-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
397	Mata Ono	12/13/2017	4:23	S101	S101-bio-18	Dark Castle Vent	-14.94058	-173.79956	2360.0	S101-bio18-POL1	5	Polynoid	frozen	Polynoid
398	Mata Ono	12/13/2017	4:23	S101	S101-bio-18	Dark Castle Vent	-14.94058	-173.79956	2360.0	S101-bio18-POL2	8	Polynoid	frozen	Polynoid
399	Mata Ono	12/13/2017	4:23	S101	S101-bio-18	Dark Castle Vent	-14.94058	-173.79956	2360.0	S101-bio18-CRB1	1	Brachyuran crab	95% EtOH; RNALater; frozen	Crab
400	Mata Ono	12/13/2017	4:23	S101	S101-bio-18	Dark Castle Vent	-14.94058	-173.79956	2360.0	S101-bio18-GAS1	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
401	Mata Ono	12/13/2017	4:23	S101	S101-bio-18	Dark Castle Vent	-14.94058	-173.79956	2360.0	S101-bio18-GAS2	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
402	Mata Ono	12/13/2017	4:23	S101	S101-bio-18	Dark Castle Vent	-14.94058	-173.79956	2360.0	S101-bio18-GAS3	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
403	Mata Ono	12/13/2017	4:23	S101	S101-bio-18	Dark Castle Vent	-14.94058	-173.79956	2360.0	S101-bio18-GAS4	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
404	Mata Ono	12/13/2017	4:23	S101	S101-bio-18	Dark Castle Vent	-14.94058	-173.79956	2360.0	S101-bio18-GAS5	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
405	Mata Ono	12/13/2017	4:23	S101	S101-bio-18	Dark Castle Vent	-14.94058	-173.79956	2360.0	S101-bio18-GAS6	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
406	Mata Ono	12/13/2017	4:23	S101	S101-bio-18	Dark Castle Vent	-14.94058	-173.79956	2360.0	S101-bio18-GAS7	2	Limpet 1	frozen	Gastropod
407	Mata Ono	12/13/2017	4:23	S101	S101-bio-18	Dark Castle Vent	-14.94058	-173.79956	2360.0	S101-bio18-GAS8	1	Limpet 1	frozen	Gastropod
408	Mata Ono	12/14/2017	3:20	S102	S102-bio-21	Bodaceous Booming Beehive (B^3)	-14.94058	-173.79956	2360.2	S102-bio21-SHR1	1	Opapepe shrimp	95% EtOH; RNALater; frozen	Shrimp
409	Mata Ono	12/14/2017	3:20	S102	S102-bio-21	Bodaceous Booming Beehive (B^3)	-14.94058	-173.79956	2360.2	S102-bio21-SHR2	1	Opapepe shrimp	95% EtOH; RNALater; frozen	Shrimp
410	Mata Ono	12/14/2017	3:20	S102	S102-bio-21	Bodaceous Booming Beehive (B^3)	-14.94058	-173.79956	2360.2	S102-bio21-SHR3	1	Opapepe shrimp	95% EtOH; RNALater; frozen	Shrimp
411	Mata Ono	12/14/2017	3:20	S102	S102-bio-21	Bodaceous Booming Beehive (B^3)	-14.94058	-173.79956	2360.2	S102-bio21-SHR4	1	Opapepe shrimp	95% EtOH; RNALater; frozen	Shrimp
412	Mata Ono	12/14/2017	3:20	S102	S102-bio-21	Bodaceous Booming Beehive (B^3)	-14.94058	-173.79956	2360.2	S102-bio21-SHR5	1	Opapepe shrimp	95% EtOH; RNALater; frozen	Shrimp
413	Mata Ono	12/14/2017	3:20	S102	S102-bio-21	Bodaceous Booming Beehive (B^3)	-14.94058	-173.79956	2360.2	S102-bio21-SHR6	1	Opapepe shrimp	95% EtOH; RNALater; frozen	Shrimp
414	Mata Ono	12/14/2017	3:20	S102	S102-bio-21	Bodaceous Booming Beehive (B^3)	-14.94058	-173.79956	2360.2	S102-bio21-POL1	1	Polynoid Large	frozen	Polynoid
415	Mata Ono	12/14/2017	3:20	S102	S102-bio-21	Bodaceous Booming Beehive (B^3)	-14.94058	-173.79956	2360.2	S102-bio21-GAS1	1	Limpet 1	frozen	Gastropod
416	Mata Ono	12/14/2017	1:17	S102	S102-bio-13	40 m SE of WP17	-14.94041	-173.79967	2357.6	S102-bio13-GAS1	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
417	Mata Ono	12/14/2017	1:17	S102	S102-bio-13	40 m SE of WP17	-14.94041	-173.79967	2357.6	S102-bio13-GAS2	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
418	Mata Ono	12/14/2017	1:17	S102	S102-bio-13	40 m SE of WP17	-14.94041	-173.79967	2357.6	S102-bio13-GAS3	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
419	Mata Ono	12/14/2017	1:17	S102	S102-bio-13	40 m SE of WP17	-14.94041	-173.79967	2357.6	S102-bio13-GAS4	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
420	Mata Ono	12/14/2017	1:17	S102	S102-bio-13	40 m SE of WP17	-14.94041	-173.79967	2357.6	S102-bio13-GAS5	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
421	Mata Ono	12/14/2017	1:17	S102	S102-bio-13	40 m SE of WP17	-14.94041	-173.79967	2357.6	S102-bio13-GAS6	5	Limpet 2	frozen	Gastropod

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
422	Mata Ono	12/14/2017	1:17	S102	S102-bio-13	40 m SE of WP17	-14.94041	-173.79967	2357.6	S102-bio13-GAS7	1	Limpet 2	frozen	Gastropod
423	Mata Ono	12/14/2017	1:17	S102	S102-bio-13	40 m SE of WP17	-14.94041	-173.79967	2357.6	S102-bio13-GAS8	5	Limpet 1?	frozen	Gastropod
424	Mata Ono	12/14/2017	1:17	S102	S102-bio-13	40 m SE of WP17	-14.94041	-173.79967	2357.6	S102-bio13-GAS9	2	Limpet 1	frozen	Gastropod
425	Mata Ono	12/14/2017	1:17	S102	S102-bio-13	40 m SE of WP17	-14.94041	-173.79967	2357.6	S102-bio13-GAS10	1	Limpet 2	frozen	Gastropod
426	Mata Ono	12/14/2017	1:17	S102	S102-bio-13	40 m SE of WP17	-14.94041	-173.79967	2357.6	S102-bio13-GAS11	14	Limpet	frozen	Gastropod
427	Mata Ono	12/13/2017	20:40	S102	S102-rock-05	~10 m upslope	-14.94267	-173.80747	2675.6	S102-rock5-HYD1	2	Hydroid	frozen	Hydroid
428	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-GAS1	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
429	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-GAS2	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
430	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-GAS3	1	Alviniconcha sp. Shell only	frozen	Gastropod
431	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-POL1	1	Polynoid Large	frozen	Polynoid
432	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
433	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
434	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
435	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-GAS4	1	Limpet 1	frozen	Gastropod
436	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-GAS5	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
437	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-GAS6	1	Ifremeria nautili	95% EtOH; RNALater; frozen	Gastropod
438	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-CRB1	1	Brachyuran crab	95% EtOH; RNALater; frozen	Crab
439	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-GAS7	1	Limpet 1	95% EtOH; RNALater; frozen	Gastropod
440	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-GAS8	1	Alviniconcha sp.	95% EtOH; RNALater; frozen	Gastropod
441	Mata Ono	12/14/2017	1:24	S102	S102-bio-14	40 m SE of WP17	-14.94041	-173.79967	2357.7	S102-bio14-ANM1	1	Anemone	95% EtOH; RNALater; frozen	Anemone
442	Mata Ono	12/14/2017	1:24	S102	S102-bio-14	40 m SE of WP17	-14.94041	-173.79967	2357.7	S102-bio14-ANM2	1	Anemone	95% EtOH; RNALater; frozen	Anemone
443	Mata Ono	12/14/2017	1:24	S102	S102-bio-14	40 m SE of WP17	-14.94041	-173.79967	2357.7	S102-bio14-ANM3	1	Anemone	95% EtOH; RNALater; frozen	Anemone
444	Mata Ono	12/14/2017	1:24	S102	S102-bio-14	40 m SE of WP17	-14.94041	-173.79967	2357.7	S102-bio14-GAS9	1	Limpet 1	frozen	Gastropod
445	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
446	Mata Ono	12/14/2017	2:26	S102	S102-bio-18	Rock Star	-14.94054	-173.79938	2351.2	S102-bio18-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
447	West Mata	12/15/2017	3:32	S103	S103-bio-26	29 m NW of WP20	-15.09374	-173.74622	1267.7	S103-bio26-SHR1	1	Alvinocariss shrimp	95% EtOH; RNALater; frozen	Shrimp
448	West Mata	12/15/2017	3:32	S103	S103-bio-26	29 m NW of WP20	-15.09374	-173.74622	1267.7	S103-bio26-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
449	West Mata	12/15/2017	3:32	S103	S103-bio-26	29 m NW of WP20	-15.09374	-173.74622	1267.7	S103-bio26-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
450	West Mata	12/15/2017	3:32	S103	S103-bio-26	29 m NW of WP20	-15.09374	-173.74622	1267.7	S103-bio26-SHR4	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
451	West Mata	12/15/2017	3:32	S103	S103-bio-26	29 m NW of WP20	-15.09374	-173.74622	1267.7	S103-bio26-SHR5	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
452	West Mata	12/15/2017	3:32	S103	S103-bio-26	29 m NW of WP20	-15.09374	-173.74622	1267.7	S103-bio26-SHR6	1	Opaepele shrimp	frozen	Shrimp
453	West Mata	12/15/2017	3:32	S103	S103-bio-26	29 m NW of WP20	-15.09374	-173.74622	1267.7	S103-bio26-SHR7	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
454	West Mata	12/15/2017	3:32	S103	S103-bio-26	29 m NW of WP20	-15.09374	-173.74622	1267.7	S103-bio26-POL1	1	Polynoid Large	frozen	Polynoid
455	West Mata	12/15/2017	3:32	S103	S103-bio-26	29 m NW of WP20	-15.09374	-173.74622	1267.7	S103-bio26-POL2	1	Polynoid small	frozen	Polynoid
456	West Mata	12/15/2017	3:32	S103	S103-bio-26	29 m NW of WP20	-15.09374	-173.74622	1267.7	S103-bio26-GAS1	1	Gastropod	frozen	Gastropod
457	West Mata	12/15/2017	2:24	S103	S103-bio-23	~40m SE of WP18	-15.09313	-173.74568	1289.1	S103-bio23-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
458	West Mata	12/15/2017	2:24	S103	S103-bio-23	~40m SE of WP18	-15.09313	-173.74568	1289.1	S103-bio23-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
459	West Mata	12/15/2017	2:24	S103	S103-bio-23	~40m SE of WP18	-15.09313	-173.74568	1289.1	S103-bio23-POL1	2	Polynoid small	frozen	Polynoid
460	West Mata	12/14/2017	18:58	S103	S103-bio-03	20 m east of WP2	-15.08813	-173.73794	1589.4	S103-bio3-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
461	West Mata	12/14/2017	18:58	S103	S103-bio-03	20 m east of WP2	-15.08813	-173.73794	1589.4	S103-bio3-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
462	West Mata	12/14/2017	18:58	S103	S103-bio-03	20 m east of WP2	-15.08813	-173.73794	1589.4	S103-bio3-POL1	1	Polynoid small	frozen	Polynoid
463	West Mata	12/14/2017	18:58	S103	S103-bio-03	20 m east of WP2	-15.08813	-173.73794	1589.4	S103-bio3-POL2	1	Polynoid small	frozen	Polynoid
464	West Mata	12/14/2017	21:00	S103	S103-bio-09	Spatter mound	-15.08923	-173.73887	1519.9	S103-bio9-SHR1	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
465	West Mata	12/14/2017	21:00	S103	S103-bio-09	Spatter mound	-15.08923	-173.73887	1519.9	S103-bio9-SHR2	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
466	West Mata	12/14/2017	21:00	S103	S103-bio-09	Spatter mound	-15.08923	-173.73887	1519.9	S103-bio9-SHR3	1	Opaepele shrimp	95% EtOH; RNALater; frozen	Shrimp
467	West Mata	12/14/2017	21:00	S103	S103-bio-09	Spatter mound	-15.08923	-173.73887	1519.9	S103-bio9-POL1	7	Polynoid small	frozen	Polynoid
468	West Mata	12/14/2017	21:00	S103	S103-bio-09	Spatter mound	-15.08923	-173.73887	1519.9	S103-bio9-BAC1	2	Bacteria sac?	frozen	Bacteria?
469	Mata Taha	12/15/2017	21:43	S104	S104-bio-07	50 m East of WP4	-15.03629	-173.78394	2308.8	S104-bio7-DEC1	1	Polychelida	95% EtOH; RNALater; frozen	Decapod

ID	Site	Date	Time	Dive	Sample ID	Station	Latitude	Longitude	Depth	Specimen ID	n	Shipboard ID	Preservation	Common ID
470	Mata Taha	12/16/2017	1:09	S104	S104-rock-16	150 m SW of WP4	-15.04044	-173.79022	2239.8	S104-rock16-HYD1	1	Hydroid	frozen	Hydroid
471	Mata Taha	12/16/2017	3:13	S104	S104-rock-20	50 m NW of WP11	-15.04170	-173.78536	2161.4	S104-rock20-HYD1	1	Hydroid	frozen	Hydroid
472	Mata Taha	12/15/2017	23:59	S104	S104-sulfide-13	100 m SW of WP6	-15.03914	-173.78965	2261.1	S104-sulfide13-HYD1	1	Hydroid	frozen	Hydroid
473	Mata Taha	12/15/2017	23:59	S104	S104-sulfide-13	100 m SW of WP6	-15.03914	-173.78965	2261.1	S104-sulfide13-HYD2	1	Hydroid	frozen	Hydroid
474	Mata Taha	12/15/2017	23:59	S104	S104-sulfide-13	100 m SW of WP6	-15.03914	-173.78965	2261.1	S104-sulfide13-SPO1	1	Sponge 1	frozen	Sponge
475	Mata Taha	12/15/2017	23:59	S104	S104-sulfide-13	100 m SW of WP6	-15.03914	-173.78965	2261.1	S104-sulfide13-SPO2	3	Sponge 2	frozen	Sponge
476	Mata Taha	12/15/2017	23:59	S104	S104-sulfide-13	100 m SW of WP6	-15.03914	-173.78965	2261.1	S104-sulfide13-AMP1	1	Amphipod	frozen	Amphipod
477	Mata Taha	12/15/2017	23:59	S104	S104-sulfide-13	100 m SW of WP6	-15.03914	-173.78965	2261.1	S104-sulfide13-BAR1	1	Barnacle	frozen	Barnacle
478	Mata Taha	12/16/2017	0:12	S104	S104-bio-14	100 m SW of WP6	-15.03914	-173.78965	2260.3	S104-bio14-COR1	1	Chrysogorgia	95% EtOH; RNALater; frozen	Coral
479	Mata Taha	12/16/2017	0:12	S104	S104-bio-14	100 m SW of WP6	-15.03914	-173.78965	2260.3	S104-bio14-GAL1	1	Chirostylid crab	95% EtOH; RNALater; frozen	Galatheid
480	Mata Taha	12/16/2017	2:53	S104	S104-rock-19		-15.04029	-173.78604	2197.6	S104-rock19-COR1	1	Coral	frozen	Coral
481	Northern Dacite	12/16/2017	23:09	S105	S105-bio-14	SE of WP5 ~50 m?	-14.89831	-173.94227	2678.8	S105-bio-14-COR1	1	Pseudochryso gorgia	95% EtOH; RNALater; frozen; dried	Coral
482	Northern Dacite	12/16/2017	23:09	S105	S105-bio-14	SE of WP5 ~50 m?	-14.89831	-173.94227	2678.8	S105-bio-14-GAL1	1	Chirostylid	95% EtOH; RNALater; frozen; dried	Galatheid

4.6 Mapping

4.6.1 AUV Sentry Dives – Leg 1 – Multibeam mapping and photo surveys

Bill Chadwick and Susan Merle

The primary goal of the AUV Sentry dives was to collect multibeam sonar data on Leg 1 in areas where we planned to make ROV SuBastian dives on Leg 2. These areas included recent eruption sites on West Mata Seamount and active hydrothermal vent fields on Mata Fitu, Mata Tolu and Mata Ua. Secondary goals included taking near-bottom photographs in selected areas for ground truth and recording MAPR data on Sentry for the purpose of hydrothermal plume mapping along the near-bottom sonar and photo-transect tracklines. The Sentry MAPR data will be described in a separate section.

The mobilization of Sentry on R/V Falkor was challenging because of high traffic and limited space at the pier in Apia, Samoa. The Falkor had to move off the pier prior to the arrival of the Sentry team and couldn't get back to load the Sentry vehicle on board for a couple days after the planned cruise start date. The decision was made to go to the work site for ship-based multibeam surveys and then return to Apia to get Sentry 1.5 days later. Once Falkor was able to get to the pier, the mobilization proceeded quickly.

The Sentry dives for multibeam sonar mapping were conducted such that: (1) the survey altitude was 65-70 meters for ~1.5 meter lateral resolution, (2) the survey speed was ~1.8 knots, (3) dive durations were between 17-23 hours, with turn-arounds of 12-16 hours in between dives, (4) AUV Sentry was within acoustic communication range for navigation most of the time, and (5) a battery powered and internally recording PMEL MAPR instrument was mounted on Sentry for all dives.

There were six Sentry science dives on Leg 1 (457, 458, 460, 461, 462, and 463), plus one short (6hr) engineering dive (459). The first 3 dives were at West Mata (summit, NE and SE) the next 2 dives were at Mata Fitu, and Mata Tolu/Ua, and the last dive was at West Mata SW. However, only the first three of the dives collected high-quality bathymetry data. On the remaining three dives, problems with the primary Reson sonar and then the back-up sonar prevented successful multibeam data acquisition, which was disappointing. The primary sonar stopped working after about 90% of the planned mapping on dive 460 (~10% lost). The secondary sonar was then put on the vehicle and worked for about the first 15% of the survey planned on dive 461, but then also failed and the remaining ~85% of the survey was lost. Neither sonars were on the vehicle for dive 462, because troubleshooting and attempted repairs were still being conducted on both of them on the ship. The primary sonar was placed back on the AUV for dive 463, but only collected very noisy data that were far below the usual mapping quality, so were only marginally useful (and only after heroic post-dive editing on shore by the Sentry group). On the bright side, the mapping data for the first three dives were excellent.

Photo surveys were conducted on dives 458, 460, and 463. During dives 458 and 460 the photo surveys were short reconnaissance transects over areas of depth change between ship-based multibeam surveys. The dive 463 survey was more extensive due to the unlikely possibility of a working sonar. The image quality, although slightly dark, was sufficient for identifying seafloor features (e.g., young vs. old lava flows) and aided in planning subsequent ROV dives.

Sentry Dive Summaries

Sentry Dive 457

This dive surveyed West Mata Summit and the upper NE and SW rifts. The Sentry AUV multibeam surveys aimed, in part, to resurvey areas that had been mapped with the MBARI AUV *D. Allan B.* in 2009. The 2017 Sentry survey targeted the recent eruption sites at the summit and on the upper parts of both rift zones that had previously been identified as depth changes from repeated ship-based multibeam surveys. This survey also provided a valuable base-map for exploration and sampling with ROV SuBastian dives S85, S87, and S103.

Sentry Dive 458

This dive mapped two separate recent eruption sites on the NE flank of West Mata, and the lower part of the NE rift zone. Both eruption sites had been identified from depth changes between ship-based multibeam surveys in 2011-2016. The first site was a ridge of pillow lavas on the steep NE slope, and the second was located at the deep NE base of the volcano. The latter site was affectionately nicknamed “the muffin”, because the Sentry survey revealed that lava had apparently intruded into sediments, domed them upward, and then lava erupted onto the seafloor around the and cracked mound of uplifted sediment. One photo transect was collected over the NE flank pillow ridge and another was run over “the muffin” and surrounding lava flows.

Sentry Dive 460

Dive 460 was conducted on the SE side of West Mata and started at the SW base of East Mata where a possible area of depth change between ship-based surveys was located, but a photo transect there showed only old eroded lava outcrops, indicating it is probably not a recent eruption site. Next Sentry surveyed up the SE flank of West Mata and the middle east rift zone where two areas of depth change had been identified between ship-based multibeam surveys between February 2016 and this cruise (December 2017). Photo transects were run over both areas of depth change. The area on the SE flank appeared to be a very smooth slope in the bathymetry and photos revealed fragmental debris that coarsened upslope and included areas of yellow microbial mats. The area on the middle east rift zone was mapped on Dive 457 and has a distinctive shingled lava flow morphology and the photo survey showed very young pillow lavas that were locally completely covered by thick accumulations of volcanic ash. In places, the ash had collapsed downward, apparently into void space among the buried pillows, forming small circular pits. Some of the pits had yellow microbial mat floc in the bottoms, apparently picked up and transported from nearby areas by bottom currents. At first these pits appeared to have positive relief in the Sentry photos, so were very confusing until the third dimension was revealed during ROV SuBastian dives. After the last photo transect, Sentry collected multibeam bathymetry over the middle NE rift zone, connecting the data surveyed on dive 457 and 458. The primary sonar failed near the end of this dive.

Sentry Dive 461

This dive attempted to map the summit of Mata Fitu, but the back-up multibeam sonar also failed after the first few tracklines were completed. Nevertheless, many old and a few active hydrothermal vent chimneys were revealed in the new bathymetry in the SE part of the survey. Unfortunately, the multibeam sonar died before the previously known hydrothermal vent field at Mata Fitu could be mapped.

Sentry Dive 462

Dive 462 was conducted between the summits of Mata Tolu and Mata Ua (both North Matas). Unfortunately neither multibeam sonars were on board for this dive since they were both being worked on the ship. Sentry only collected sensor data on this dive.

Sentry Dive 463

The final Sentry dive was along the lower SW rift zone of West Mata. The primary multibeam sonar was back on the vehicle after an attempted repair, and it did collect some data, but it was far noisier than usual, and so it was not very useful, despite a heroic attempt to edit the data by the Sentry team on shore. The Sentry tracklines during dive 463 crossed over two areas of depth change detected between ship-based multibeam surveys. The deepest one was at the base of West Mata’s SW rift and appeared between surveys in May 2010 and November 2011. The other area, just to the east, appeared between surveys in June 1996 and November 2008. The latter area of depth change is at the western edge of the area mapped by the MBARI Mapping AUV in May 2009, and so was probably a post-eruption survey. Photo survey lines were collected over both of the areas of depth change at the end of the dive. The photos confirmed that both areas of depth change appeared to be recent eruption sites.

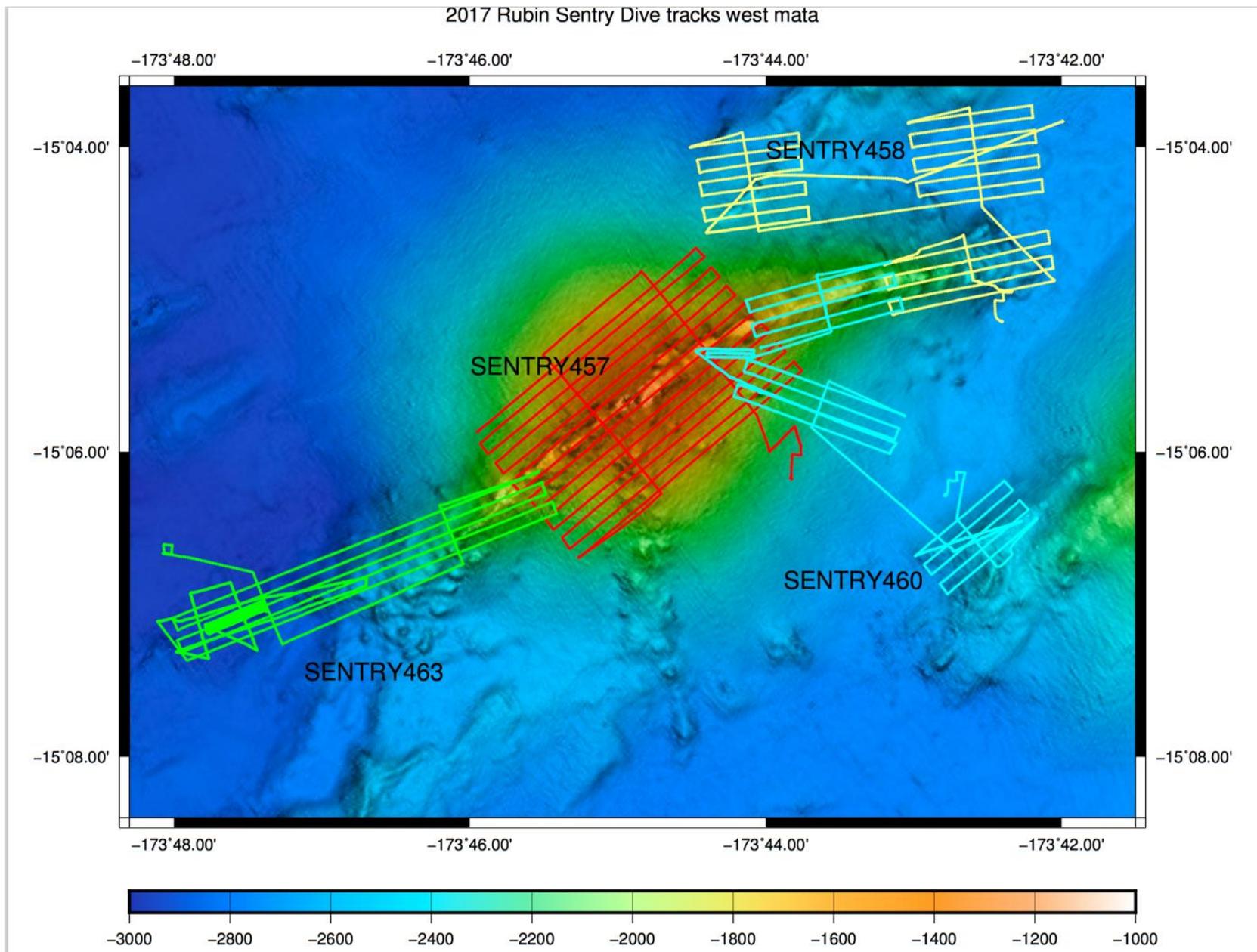


Figure 4.6.1-1 Map of tracklines from AUV Sentry dives 457, 458, 460, and 463 at West Mata volcano.

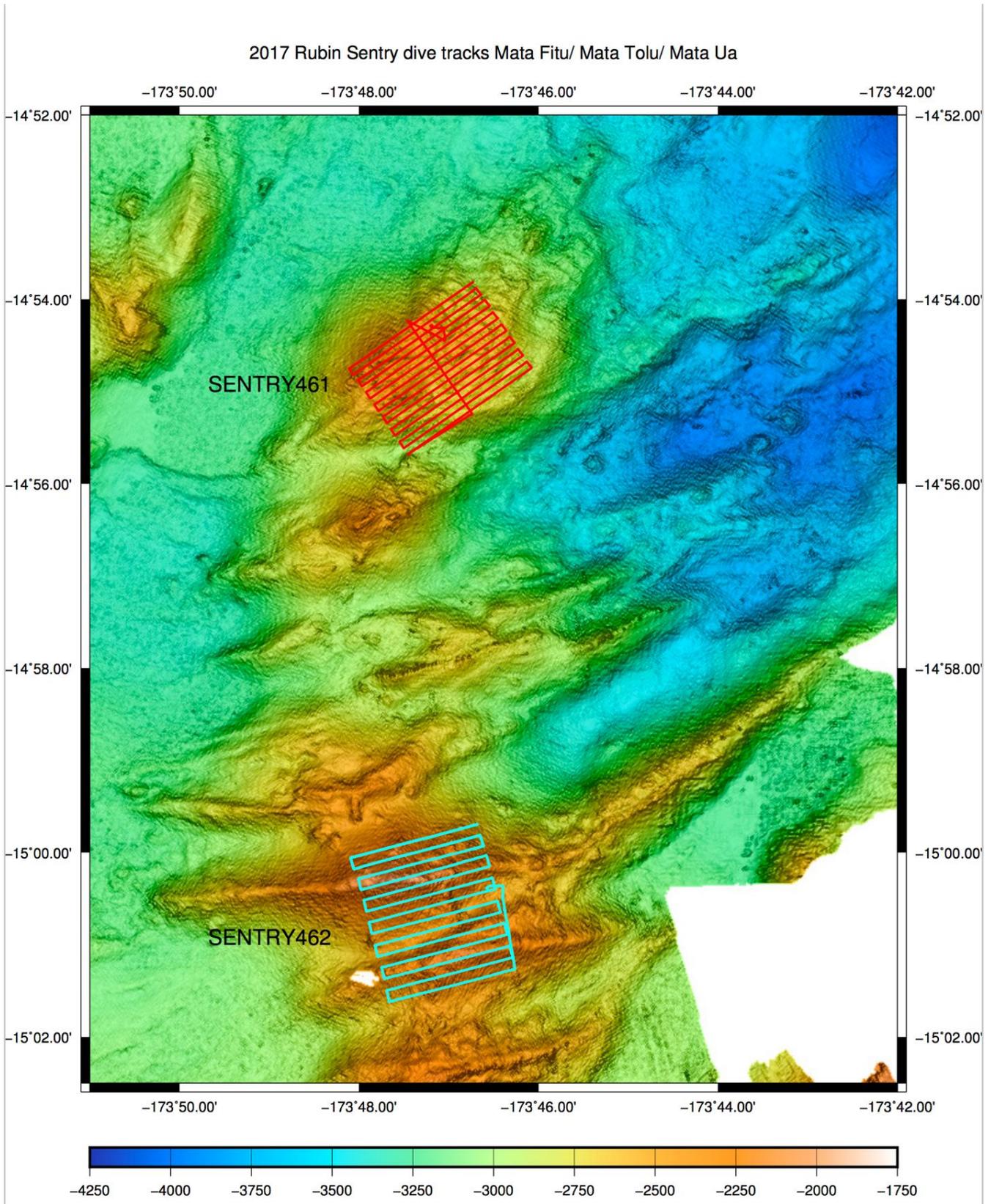


Figure 4.6.1-2 Map of tracklines from AUV Sentry dives 461 and 462 at Mata Fitu, Mata Tolu, and Mata Ua.

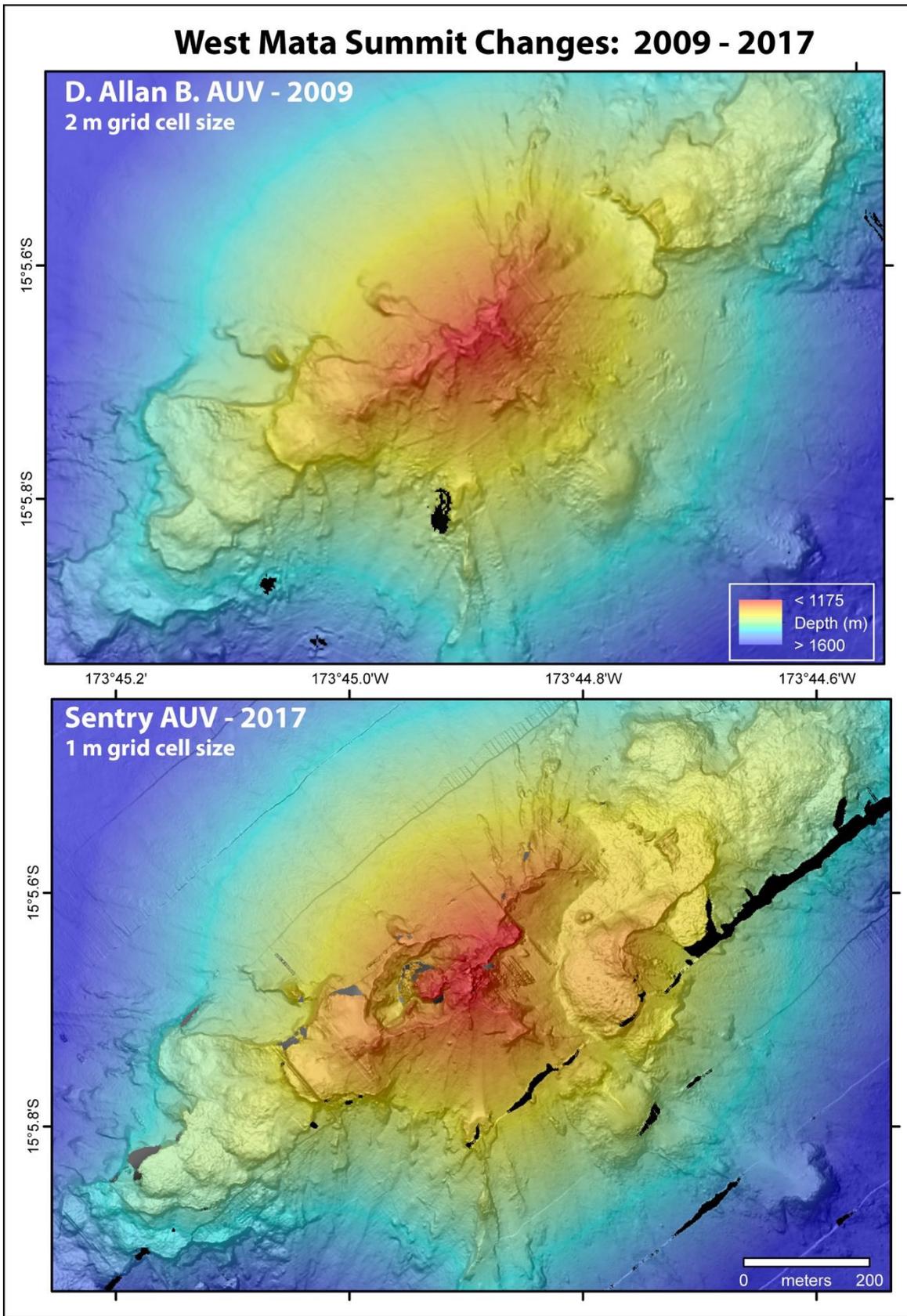


Figure 4.6.1-3 Maps of AUV surveys at West Mata summit in 2009 and 2017, revealing depth changes.

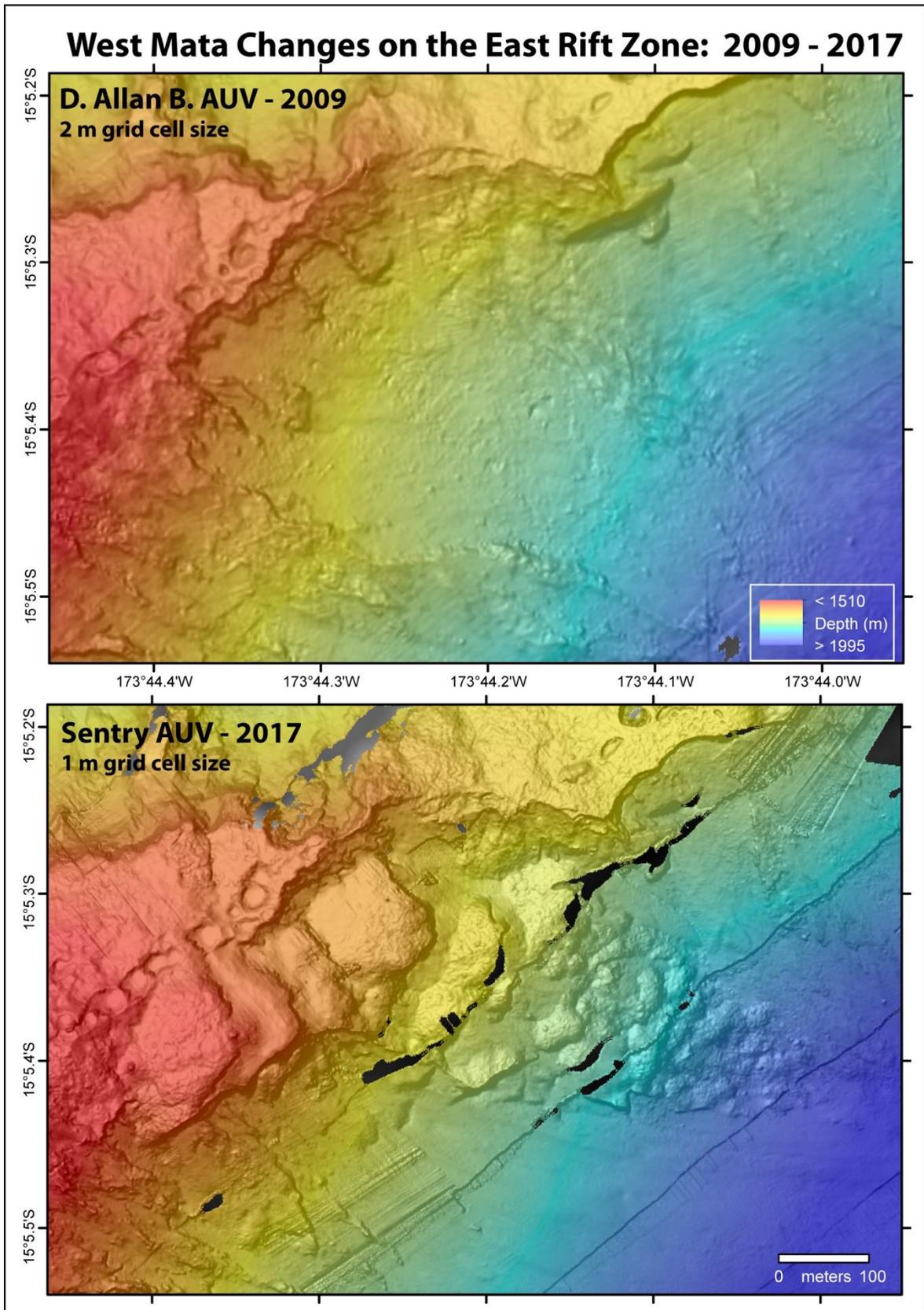


Figure 4.6.1-4 Maps of AUV surveys at West Mata east rift in 2009 and 2017, revealing depth changes.

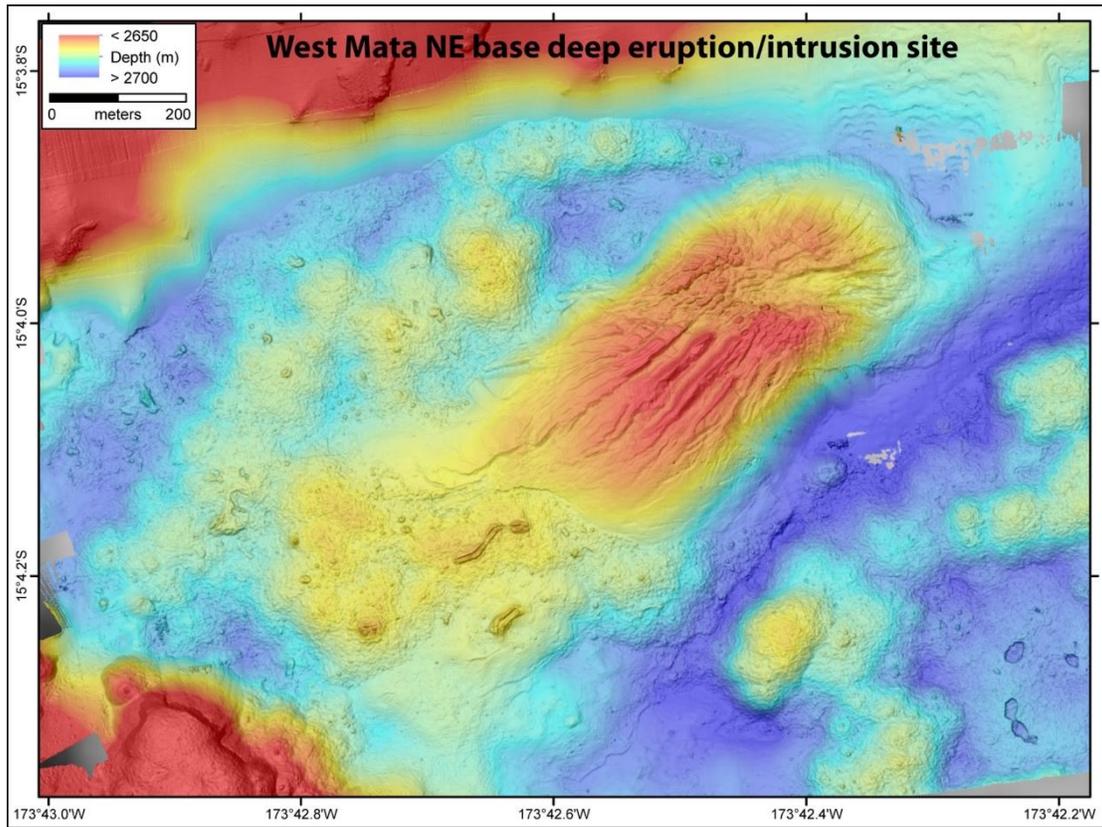


Figure 4.6.1-5 Map of Sentry AUV bathymetry (dive 458) of “the muffin” at the NE base of West Mata, the area of uplifted sediments (red area at center with cracks) due to intrusion of lava below, which later erupted on the seafloor to the W and S (light blue and yellow areas with rougher texture).

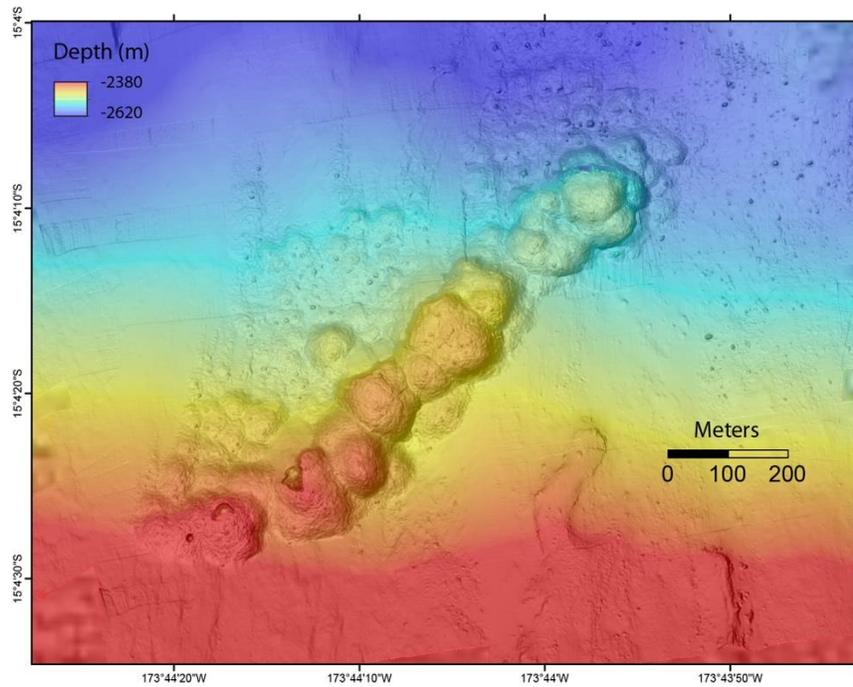
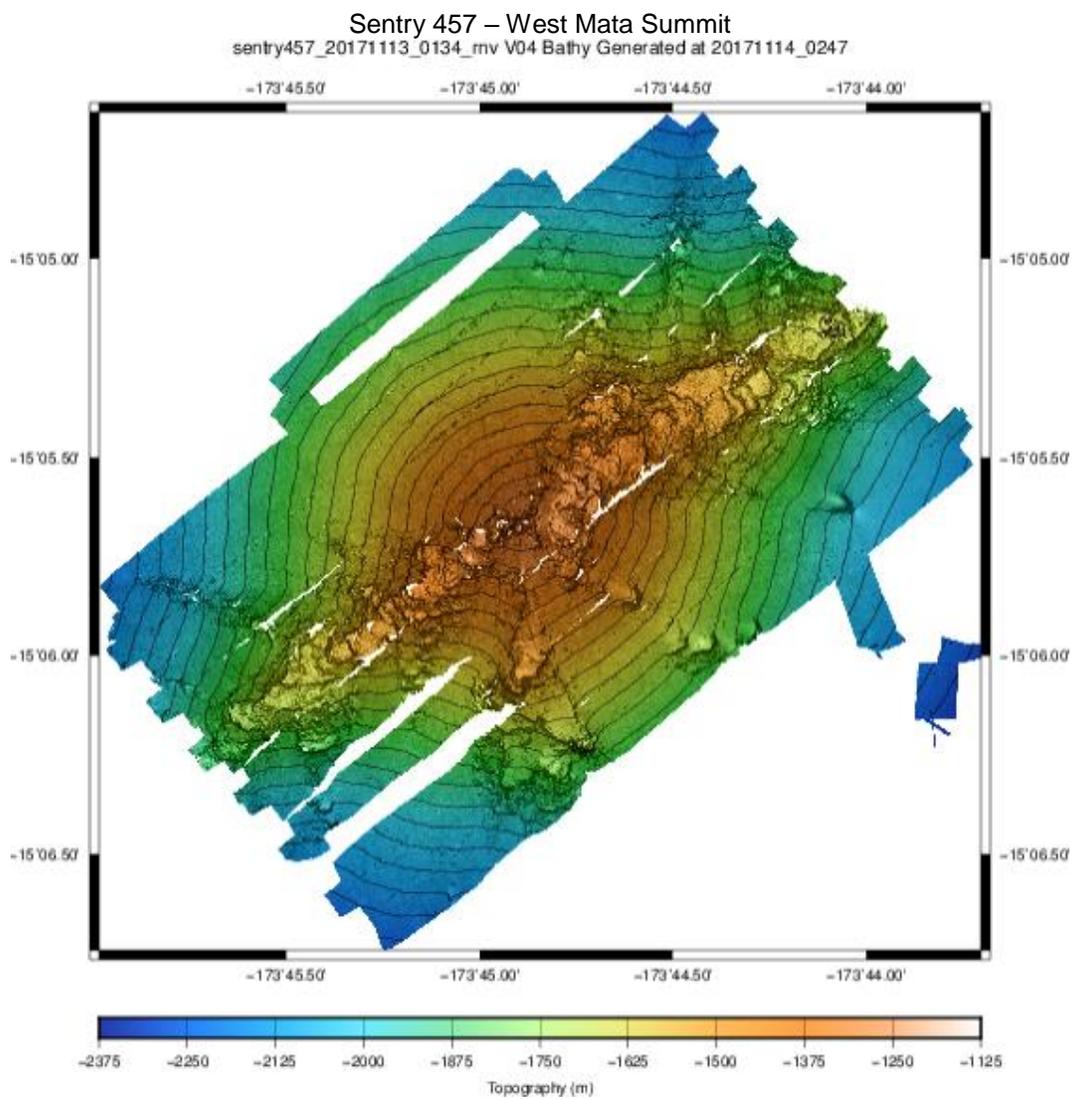


Figure 4.6.1-6 Map of Sentry AUV bathymetry (dive 458) of the young pillow ridge on the NE slope of West Mata that appeared as depth changes between 2011-2016 ship-based bathymetric surveys.

Sentry Dive Statistics

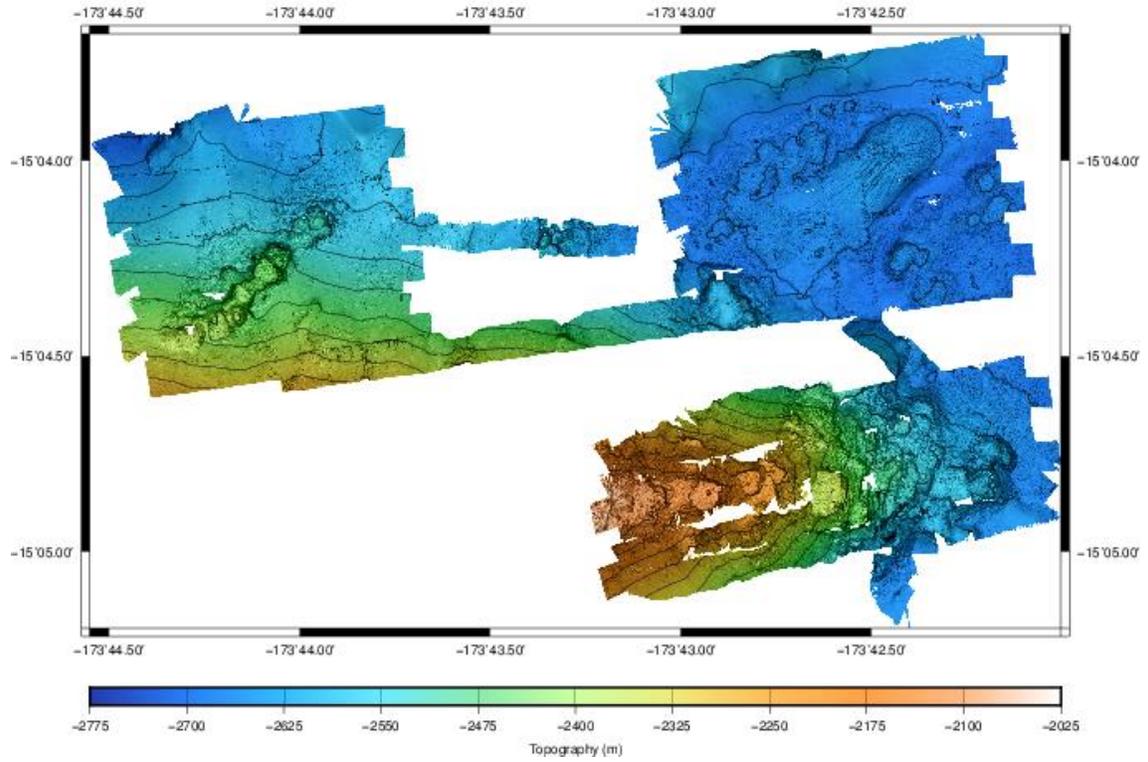
Sentry Dive Statistics					
Dive number	Start Time (GMT)	End Time (GMT)	Survey Time hours	Deck-to-Deck hours	Distance Travelled (km)
Sentry 457	11/11/2017 22:01	11/12/2017 20:07	19.9	22.3	60.14
Sentry 458	11/13/2017 09:44	11/14/2017 04:24	16.4	18.7	49.57
Sentry 460	11/15/2017 04:43	11/15/2017 22:35	15.8	17.9	42.30
Sentry 461	11/16/2017 09:20	11/17/2017 04:15	16.5	18.9	52.62
Sentry 462	11/18/2017 01:08	11/18/2017 17:50	14.5	16.7	41.67
Sentry 463	11/19/2017 02:12	11/20/2017 00:19	19.5	22.1	47.75
Totals			102.6	116.6	294.05

Sentry Dive Bathymetry Maps



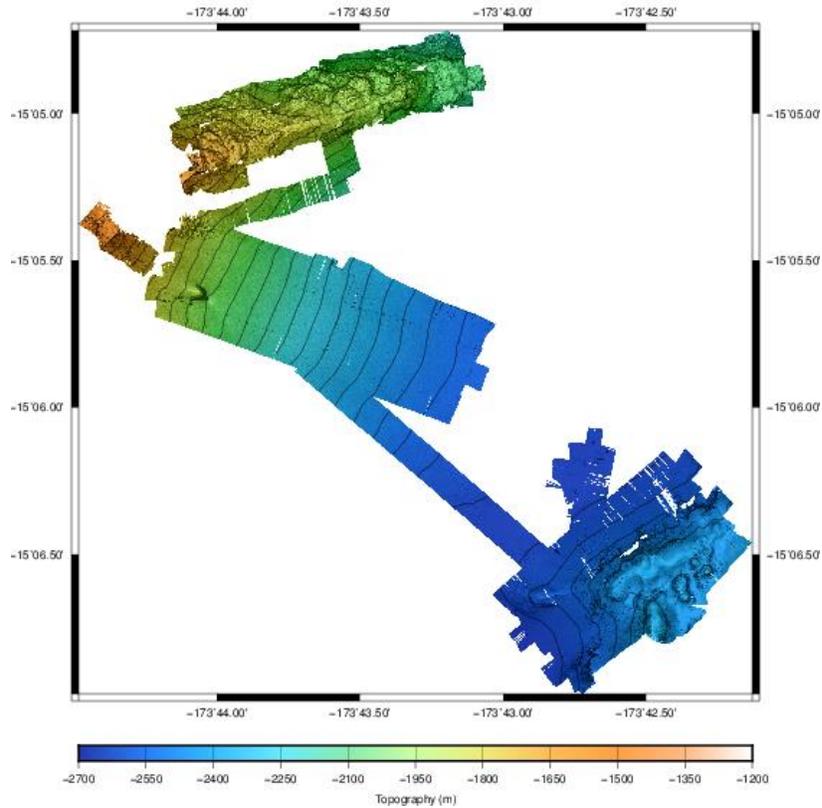
Sentry 458 – West Mata – NE Flank, NE Base, and Lower NE Rift

sentry458_20171114_0544_mv V01 Bathymetry Generated at 20171114_0617



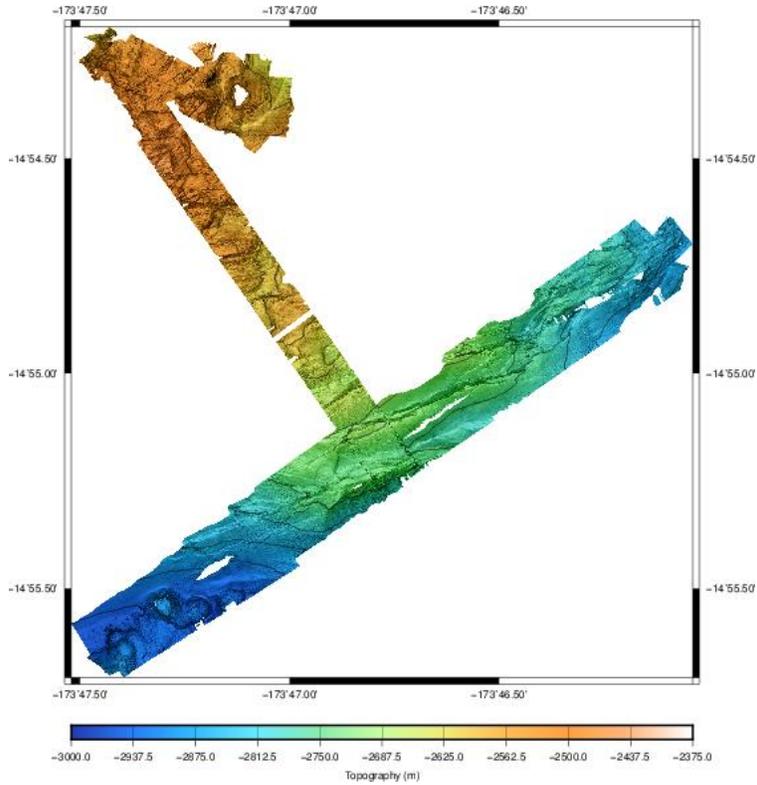
Sentry 460 – West Mata SE Flank and middle NE Rift

sentry460_20171115_2326_mv V03 Bathymetry Generated at 20171116_0632



Sentry 461 – Mata Fitu

sentry461_20171117_0517_mv V01 Bathymetry Generated at 20171117_0529



Sentry Dive Photos

sentry.20171114.011056618251.131.tif 2017/11/14 01:10:56 UTC
Lot: -15.07417866 Lon: -173.73827377 Depth: 2364.52 Alt: 5.96 Hdg: 47.73
TEMP: 1.98 SAL: 34.64 OPT: 154.76 ORP: 4.924e-07V/s OBS: 0.0094



sentry.20171114.011623281019.201.tif 2017/11/14 01:16:23 UTC
Lot: -15.07292755 Lon: -173.73703536 Depth: 2411.97 Alt: 7.93 Hdg: 45.91
TEMP: 1.98 SAL: 34.64 OPT: 154.28 ORP: 4.112e-05V/s OBS: 0.0112



Photos from Sentry dive 458 (West Mata NE Base) of the young pillow ridge (2012-2016) NE of the summit. (Left) Young intact pillow lavas, (Right) Co-eruption talus accumulated below steep slopes.

sentry.20171114.022412982575.585.tif 2017/11/14 02:24:12 UTC
 Lot: -15.07015635 Lon: -173.71644371 Depth: 2683.55 Alt: 6.64 Hdg: 68.45
 TEMP: 1.86 SAL: 34.65 OPT: 154.19 ORP: 3.132e-05V/s OBS: 0.0113



sentry.20171114.022812979633.642.tif 2017/11/14 02:28:12 UTC
 Lot: -15.06975331 Lon: -173.71532850 Depth: 2672.00 Alt: 5.85 Hdg: 69.30
 TEMP: 1.85 SAL: 34.65 OPT: 154.21 ORP: -3.801e-05V/s OBS: 0.0091

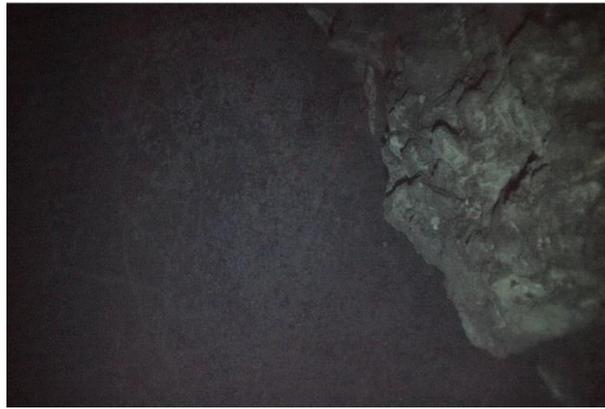


Photos from Sentry dive 458 (West Mata NE Base) of (left) young lava flows (2012-2016) that erupted around the uplifted sediment (“the muffin”), and (right) lavas had ash-laden sediment and prominent ripple marks, suggesting co- or post-eruption density currents.

sentry.20171114.023736306076.778.tif 2017/11/14 02:37:36 UTC
 Lot: -15.06876466 Lon: -173.71269773 Depth: 2663.98 Alt: 6.28 Hdg: 70.69
 TEMP: 1.85 SAL: 34.65 OPT: 154.40 ORP: -3.102e-06V/s OBS: 0.0130



sentry.20171114.025431515755.1003.tif 2017/11/14 02:54:31 UTC
 Lot: -15.06677236 Lon: -173.70752405 Depth: 2644.43 Alt: 6.93 Hdg: 68.74
 TEMP: 1.86 SAL: 34.65 OPT: 154.87 ORP: 2.36e-05V/s OBS: 0.0181

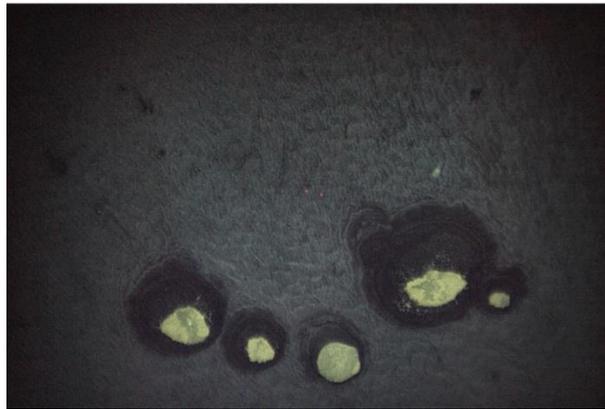


Photos from Sentry dive 458 (West Mata NE Base) showing (left) ash-laden ripple marks on the uplifted sediment (“the muffin”), and (right) the edge of a fissure atop the uplifted sediment.

sentry.20171115.165425314485.2691.tif 2017/11/15 16:54:25 UTC
 Lot: -15.08923572 Lon: -173.73468945 Depth: 1821.29 Alt: 5.39 Hdg: 189.03
 TEMP: 2.48 SAL: 34.60 OPT: 157.24 ORP: 1.432e-05V/s OBS: 0.0055



sentry.20171115.163855314567.2487.tif 2017/11/15 16:38:55 UTC
 Lot: -15.08878597 Lon: -173.73858122 Depth: 1564.24 Alt: 5.19 Hdg: 94.79
 TEMP: 2.81 SAL: 34.57 OPT: 157.54 ORP: -3.372e-05V/s OBS: 0.0054



Photos from Sentry dive 460 (West Mata middle NE Rift) showing (left) young pillow lavas erupted between 2016-2017, and (right) ash cover with pits and yellow microbial mat.

sentry.20171115.144947872613.1329.tif 2017/11/15 14:49:47 UTC
Lot: -15.09785779 Lon: -173.72195145 Depth: 2486.50 Alt: 5.50 Hdg: 300.05
TEMP: 1.96 SAL: 34.64 OPT: 155.07 ORP: -3.953e-06V/s OBS: 0.0105



sentry.20171115.154253650330.2012.tif 2017/11/15 15:42:53 UTC
Lot: -15.09379898 Lon: -173.73251427 Depth: 2039.89 Alt: 6.77 Hdg: 297.59
TEMP: 2.27 SAL: 34.62 OPT: 155.99 ORP: -0.0001954V/s OBS: 0.0055



Photos from Sentry dive 460 (West Mata SE Slope) of (left) fragmental debris making up area of depth change (2016-2017), (right) with staining from microbial mat in some places.

sentry.20171119.142706004388.73.tif 2017/11/19 14:27:06 UTC
Lot: -15.11834305 Lon: -173.80072613 Depth: 2963.07 Alt: 5.91 Hdg: 78.95
TEMP: 1.70 SAL: 34.66 OPT: 159.06 ORP: -1.451e-05V/s OBS: 0.0093

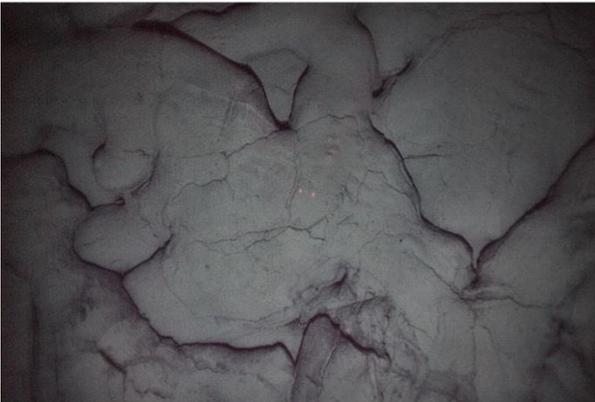


sentry.20171119.142939335942.110.tif 2017/11/19 14:29:39 UTC
Lot: -15.11829547 Lon: -173.79995294 Depth: 2965.90 Alt: 5.26 Hdg: 136.45
TEMP: 1.70 SAL: 34.66 OPT: 159.08 ORP: -1.16e-05V/s OBS: 0.0084



Photos from Sentry dive 463 (West Mata SW Base) showing (left) older knobby lava flow, and (right) the overlying younger (2010-2011) lava flow with local hydrothermal staining.

sentry.20171119.143116001443.135.tif 2017/11/19 14:31:16 UTC
Lot: -15.11850456 Lon: -173.79959552 Depth: 2955.26 Alt: 5.99 Hdg: 105.21
TEMP: 1.70 SAL: 34.66 OPT: 159.04 ORP: -3.153e-05V/s OBS: 0.0091



sentry.20171119.144801789195.364.tif 2017/11/19 14:48:01 UTC
Lot: -15.11730532 Lon: -173.79494308 Depth: 2946.95 Alt: 8.93 Hdg: 79.85
TEMP: 1.72 SAL: 34.66 OPT: 158.23 ORP: 2.299e-05V/s OBS: 0.0073



Photos from Sentry dive 463 (West Mata SW Base) showing (left) fluid lobes of the young (2010-2011) lava flow, and (right) the edge of an uplifted tumulus in the young flow.

4.6.2 R/V Falkor EM302 Multibeam Mapping

Susan G. Merle

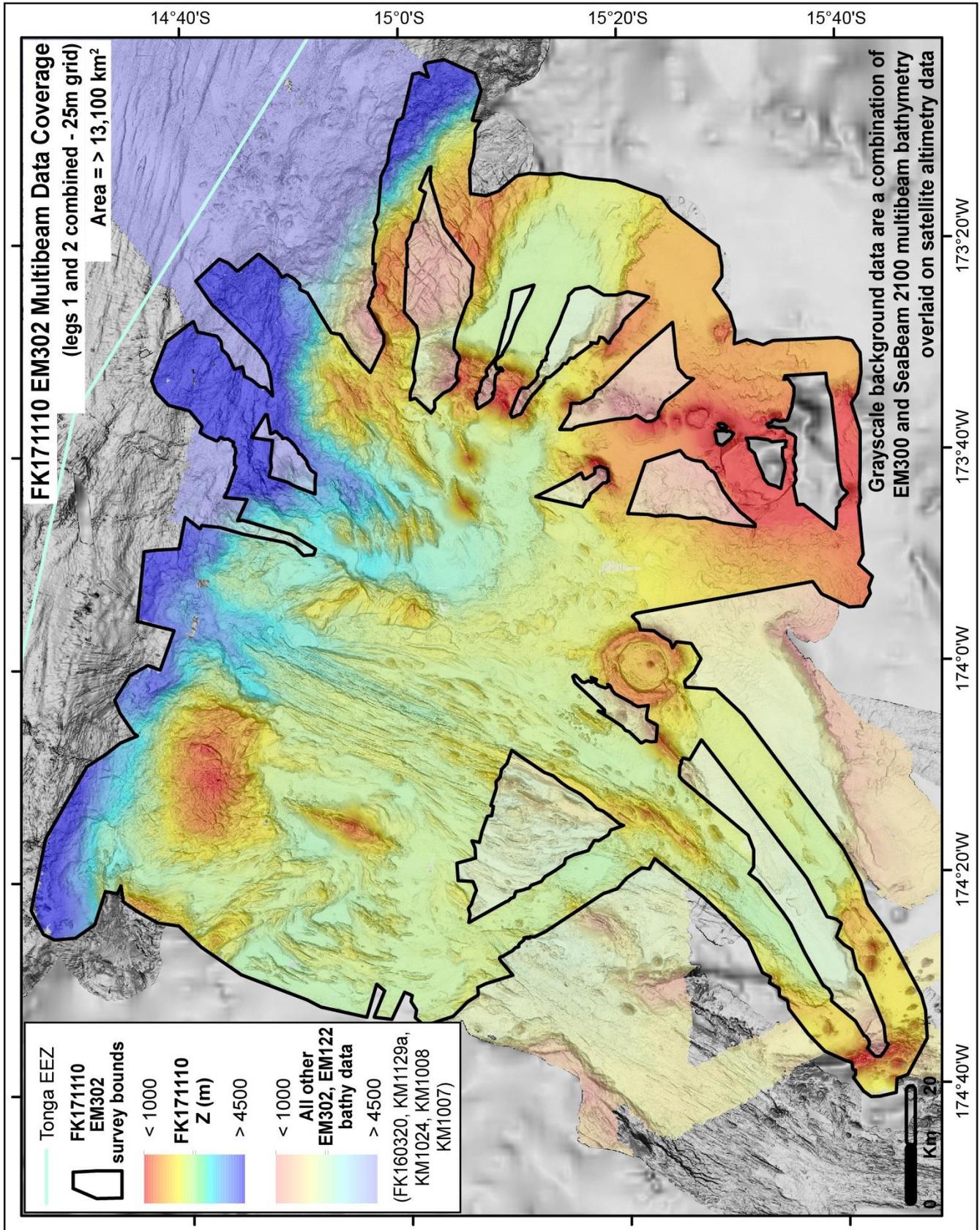


Figure 4.6.2-1 EM302 Multibeam coverage of the area.

Mapping with the R/V *Falkor* EM302 multibeam system was conducted between other operations on leg 1 (CTD casts, tows, Sentry dives) and leg 2 (ROV Subastian dives). Time did not allow us to venture too far away from our general operations area, so after we had mapped all previously unmapped areas, we decided to focus our efforts on mapping over older, lower-quality EM300 and SeaBeam 2100 data in the NE Lau basin area. The new EM302 and EM122 systems have nearly 4 times as many soundings per ping when compared to the older EM300 system (432 vs. 135), justification for the re-survey with the newer EM302 system. There were five EM302 and EM122 surveys in the area over the past several years: FK160320, KM1129a, KM1024, KM1008 and KM1007. The *Falkor* 2017 effort was to edge-map around those datasets, filling in gaps between those surveys. An area greater than 13,100 km² of the seafloor was mapped on the FK171110 expedition. Data were generally good, especially at survey speeds of 8 knots and less. Predictively, the data were noisier as ship speed increased or the weather degraded. Raw and processed multibeam data are available at NCEI, formerly NGDC.

Depth Differencing

West Mata and the Northeast Lau Spreading Center (NELSC) were re-mapped to compute bathymetric depth differences between the FK171110 survey and previous surveys.

West Mata

Using water column and gas data, an eruption at West Mata was first discovered during the November 2008 expedition (TN227). Subsequent multibeam surveys have revealed a number of eruptions at the volcano over the next decade. See Embley et al. 2014 for information regarding all depth differences computed between June 1996 and November 2011 at West Mata. A survey in March 2016 (FK160320) was compared to the 2011 data and new lava flows were discovered near the summit and at the N/NE base of the edifice. West Mata was surveyed again at the start of the FK171110 expedition. When comparing the 2017 bathymetry to data collected the previous year on FK160320, two new areas of depth change were discovered, one on the middle east rift zone (over 70 m thick) and the other downslope to the southeast (over 30 m thick). The east rift depth change was confirmed as a new eruption site by AUV Sentry and ROV SuBastian dives. The downslope area covered with fragmental debris was more enigmatic. It could be debris shed from the east rift eruption site. West Mata was surveyed two more times during the six week expedition. No new areas of depth change were detected between the start and end of the 2017 expedition, indicating there was no eruptive activity while we were there.

Tafu, Northeast Lau Spreading Center (NELSC)

Using water column and gas data, an eruption at NELSC was discovered during the November 2008 expedition (TN227). During the following May 2009 rapid-response expedition (TN234) the Jason ROV discovered young, sediment-free, glassy lava with no sessile organisms at the “Puipui” eruption site. The 2009 multibeam data were also compared to bathymetry collected earlier by the Koreans in 2006, and an area of depth change was discovered on the north rift zone of Tafu Cone (a small volcano on the NELSC, N of the “Puipui” site). The NELSC and surrounding area were re-surveyed during the FK171110 expedition. Prior to the 2017 expedition, the last multibeam survey at NELSC was in May 2010 (KM1008). FK171110 bathymetry data were compared to the 2010 data and two new areas of depth change were discovered, one on the north rift zone of Tafu, and one on the south rift zone. The larger lava flow on the south rift zone had a maximum thickness of 108 m.

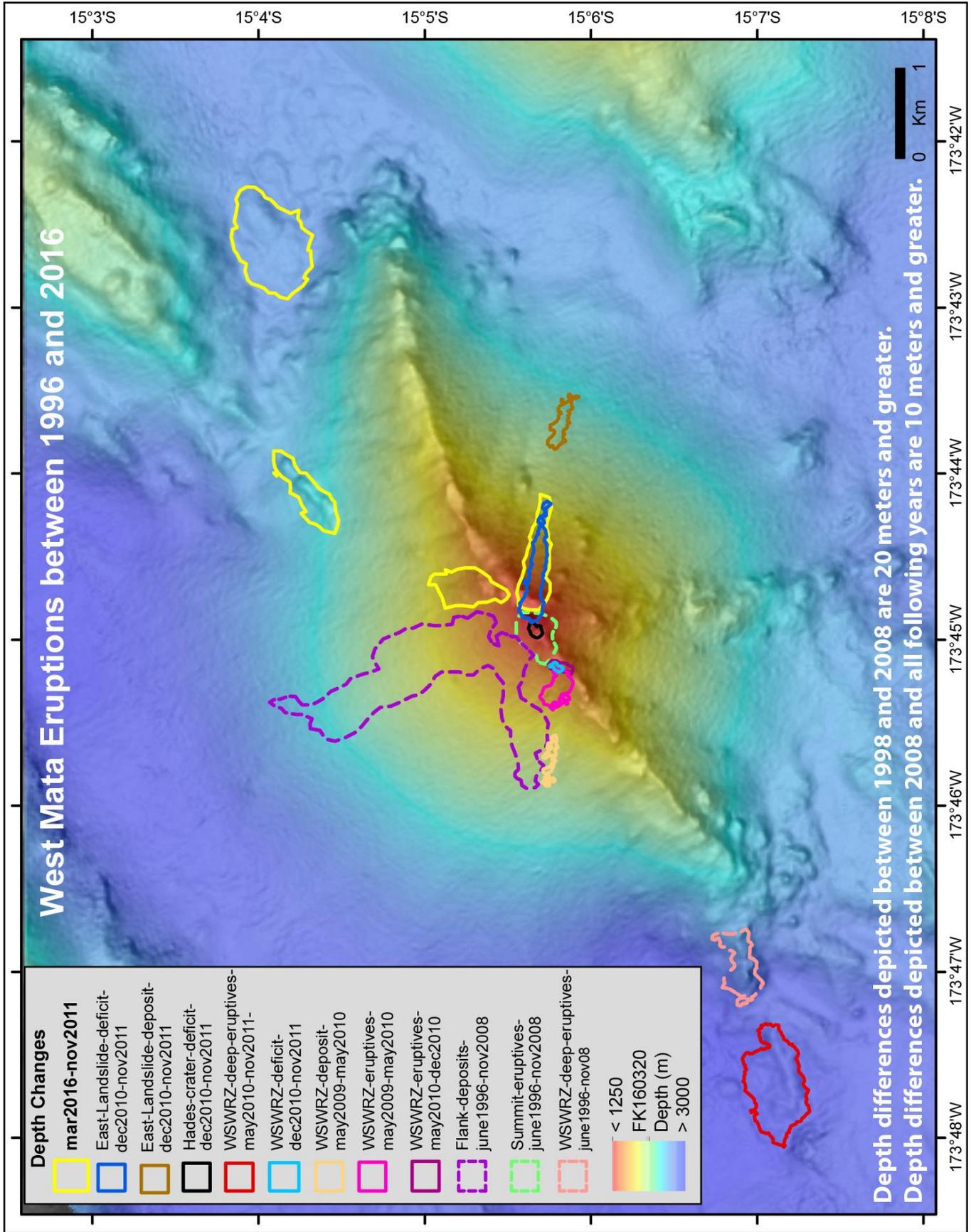


Figure 4.6.2-2 West Mata depth differences showing eruptions.

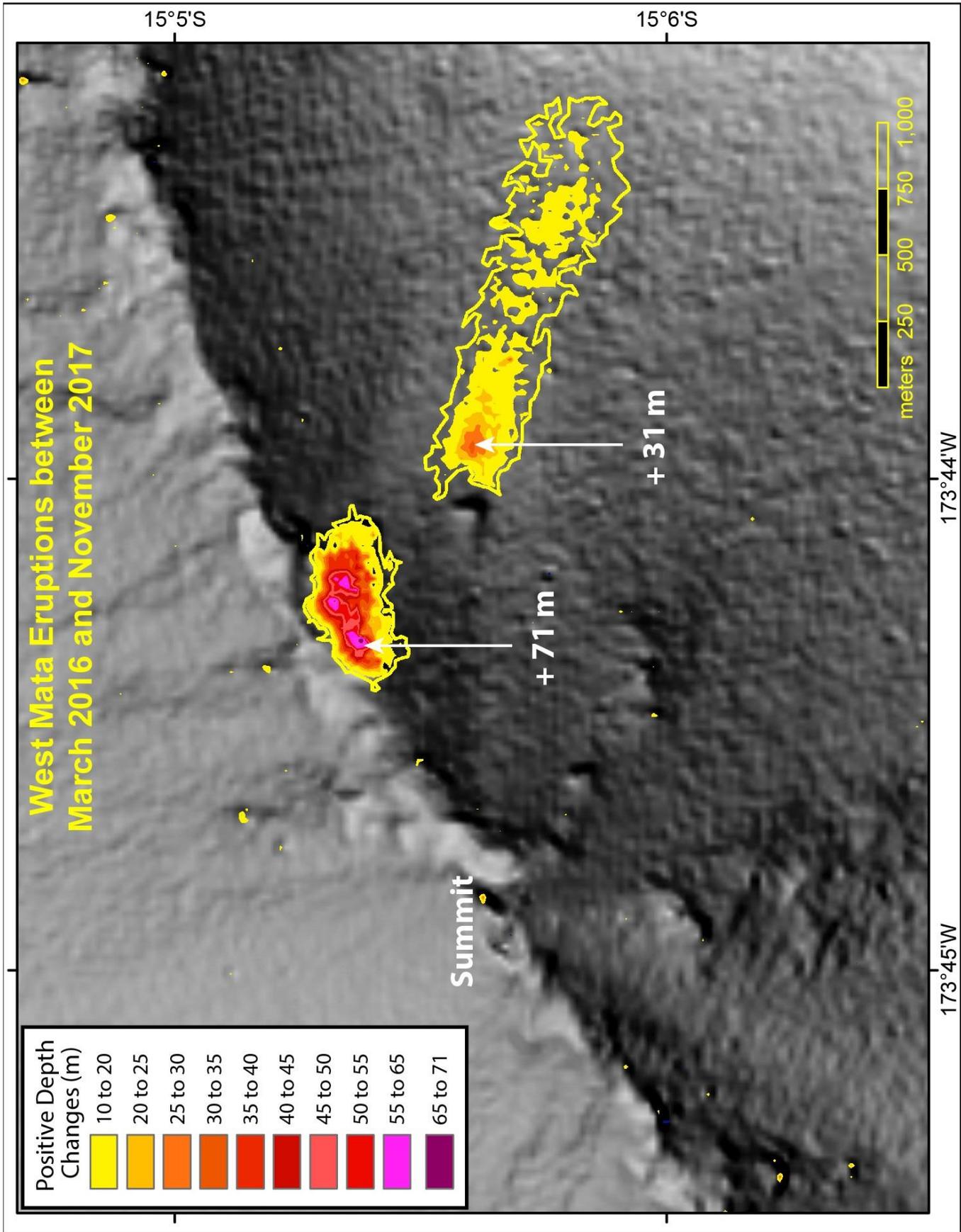


Figure 4.6.2-3 West Mata eruptions between March 2016 and November 2017.

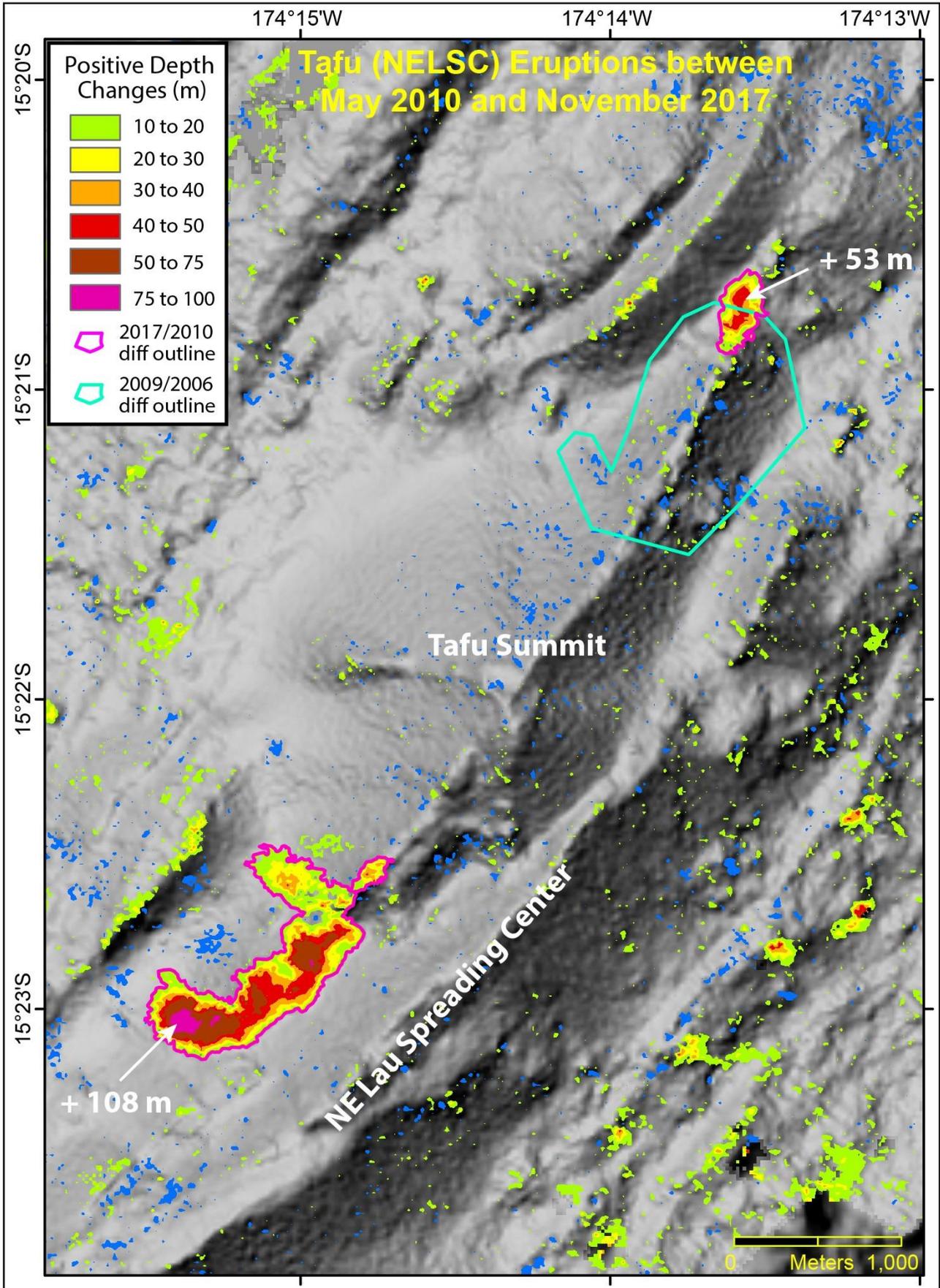


Figure 4.6.2-4 Tafu depth differences and eruptions.

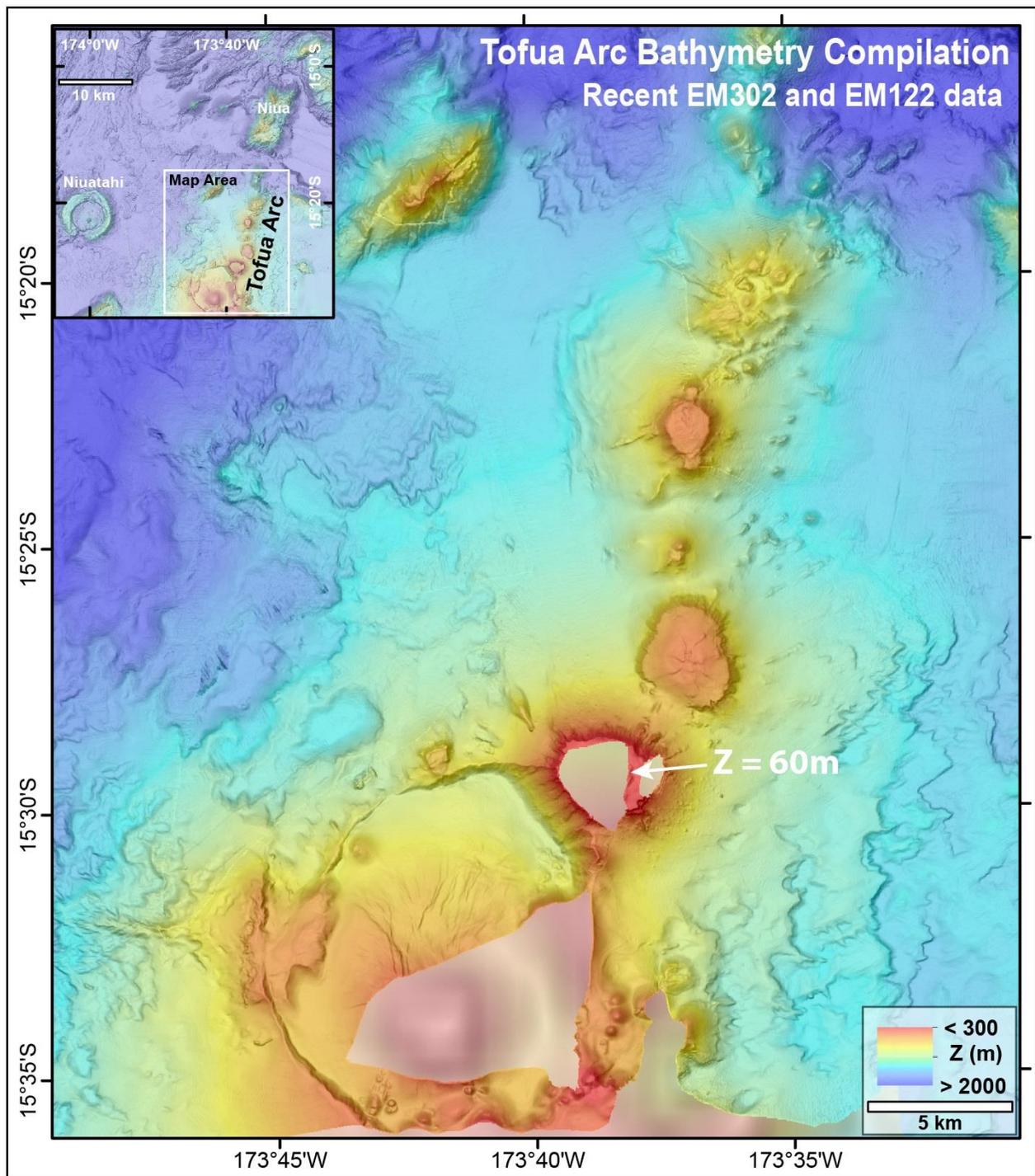


Figure 4.6.2-5 Tofua Arc multibeam bathymetry compilation.

A concerted effort was made to map more of the active Tofua arc during the 2017 expedition. Prior to the FK160320 survey, only satellite altimetry data were available at 750 m grid-cell size on the northern arc (with the exception of Niua). The FK171110 expedition appended the 2016 data moving farther south along the arc. A stunning large caldera was discovered (bottom of image) that is at least 14 kilometers across. Concern about the possibility of unmapped shoals in the area prohibited mapping the entire structure with R/V Falkor.

4.7 Outreach

Bill Chadwick

Our on-board videographer and outreach coordinator this year was Mónica González from a company called Luma (<https://luma.co.cr/>). She wrote or solicited all the posts to the cruise blog on the Schmidt Ocean Institute web site:

<https://schmidtocean.org/cruise/underwater-fire-studying-submarine-volcanoes-tonga/>

and recorded and edited stills and video clips that were posted on the cruise blog. These video clips are also now posted on the EOI YouTube Channel:

<https://www.youtube.com/channel/UCwYal-KFaA52F5IF9IUd9oA>

Ship-to-shore video calls included interactions with students and teachers in several classrooms from Oregon. We also corresponded to several reporters interested in the cruise while at sea, who wrote on-line stories about the cruise, such as this one:

<https://earthier.com/robots-are-now-livestreaming-underwater-volcanoes-for-s-1821051300>

During SuBastian ROV dives, Falkor streamed live video to shore via the SOI YouTube channel, and the video from all of the ROV dives is now archived and available there:

https://www.youtube.com/playlist?list=PLJGVqQI3okzZM9VcE_JWliRcdgxXJL85Y

or here:

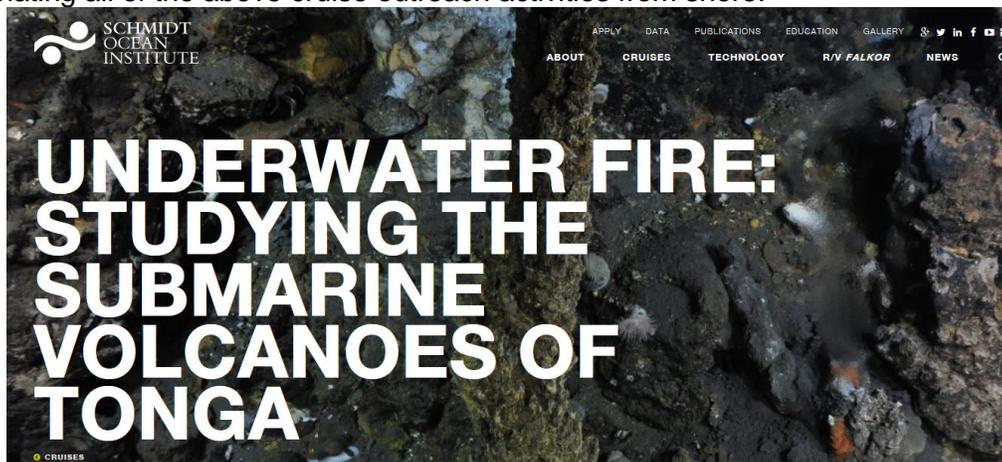
<https://www.youtube.com/user/SchmidtOceanVideos/playlists>

During the dives, as time allowed, we conversed with public viewers all over the world in real-time via live chat on the SOI YouTube channel and/or the SOI Facebook page from the ROV control room on Falkor.

Something new this year was using the web-based software and smart-phone app Slack (slack.com) to enhance communication between the on-board science team and scientific colleagues on shore. This was done by inviting a group of people to use a chatroom or workspace where text, images, and files could be shared, and we conversed in real-time during the dives.

After the cruise, a press release from the Schmidt Ocean Institute was released to highlight the main results and findings.

Carlie Wiener, Victoria Sindorf, and Logan Mock-Bunting (SOI shore-side outreach specialists) were very helpful in coordinating all of the above cruise outreach activities from shore.



5.0 ROV SuBastian data logging, imagery and video recording systems

Bill Chadwick and Andra Bobbitt

Data Logging

During FK171110 – Leg 2, we first attempted to use Squidle+ software for data logging and capturing video frame grabs during ROV *SuBastian* dives. Squidle+ was developed for annotating photo surveys over coral reefs, and later other capabilities were added for more general scientific logging during ROV dives. Squidle+ had been used on Falkor with SuBastian in September 2017 with many needed changes & improvements identified, and software updates were still being made just before and during our cruise. A major drawback to this was that the software developer was located in Australia and no one on board Falkor was familiar with the software and how it worked to help troubleshoot problems. Squidle+ was used for data logging during the first few ROV dives (S85-S88), but we lost confidence in the software when we noticed that some log entries were missing from the post-dive Squidle+ logs. Fortunately the marine technicians in the control room were also performing some sparse logging in parallel using “Leighton’s logging system”, and this helped us discover and partially recover from the drop-outs in Squidle+. After dive S88, we abandoned Squidle+ for data logging and used Leighton’s logging system exclusively for dives S89-S105. One drawback to Leighton’s system is that it has no integration with the frame-grabbing system. So we continued to run Squidle+ during each dive, but only to capture video frame grabs at 1Hz throughout the dives.

Leighton’s system did have the advantage that a more complete suite of ROV data was logged. ROV navigation positions were recorded for USBL, Sprint and Greensea. Falkor ship positions were included in the spreadsheet as well. ROV CTD data was recorded including pressure converted to depths in meters which proved to be very useful. In total, depths were noted in Leighton logs for Greensea, Sprint, PARO and CTD. PARO was the ROV’s depth recorder and was expected to be the depth utilized during dives for data logging and navigating. Due to depth difference problems noted in the 2016 Mariana SuBastian expedition (FK161129), the 2017 data was analyzed for its relative match with the AUV Sentry bathymetry collected on Leg 1.

Major depth problems were discovered with the Squidle+ logging system, Figure 5-1. The depth recorded was offset from not only the Sentry data but did not match the raw PARO depths provided in a separate file. Squidle+ depths were consistently deeper than Sentry but the raw PARO depth matched within a few meters of Sentry. For dive S088, Leighton’s logging system was operating during sample collection and pilot activities. The depth data from this file showed that the Sprint depth offset (~30m) was the same as the Squidle+ depth offset between Sentry (Fig 5-1 inset for S088). The depths from Sentry, PARO and the CTD were all much more in agreement for this dive (less than a few meters difference). For all of the Squidle+ dives, the depths from the raw PARO file did not match the depths recorded in data logs and offsets increased with dive depth. The evidence would indicate that instead of logging the ROV depths, Squidle+ logged Sprint depth. Offsets were noted during the dives by the data logger and scientist but were complicated by the deterioration of the USBL navigation system. Table 5-1 summarizes the depth discrepancies observed in the data. Once logging was switched to Leighton’s system, depths were more consistent with PARO (logged and raw), CTD and Greensea in agreement and an offset of Sprint ~30m deeper. The exceptions were a 19m average offset (vs. 30m) of Sprint for S091 and subsequent data switching during dives S093-S095. S093 appears to have switched logging PARO at 22:58:34 with Sprint depths, less than half-way through the dive (Fig. 5-1). S094 and S095 had shorter periods of depth data switching.

Navigation varied for each dive and deteriorated once the USBL transducer malfunctioned. Ship’s heading was found to improve navigation in some cases but it was not always possible to optimize heading due to sea conditions. All dives required post-cruise edits but some dives were nearly unrecoverable so sample positions

are questionable. Greensea and USBL positions were almost identical in the logging files and it appeared Greensea was used for the Squidle+ dives so for consistency these were used for the GIS positions.

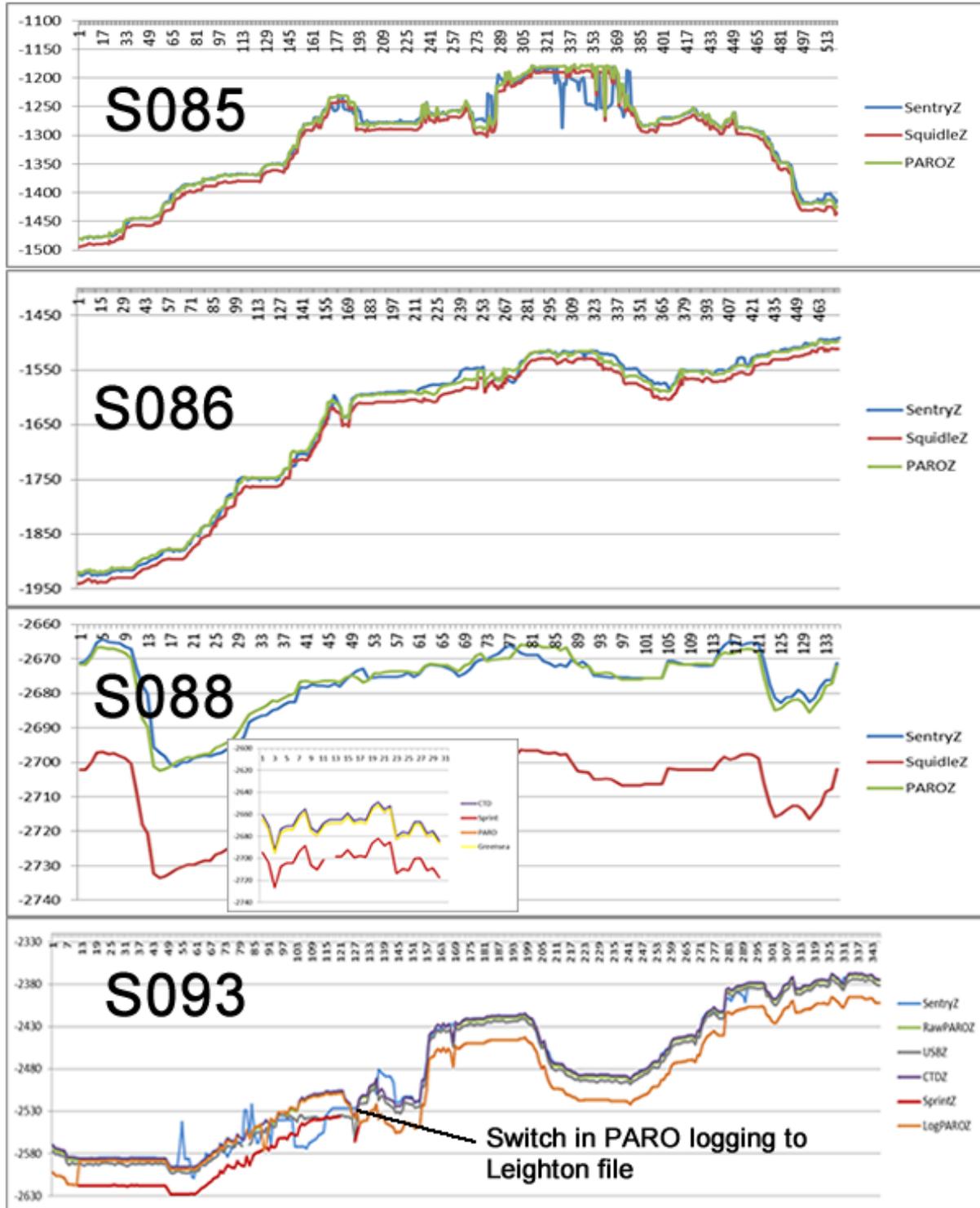


Figure 5-5. Altitude was added to all the depth values for comparison with AUV Sentry depth. The insert for S088 is depth, no altitude and shows the 30m deeper depths of Sprint which were apparently used for Squidle+ as depth. Graph S093 shows depth logged as PARO became offset compared to the raw PARO values at 22:58:34 and remained so for the dive.

Table 5-1 Depth offsets and navigation notes.

Dive	Place	Logging	Nav Quality	Navigation Notes	Depth Notes
S085	WMata	Squidle	ok	bad nav at summit	Squidle depth ~10m deeper than SentryZ; Squidle ~11m deeper than PARO
S086	WMata	Squidle	good	bad nav at some sampling sites	rawPARO+Alt ~1.2m shallower than SentryZ; Squidle ~16m deeper than Sentry; Squidle Z is 15m deeper than Raw Paro Z.
S087	WMata	Squidle	good		Squidle depth ~14m deeper than PARO
S088	WMata	Squidle	bad	Nav bad between samples 5-14	Squidle depth ~30m deeper than SentryZ (Appears that SprintZ was being logged as Z)
S089	Mata Ua	Leighton	good		PARO 2.7m deeper than CTDZ; depths similar (except Sprint)
S090	Mata Fitu	Leighton	bad	Bad after sample 11; ok at beginning	Can't compare Sentry Z due to bad nav; depths similar, PARO 2.8 deeper than CTDZ
S091	Mata Tolu	Leighton	good	Bad at sample-02	(Sprint depth ~19m deeper than others)
S092	Dacite	Leighton	good		CTD depth ~30m shallower than all other depths (including SPRINT which is usually off compared to others).
S093	WMata	Leighton	ok	bad around sample-05	At beginning until 20:24 & 22:45 Sprint & logged "PARO" switch and then offset 30m compared to other depths. PARO*.raw values differ than logged Paro at this point.
S094	Mata Tolu	Leighton	bad	really bad at beginning	Sprint/CTD depths switched and offset again ~10m average: begin-19:29:44
S095	WMata	Leighton	bad	Noisy throughout dive	At 20:29:41 Paro switched and now matches CTD; Greensea switched from Sprint values.
S096	Mata Fa	Leighton	good		Sprint consistently deeper (~30m)
S097	Mata Fitu	Leighton	good		Sprint consistently deeper (~30m); CTD ~2m shallower than Paro; Sentry 461 matches Paro!
S098	South Tafu	Leighton	mixed	Bad after sample-13	22:45-23:02 Greensea/Paro match Sprint, offset from CTD depth.
S099	North Tafu	Leighton	bad	editable	Sprint consistently deeper (~30m)
S100	Mata Ua	Leighton	bad	do not trust any positions	Sprint consistently deeper (~30m)
S101	Mata Ono	Leighton	bad	mainly bad until after sample-11	one small offset at 23:25 where all are same as Sprint except CTD
S102	Mata Ono	Leighton	bad	entire dive is bad	Sprint consistently deeper (~30m)
S103	WMata	Leighton	mixed	bad at beginning/deep & between wp11-13	Sprint consistently deeper (~30m); Sentry ~12m deeper than PARO/CTD
S104	Mata Taha	Leighton	bad	entire dive is shakey	Sprint consistently deeper (~30m)
S105	Dacite	Leighton	bad	entire dive is really bad	Sprint consistently deeper (~30m)

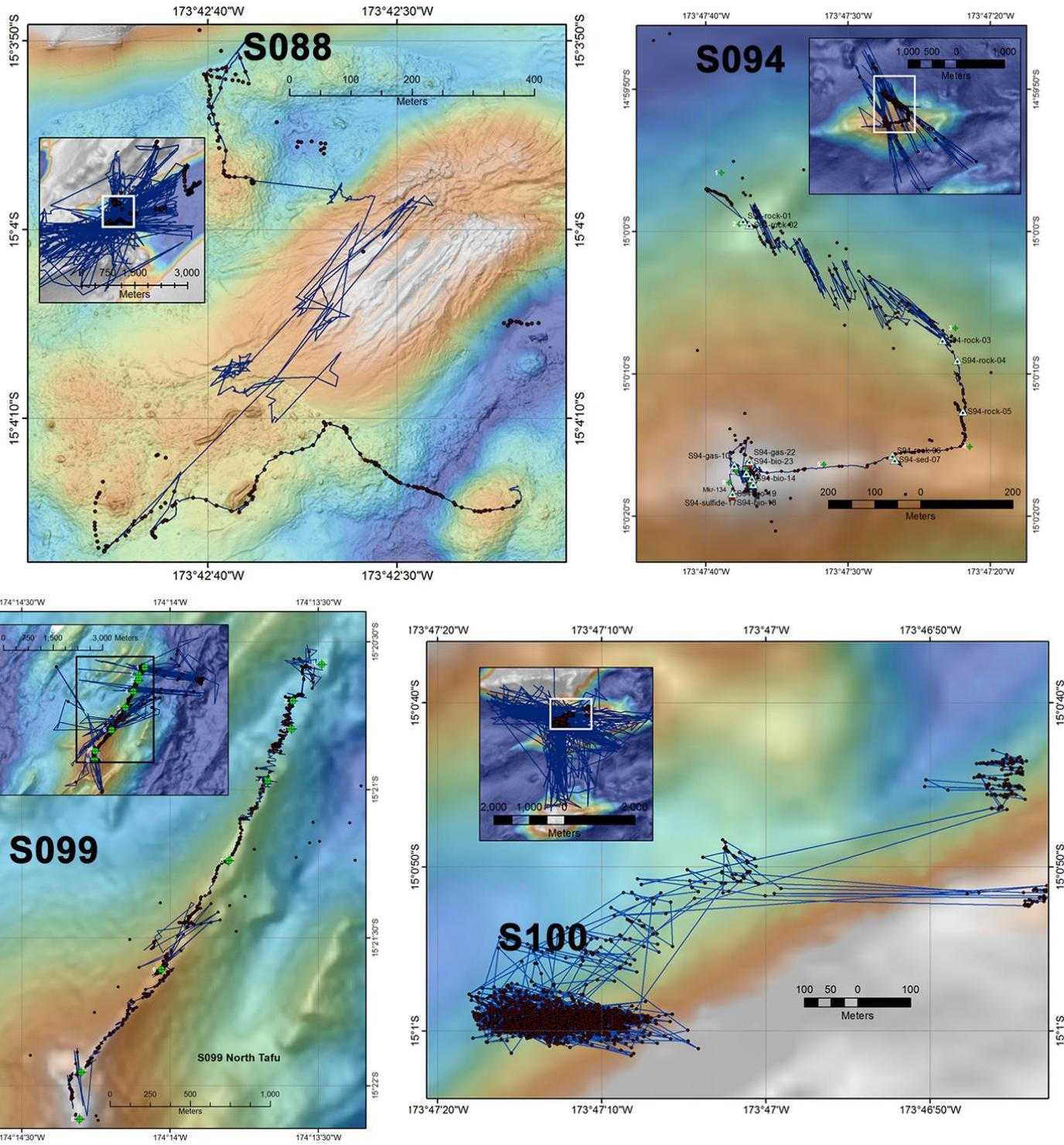


Figure 5-2. Navigation before and after edits for select dives. Inserts show the 1-second Greensea navigation fixes before editing. Blue lines are the ROV tracks from the 1-second data and the red dots are the navigation from the dive logger (Squidle+ or Leighton) files.

Still imagery (video frame-grabs)

ROV SuBastian has no digital still camera. The only still imagery is from video frame-grabs from the 4K science camera on the ROV. There were two ways of capturing frame-grabs. One was to run the Squidle+ software to continuously capture frame-grabs at 1Hz in the background, which were recorded at 4K resolution (3840 x 2160 pixels) as jpg files that are 1-3 Mb in size, with filenames like FK171110_FK171110_S0101_20171212T235819Z_S5K.jpg. The other method was to manually capture a framegrab from the same 4K camera, but triggered by the marine tech in the control room hitting the space bar on a keyboard on request. (We made the recommendation to SOI that this function should be made available to the science watch leader or the science data logger in the future). These highlight frame grabs are also at 3840 x 2160 pixels and 0.9-2.5 Mb in file size.

Table 5-2 Summary of the video framegrabs for each ROV *SuBastian* dive.

Dive number	Number of Squidle 1Hz framegrabs	Total Squidle file size (Gb)	Number of 4K highlight grabs	Total 4K file size (Mb)
S85	40,142	62.56	648	803.5
S86	32,270	51.81	495	596.8
S87	33,978	63.18	437	606.3
S88	38,855	54.77	450	524.4
S89	40,447	71.70	644	849.7
S90	37,770	55.88	538	650.8
S91	34,401	64.47	536	727.3
S92	37,556	60.83	460	558.3
S93	30,362	55.33	425	556.6
S94	31,618	51.59	569	691.3
S95	38,348	64.27	577	764.9
S96	31,220	56.90	567	767.3
S97	32,808	53.13	478	586.7
S98	33,164	60.05	550	722.2
S99	35,836	65.03	710	944.4
S100	38,177	58.67	505	591.5
S101	22,994	36.51	363	419.9
S102	39,096	61.24	459	577.1
S103	35,793	70.40	607	902.2
S104	32,088	56.87	431	582.8
S105	22,102	43.04	336	502.3
TOTAL	719,025	1218.23	10785	13926

Video recordings

Video was recorded during the ROV *SuBastian* in several formats. Video from the 4K Science Camera was recorded continuously in both 4K format (3840 x 2160) and HD format (1920 x 1080). In addition, video from the Pilot's camera was also recorded continuously in HD format. We only summarize the HD format files below. The continuous HD video was recorded in 10-minute mp4 video files (~1.89 Gb each with a data rate of ~25 Mbit/sec for the Science camera, and 0.6-1.9 Gb each with a data rate of 10-20 Mbit/sec for the Pilot's camera). All the continuously recorded HD video files have control room audio and a date/time annotation overlay. These files have names like "FK171110_20171126T180727Z_HD_S0085.mp4".

Another set of video files that were recorded are ones that were manually captured as 4K video highlights to files without date/time in the names, like "Capture0000.mov", "Capture0001.mov", etc, and are numbered sequentially during each dive. However, sometimes there is more than one folder of highlight movies for a given dive (folder names of SSD1, SSD2), and each start with "Capture0000.mov", so there can be redundancy in file names. However, the files in the SSD1 folder are from the Science Camera, and the files in SSD2 are from the Pilot Camera. The highlight files were recorded at 4K resolution (3840 x 2160) with a data rate of ~900 Mbit/sec. There is no audio and date/time overlay included with these highlight video files, but they do have embedded timecode.

Table 5-3 Summary of the HD and 4K highlight video files for each ROV *SuBastian* dive.

Dive number	Continuous HD SCI_cam # files / total file size (Gb)	HD SIT_cam # files / total files size (Gb)	Manual video highlights – number of clips	Manual video highlights – total file size (Gb)
S85	67 / 125.39	67 / 93.50	9	34.31
S86	70 / 131.40	70 / 99.89	20	204.01
S87	59 / 105.60	60 / 92.03	4	24.76
S88	65 / 121.62	65 / 64.97	17	162.26
S89	63 / 117.92	64 / 97.09	20	352.19
S90	55 / 103.51	55 / 75.54	12	217.26
S91	63 / 113.14	64 / 102.81	42	425.42
S92	63 / 116.69	62 / 74.24	13	212.36
S93	50 / 93.32	50 / 87.13	6	143.91
S94	56 / 104.26	56 / 96.59	33	305.26
S95	53 / 98.91	54 / 77.82	23	218.67
S96	53 / 99.89	51 / 83.96	19	151.59
S97	58 / 100.4	58 / 85.3	37	474.26
S98	60 / 107.12	57 / 79.14	15	76.93
S99	60 / 113.88	60 / 95.91	27	201.46
S100	55 / 101.95	56 / 89.65	47	290.48
S101	39 / 72.24	39 / 60.84	21	101.13
S102	55 / 102.84	55 / 88.74	46	273.82
S103	66 / 121.87	65 / 103.45	28	162.09
S104	55 / 100.09	54 / 75.70	6	57.72
S105	37 / 69.62	37 / 63.75	1	6.81
TOTAL	1202 / 2221.66	1199 / 1788,05	446	4096.70

Note that in addition to the video files above, there were also 4K continuous video files, which are not included in the list above.

6.0 ROV SuBastian

6.1 SuBastian Summary and Statistics

Ken Rubin

Summary of ROV SuBastian Dives

ROV SuBastian was deployed 21 times, visiting 11 different submarine volcanoes. The vehicle generally went in the water at approximately 7 AM and returned to the ship at 7 PM each day. Dive plans were developed using the (fairly cumbersome) SOI dive plan template, which we streamlined during the expedition, to include detailed lists of way points, objectives, sampling tools, and location maps; finalized dive plans and navigation underlay maps were provided on the day of the dive to various parties on the ship (ROV team, bridge, marine techs, science party) and the shore-based SOI team via google drive. Ken Rubin and Bill Chadwick shared responsibility for dive planning, alternately producing plans to meet as many science party objectives as possible. In general there were two types of dive profiles (a. exploration + geo-sampling, and b. more focused hydrothermal vent, chimney and biological sampling). We were always prepared to take most types of sample (rocks, sediment, fluids, organisms) on each dive, and many dives ended up being a hybrid between these aforementioned profiles. A general strategy of dives was discussed with the science party and SOI staff before the expedition, including dive target prioritization, and then during the expedition discussed with the scientists, ROV team and bridge to optimize objectives and efficiency. Dives generally had one of two configurations of tools of the front porch of the vehicle as per the dive profiles above, optimized either for (a) geological specimen collection (grabs, scoops, push cores), with one biobox and fluid sampling (at most, 4 majors and 3 gas tights across the front of the porch). We made frequent use of the suction sampler for bio specimens, as well as the manipulator for bio sample grabs, and through the course of the expedition worked with the engineering department and ROV team to develop sediment scoops (canvas bags on metal rings) of various configurations. These also proved useful for some bio sampling (e.g., snails on chimneys). NOAA-EOI site markers were carried on each dive and deployed at sites of likely return. These were extremely useful at hydrothermal vent revisits at Matas Tolu and Ono, although we were unable to find at least one marker we deployed at West Mata in one of the young lava flows near the summit.

Dive base maps were prepared initially from existing (EM122 and 302) and then new shipboard (EM302) multibeam, as geotiffs, followed by addition of AUV Sentry bathy maps in a handful of spots where we had coverage from Leg 1 operations, and/or existing AUV bathy: D. Allen B. AUV bathy at West Mata collected in 2009 in collaboration with MBARI and Abyss AUV (Remus 6000) bathymetry collected in 2012 at Mata Tolu in collaboration with Marum institute. Waypoint files provided to the ROV team were combined with the base maps for in-dive display.

Dive navigation was done on the ship using the SOI proprietary Greensea system, which used real-time USBL, DVL and INS navigation streams to provide a so-called best estimate vehicle position. Navigation proved to be the most problematic area of ROV operations, both because of the obtuse nature of the Greensea processing algorithm, and because of subpar and essentially faulty USBL system performance, especially during the second half of leg 2. The impacts were felt greatest on dives deeper than 2000m water depth (i.e., most of them) with some dives having essentially no useable USBL. Instead, we have estimated vehicle position from water depth and features observed. Substantial effort was done by Susan Merle on the ship, and Andra Bobbitt back on shore, to try to improve the dive nav and to remove the spurious fixes, with variable quality results. Some dives, such as parts of dive S100 at Mata Ua, are essentially unfixable. It is likely that some dive tracks will be revised in places as details of each dive are reviewed in the context of the GIS data available.

Dive logging was another issue that proved difficult. The Squidle+ system SOI had contracted for the service proved to be cumbersome and unreliable for real-time logging activities, crashing when too many entries were stored, and losing entries that the system could not associate with an image. Eventually these bugs were largely worked out, but not until several dives into the program, and not without significant loss of confidence in the system by the logging team. The team migrated after the second dive to using an in-house logging system developed by lead tech Leighton Rolley (the so-called Leighton-Logger), which performed for the most part flawlessly, although it does not associate images with log entries and has some issues with text string parsing

that requires manually cleaning of the log files when special characters or commas make their way into user logged data. The logging effort was led by Susan Merle, who trained up a handful of other cruise participants on the types of observations to log, descriptive terms, sampling nomenclature, and the like.

All dives were streamed live on YouTube and Facebook live, using capabilities of the ship, ROV, and marine tech team. Dives were narrated by Ken and Bill on a spit watch system with opportunities for a handful of other cruise participants to also have time on the microphone. Because SOI only has one live stream, we occasionally had them display dive maps and navigation screens (when the nav was usable), to help viewers see where we were. Although the numbers of comments in the chats on these two feeds were large (especially on Facebook, which had many thousands of viewers at a time), dive leads were able to interact occasionally with these viewers using the chat capability of those feeds.

Real-time interaction with a handful of interested, shore-based colleagues (e.g., Embley, Shank, Clague, Carrey, Portner, Resing and the shore-based outreach team of Carlie and Logan) were facilitated by the use of Slack (a web-based collaboration tool). A workspace was developed for the program, with each dive getting a separate channel. Dive plans and maps were shared before the dive, and nav screen grabs and other commentary were shared during the dives. We received many helpful suggestions and discussions during the dives from this interaction that enhanced the dives.

Table 6-1 lists all of the dives and locations, and Section 6.2 has brief narratives and objectives for each dive. Please see also the maps for each dive (6.3). In summary, there were 21 total deployments at 11 Volcanoes, including 7 dives at West Mata, 2 each at Mata Ua, Mata Ono, Mata Fitu, Mata Tolu and Tafu, 1 each at Mata Fa, Mata Taha and 2 large unnamed dacite lava flows, “LL_B” and “LL_D” of Embley and Rubin, 2018). During these dives we collected 250 rock samples, 59 sediment samples, 31 sulfide samples, 56 Vent fluid samples (of which 24 were for gas), and > 470 biological samples.

Preliminary results of these ROV dives:

6. West Mata is the most active volcano in the area (8 to 10 eruptions in last 10-15 years). Diffuse flow systems continue at the summit and new ones are established at two of the most recent eruption sites. There is still no focused flow hydrothermal venting at West Mata, but several diffuse flow sites are developed and colonized..
7. There is a significant variety in eruption style at West Mata, with lavas and pyroclasts in all cases, but a great proportion of pyroclasts (in some cases >1m thick) near the 1.2 km depth summit (i.e., in shallower water) and a greater proportion of lavas at depth. A single flow that started as an intrusion, uplifting sediments and spilling lava out its base was also observed and sampled on the northern flank of the volcano's base.
8. Hydrothermal vents: A new active hydrothermal system was discovered at Mata Ono. Previously-known vent fields at Mata Ua and Mata Fitu are now known to be much larger than thought before the expedition. The vent field at the Mata Tolu summit was much better defined in size and relationships to geological structures on the volcano. Extinct chimneys were found at Mata Taha. No active venting was observed at Mata Fa (although some minor diffuse flow was indicated in places on the youngest volcanic cones)
9. Distinct differences in chimney size, shape, number, ecology and community structure were observed at the different hydrothermal vent sites. Vent fluid compositions are broadly similar to what has been observed in the past. Vent fields are located in different areas of the volcanoes, with only two of them being at the volcano summits (Tolu and Ua).
10. North Mata apparent eruption ages: The youngest volcanism at Matas Talu and Ua was discovered to be on satellite cones near to but away from the summits. Mata Fa has a wide mixture of apparent volcanic ages across several small cones, Mata Taha appears to be the least active (recently) and Mata Fitu is largely tectonized, but with some young volcanism at the eastern base of the summit cone.
11. We observed large scale production of volcanic sediments from explosive phases of volcanism at West Mata and Tafu Cone (on the NELSC), which were sampled. Similar volcanic sediments were also discovered and sampled at Mata Tolu, Fa and the large dacite lava flows LL_B and LL_D (the dacites also appear to have produced pumice deposits).

12. Eruption Style: There is a large variety of lava eruption styles at most volcanoes, including pillows (as expected) but with a significant range of morphologies. Particularly surprising was the co-occurrence of high flow-rate lava forms at West Mata, Mata Tolu and Mata Fitu. Also, discovery of a magma intrusion into sediment, causing uplift, and that subsequently erupted from the base of the uplift structure, at West Mata was a first for the region.
13. Two new eruptions in the last 5 years were discovered and documented at Tafu Cone (NELSC), as well as a diffuse flow hydrothermal site discovered at its summit.

Table 6-1 Dive locations and statistics

Dive	Place	Date Begin(UTC)	Off Deck	On Bottom	Off Bottom	On Deck	Total Time	Bottom Time	Samples
S085	West Mata	11/26/2017	17:44:02	18:58:13	5:32:53	5:55:12	12:11:10	10:34:40	22 samples collected (2 fluid; 2 gas; 5 biology; 1 sediment; 12 rock)
S086	West Mata	11/27/2017	17:11:25	18:33:31	4:10:18	4:46:21	11:34:56	9:36:47	21 samples collected (5 biology; 2 sediment; 14 rock)
S087	West Mata	11/29/2017	17:17:15	18:39:34	4:10:16	5:11:03	11:53:48	9:30:42	18 samples collected (4 fluid; 3 gas; 4 biology; 2 sediment; 5 rock)
S088	West Mata-Muffin	11/30/2017	17:07:23	19:02:05	4:48:18	5:48:05	12:40:42	9:46:13	18 samples collected (1 fluid; 4 sediment; 13 rock)
S089	Mata Ua	12/1/2017	17:11:08	19:08:15	3:44:00	5:42:07	12:30:59	8:35:45	25 samples collected (4 fluid; 3 gas; 8 biology; 3 sulfide; 1 sediment; 6 rock)
S090	Mata Fitu	12/2/2017	17:06:12	19:00:48	4:09:25	5:58:17	12:52:05	9:08:37	17 samples collected (1 sediment; 16 rock)
S091	Mata Tolu	12/3/2017	17:06:39	19:12:40	4:38:03	6:02:25	12:55:46	9:25:23	19 samples collected (2 fluid; 2 gas; 3 biology; 3 sulfide; 1 sediment; 8 rock)
S092	Large Dacite	12/4/2017	17:15:15	19:10:20	3:46:48	5:26:16	12:11:01	8:36:28	23 samples collected (2 biology; 5 sediment; 15 rock; 1 bottle)
S093	West Mata	12/5/2017	17:07:38	18:49:36	3:19:17	4:57:36	11:49:58	8:29:41	19 samples collected (5 sediment; 14 rock)
S094	Mata Tolu	12/6/2017	17:09:35	19:01:18	3:59:35	5:36:34	12:26:59	8:58:17	25 samples collected (4 fluid; 3 gas; 7 biology; 4 sulfide; 1 sediment; 6 rock)
S095	West Mata	12/7/017	17:04:02	19:13:54	3:43:46	5:54:19	12:50:17	8:29:52	22 samples collected (2 biology; 3 sediment; 17 rock)
S096	Mata Fa	12/8/2017	17:08:46	18:50:41	3:33:07	5:12:59	12:04:13	8:42:26	20 samples collected (3 biology; 3 sediment; 14 rock)

Dive	Place	Date Begin(UTC)	Off Deck	On Bottom	Off Bottom	On Deck	Total Time	Bottom Time	Samples
S097	Mata Fitu	12/9/2017	17:06:47	18:50:18	3:56:05	5:50:36	12:43:49	9:05:47	22 samples collected (4 fluid; 3 gas; 5 biology; 7 sulfide; 1 sediment; 2 rock)
S098	South Tafu	12/10/2017	17:09:03	18:43:18	4:14:58	5:29:32	12:20:29	9:31:40	22 samples collected (2 fluid; 1 biology; 5 sediment; 14 rock)
S099	North Tafu	12/11/2017	17:05:08	18:34:30	4:28:40	5:37:43	12:32:35	9:54:10	26 samples collected (4 fluid; 2 biology; 3 sediment; 17 rock)
S100	Mata Ua	12/12/2017	17:03:46	18:50:16	3:52:29	5:41:22	12:37:36	9:02:13	28 samples collected (5 fluid; 3 gas; 6 biology; 6 sulfide; 1 sediment; 7 rock)
S101	Mata Ono	12/13/2017	20:10:45	22:11:11	4:43:04	6:35:03	10:24:18	6:31:53	21 samples collected (3 fluid; 1 gas; 1 biology; 2 sulfide; 3 sediment; 11 rock)
S102	Mata Ono	12/14/2017	17:03:31	19:00:44	4:05:50	5:55:17	12:51:46	9:05:06	25 samples collected (4 fluid; 3 gas; 4 biology; 3 sulfide; 2 sediment; 9 rock)
S103	WMata	12/15/2017	17:06:47	18:20:02	4:15:05	5:14:24	12:07:37	9:55:03	25 samples collected (4 fluid; 3 gas; 4 biology; 3 sulfide; 2 sediment; 9 rock)
S104	Mata Taha	12/16/2017	17:06:53	18:55:03	3:49:45	5:29:16	12:22:23	8:54:42	21 samples collected (2 biology; 2 sulfide; 2 sediment; 15 rock)
S105	Northern Dacite	12/17/2017	16:01:32	18:00:46	0:10:16	1:54:09	9:52:37	6:09:30	18 samples collected (1 biology; 5 sediment; 12 rock)

6.2 Dive Objectives and Summaries

S085 West Mata Summit Objectives:

1. This is a survey and 2.2 km long geo-transect of the West Mata Summit intended to traverse several features that show up as depth anomalies in MB surveys since 2009, We have 2017 Sentry data for all of the dive site.
2. Work generally upslope from 1400m to 1200m for first half of the dive towards a collapse pit, traverse undulating topography @ 1180 to 1250m for most of the second half of the dive, then, time permitting, descend back to 1400m along the north slope of the NE rift one.
3. Take opportunistic rock and push core samples, note locations of vents for next dive at summit. (we will use the temperature probe and sample some bio and fluids if observed – minimal fluids configuration)

S085 Summary:

This was a familiarization dive starting west of previously known terrain around “mat meadow”, traversing to the summit, into Hades pit, along the north face of the ridgeline above the former Prometheus, shrimp city and creamsicle sites, returning eastward on the south side of that ridge (the landslide headwall), traversing onto the young (post 2012) lava mound that developed in the old landslide area, and then traversing north to another contemporaneous eruption deposit on the north face of the volcano. The young lava mound has experienced widespread diffuse flow hydrothermal activity and has associated organisms. A collapse on the south side (downslope) of this new flow was also briefly explored. After this the dive headed northeasterly to visit another young lava unit emplaced in the same time period. It was viewed heading downslope to have some very steep debris laden flow fronts and young fresh lava mounds, but no fluid venting.

S086 West Mata Summit Objectives:

1. This is a survey and 1.8 km long sinuous geo-transect of the lava formation NE of the West Mata Summit intended to traverse a feature that showed up as depth anomaly in between 2016 and 2017 Falkor MB survey, We have 2017 Sentry data for all of the dive site.
2. Work generally upslope from 1920m to 1485m in a new lava flow on a sinuous but generally uphill trajectory for the first 12 WPs and then in older terrain with interesting “Pillow Pox” formation seen in Sentry Photos.
3. Take opportunistic rock and push core samples, we will likely use the temperature probe and sample some bio and fluids if observed – minimal fluids configuration)

S086 Summary:

This dive visited the newest eruption deposit at West Mata, that formed sometime between repeat bathy mapping in 2016 and late 2017. The dive started in sediment east of the eastern distal end of the lava flow, traversed westward over pillow lavas with some pyroclastic debris cover, then ran a series of east-west traverses up a stair steps of flow lobes with steep nearly vertical flow fronts and nearly flat interiors. The shallowest portions of the new flow are extensively to completely covered by pyroclastic debris and extensive microbial mat deposits. The dive also explored the northern lava flow boundary and found non-vent fauna and abundant young pyroclasts mantling older lava outcrops.

S087 West Mata Summit Objectives:

1. This is a survey and 1.9 km long geo-transect upslope from the shallow part of the south rift ne and 16430m depth to the summit region at 1230m depth, collecting lava and sediment samples.
2. At the summit we will visit Hades Pit first and then sites along roughly the same dive path as Dive S85, with more intensive sampling of fluids and biology, including the 2012-2016 cone on the SE part of the summit. FULL Fluids configuration of basket (3 gas tights + 4 majors).

S087 Summary:

This dive started downslope on a north-south trending ridge line from the summit (perhaps a less-well

developed rift zone) in an area of mapped depth change in the past decade. His area was largely sediment covered with some deep sea corals on rocks outcrops with no evidence of recent igneous activity. The dive continued to the summit, re-visiting sites in Hades pit and the post 2012 lava mound for more extensive water and biological sampling.

S088 West Mata NE base – “The Muffin” Objectives:

1. This is a geo-transect across an uplifted mound of sediment (“the muffin”) and young lava flows that surround it, located at the NE base of West Mata. Both the sediment mound and the surrounding lava flows are part of a MB depth change between 2012-2016. We have 1-m Sentry bathymetry for this dive site.
2. The dive will start SE of the muffin ridge, will sample old & new lavas, then will drive up the axis of the sediment mound, and finally back down to the lava flows on the NW side of the mound. Area is relatively flat 2690m to 2650m. Main sampling will be opportunistic rock and push core samples, and sediment scoop bags (fluids if observed – minimal fluids configuration).

S088 Summary:

This last of the initial sequence of West Mata dives visited the curious uplifted sediment dome affectionately referred to as the “muffin” on board ship, surrounding lava flows (which appear to flow out from the base of the uplifted mound), and the contact of young lavas with the West Mata edifice on the south margin. The lavas were young but otherwise unremarkable (boninite like everything else at West Mata). Several small rifts at the summit of the sediment mound were examined and found to have 1-2 m thick sequences of sediment (largely volcanoclastic and presumably turbidites or debris flows related to the surrounding edifices) that in places had active diffuse flow hydrothermal activity and microbial mat development. Navigation was particularly bad on this dive.

S089 Mata Ua Flank to Summit from North Objectives:

This is a two part dive at Mata Ua with a 1.3 km long track

1. Survey/circumnavigate a previously studied vent field, taking rock, sulfide, water and bio samples at a site centered at 2360m water depth. FULL Fluids configuration of basket (3 gas tights + 4 majors)
2. Sample lavas and make observations on a geotransect to the summit. To accomplish the second goal, fluid sampling should be completed by 1 PM.

S089 Summary:

This dive started in the valley between Matas Ua and Tolu, and 250m east and 100m north of a known hydrothermal vent system from the 2012 SROF expedition. Extensive active hydrothermal chimneys and diffuse flow venting were encountered nearly immediately, and in much greater density than a site visited in 2012 further to the southwest. This site was named Temple of Smoke, for the large number of smoking spires, many covered with extensive colonies of stalked barnacles. The field was sampled and explored to define the downslope and upslope extent (restricted to a ~50m depth range), after which the field was explored to the southwest, including the 2012 site and the western edge of the field. The dive then did a quick geo-transect traverse up the north flank of the volcano, visiting both of the two mounds at the summit. Both were found to be extensively sedimented.

S090 Mata Fitu Objectives:

1. This is a geo-transect across the summit of Mata Fitu volcano, which is the northern-most of the North Mata group. This area of the seamount has not been visited before, so this will be an exploratory dive to check out areas where the MAPR sensors on AUV Sentry saw anomalies on Leg1. (so there is no guarantee we’ll see any venting, but it’s possible we’ll find something new). We DO NOT have 1-m Sentry bathymetry over most of the area for this dive site (just ship bathymetry).
2. The main sampling will be opportunistic rock sampling and fluids if observed (minimal fluids configuration on the ROV). Depth range is 2385 to 2535 m.

S090 Summary:

This dive visited the broad platform just south and east of the highest peak at Mata Fitu, traversing SE, NE and

the NW through a series of fault block horst and graben terrain showing mostly sediment and highly fragmented lava debris, with almost no in place lava observed in the first half of the dive. A brief interlude up the south face of the summit cone found only rock debris. The dive then traversed east and then north, along a single trackline of AUV Sentry bathy, into younger-looking and less tectonized lava flows, including fairly young looking lava near the end of the dive. The dive was remarkable for the complete dearth of hydrothermal venting and fauna, with only sparse non-vent fauna observed.

S091 Mata Tolu West Rift to Summit from North Objectives:

This is a two part dive at Mata Ua with a 1.4 km long track

1. Sample lavas and make observations on a geotranssect along the west rift one to the summit.
2. Survey/circumnavigate a previously studied vent field, taking rock, sulfide, water and bio samples at a site centered at 2360m water depth. Part Fluids configuration of basket (2 gas tights + 2 majors).

S091 Summary:

The first part of this dive was a geo-transect along the west rift zone to the summit to sample lavas and make observations. Pillowed flow lobes with flatter tops were observed, as well as an area of high effusion rate sheet flows and jumbled flow terrain just beneath the summit. The second part of the dive was to survey, circumnavigate and sample a previously studied vent field (2012) at the summit, to provide spatial ground truth to a poorly navigated 2012 AUV Abyss bathy map, and then to identify and sample some hydrothermal chimneys, with a site revisit anticipated. A small pit on the west side of the summit platform was examined, and found to have extensive active diffuse flow venting, as well as debris strewn walls. The formation mechanism of the pit is presumably collapse, but no definitive evidence was observed in the walls.

S092 Large Dacite Flow Objectives:

1. This dive will be a geo-transect across a Large Dacite Lava Flow on the seafloor located 19 km SW of West Mata summit (mostly 2400-2550 m). Main objective is to sample lavas and make visual observations on a geo-transect from a large lava pond to a series of hills located to the west. No hydrothermal vents expected (minimal fluid-sampling configuration on ROV).
2. Determine if the western hills, which have low-acoustic backscatter compared to the high-backscatter of the dacite flow, are part of the eruption of this flow (perhaps as pyroclastic phase?) and perhaps the source of the dacite lava flow, or whether they are older seafloor surrounding the dacite flow.

S092 Summary:

This dive was a geo-transect across a Large Dacite Lava Flow located 19 km SW of West Mata summit (mostly 2400-2550 m), starting on a broad shallow collapse depression and working west. Lavas with a range or morphologies and with some sediment dusting were observed on the floor of the collapse. The "wall" of the collapse was a series of down-dropped and separated slivers of rock allowing views of the internal stratigraphy of what appear to be quite massive flow interiors (up to 20m). The dive then traversed an area of parallel collapse and apparent lava flow channels, reaching a very tall (>25m) tumulus structure near the western lava flow boundary. The dive then visited two low-acoustic backscatter "hills" to the west of the flow as potential vent sources. These were dusted with sediment, although the sides of the lower (eastern) of the two mounds visited was strewn with small dacite cobbles and blocks, and has ~50 cm thick, coarse volcanolastic deposit of nearly pure volcanic glass chunks with fragmental and fluidal shapes. The higher mound had fewer to no dacite blocks, but near its summit we encountered a partly lithified deposit (15-20cm thick) of poorly cemented (welded?) fresh glass fragments. No evidence of hydrothermal venting on this dive.

S093 West Mata – NE Pillow Ridge Objectives:

1. This dive will be two separate geo-transects: one shorter one up an older ridge NE of West Mata volcano, and a second longer transect up a young ridge of pillow lavas on the NE flank of West Mata volcano that was erupted between 2012-2016. The starting depth is 2587 m and will end at 2365 m.
2. The main objective is to sample both old and new lavas and make visual observations on a geo-transect. We will also sample sediments. No hydrothermal vents expected (minimal fluid-sampling configuration on ROV).

S093 Summary:

This dive started to the north of West Mata, on the toe of an older NE-SW ridgeline of unknown parentage, traversing over a sedimented field strewn with stalked organisms, and then working upslope to West Mata, to perform a geo-transect up a young ridge of pillow lavas on the NE flank of West Mata erupted between 2012-2016, sampling lavas and sediments, and making visual observations on a geo-transect. These mounds were very steep sided and roughly flat topped, with a large collapse structure in one of the shallowest mounds that showed some evidence of diffuse flow venting. This dive had the benefit of an excellent AUV Sentry map from Leg 1.

S094 Mata Tolu West Rift to Summit from North Objectives:

This is a two part dive at Mata Tolu with a 1.3 km long track overall

1. Sample lavas and make observations on a geotransect along a mound of the north part of the volcano and on the upper east rift one to the summit.
2. Sample the vent field at sites identified on dive s91, taking sulfide, water and bio samples at a site centered at 1800m water depth. Full Fluids configuration of basket (3 gas tights + 4 majors).

S094 Summary:

This dive started on a constructional mound north (~50m tall) of the summit that was found to be relatively young boninite lava. The dive then traverse east over mostly sedimented terrain (including areas of hydrothermal stain) to the N rift zone, then following a traverse of the upper east rift to the summit. The lavas were not particularly young looking, and have variable sediment coating, as well as extinct hydrothermal chimneys and sediment more than 10m east of the summit. The dive then went to the summit and samples and examined in and around several chimney structures as well as in the small west-summit pit. Shifted AUV Abyss bathy was a big help at the summit.

S095 West Mata – SW Base Objectives:

1. This dive will be a geo-transect at the SW Base of West Mata volcano, roughly from west-to-east, starting deep at nearly 3000 m and generally driving upslope, ending at 2600 m. We will visit and sample two recent eruption sites (one definite, one unsure) and the surrounding older lavas. This dive will be mainly rock and sediment sampling; no hydrothermal vents expected.
2. The first (deeper) young lava flow is on relatively gentle slopes with only about 100 m of relief. This was identified by ship multibeam depth changes between May 2010 and November 2011. It consists of thinner pillow lavas to the north and a thicker ridge of pillow mounds, oriented E-W, to the south.
3. The second, shallower area of depth change is between surveys in 1996 and 2008 and is less certain because the 1996 survey is of lower quality. Nevertheless, it corresponds to an area of pillow mounds in 2009 MBARI AUV bathymetry and we will want to sample them.

S095 Summary:

This dive was a geo-transect at the SW Base of West Mata volcano, roughly west-to-east, through two areas of depth change at the volcano between May 2010 and November 2011, and 1996 and 2008, respectively. This was one of the deepest dive starts (~3000 m). Lava surrounded by sediment was observed in the younger of the two deposits, with pillows, including some ornamented. A zone with tumuli was observed well to the north of the shallow ridge forming the south portion of this lava flow, with some high effusion rate morphologies. The dive then traversed somewhat older looking sea bed, comprised mostly of pillow lava, with unclear distinction between the eastern boundary of the younger flow, the somewhat older lava flow, and intervening terrain, finishing upslope on the SW rift zone.

S096 Mata Fa Objectives:

1. This dive will be a geo-transect across the summit of Mata Fa volcano, one of the North Mata group of volcanoes. This will be the first ROV dive on Mata Fa, and there have been no camera tows here, so the dive will be a very exploratory in that we don't know what we will find. There is no evidence of a hydrothermal system on Mata Fa, but it's possible we could encounter some extinct chimney fields. The dive track is designed for viewing and sampling the main constructional morphologic features around the summit.

2. Main sampling with be rocks and sediments (using scoops). The dive starts on the west rift zone of Mata Fa, which is made of two separate ridges, one higher than the other. It starts on the lower ridge then jumps to the higher ridge before proceeding towards the summit. Afterwards the ROV will drive down the east rift zone.

S096 Summary:

This dive was a geo-transect across the ridgelines and cones that define the structure we call Mata Fa volcano. It was our first and only visit to the volcano. The main constructional features around the summit area are an E-W trending ridgeline, a N-S trending ridgeline capped by several mounds, and a broader E-W trending ridgeline east of that. The dive started on a deeper, steep-sided ridgeline of pillow lava with sediment on the narrow top of the ridge, traversed upslope on to a less steep sided but equally sedimented pillow lava mound, explored three young and step sided constructional pillow mounds on the N-S ridge, with some faint evidence of diffuse flow, and then traversed north to the eastern ridge, which was again mostly sedimented, older lava terrain.

S097 Mata Fitu Vent Site Objectives:

1. This dive will visit the known hydrothermal vent field at Mata Fitu volcano, one of the North Mata group of volcanoes. The dive will start downslope of the area of known venting and will traverse back-and-forth upslope to establish the aerial extent of venting. The dive will be a mix of geo-transects to visually explore the area, sample lavas and sediments, and will also do chemical and biological sampling at the hydrothermal vents.
2. This is the second dive of this expedition at Mata Fitu. The first dive explored the summit area to the northwest of this dive and did not visit the hydrothermal vent field.

S097 Summary:

This second dive at Mata Fitu started near a series of small mounds in the one swath of AUV Sentry data that we had from leg 1 at this site and then traversed upslope to previously studied (2012) vent field. The deeper structures turned out to be mostly extinct, 10-15 m tall hydrothermal chimneys, although one active chimney was found as well. An east-west transect through the area found plenty of extinct but no more active chimneys. The dive then headed upslope and observed and sampled within and around a previously studied (2012) vent field.

S098 South Tafu Eruption Site Objectives:

1. This dive will visit a young volcanic deposit that was emplaced sometime after 2010 and before our survey of a few days ago, according to a MB difference map. We expect to see and sample young basalt lava and pyroclasts.
2. Opportunistically sample vent fluids or biota if observed (minimum fluids config.).

S098 Summary:

This dive was on a young volcanic deposit emplaced sometime after 2010 and before our 2017 Falkor survey south of Tafu Cone on the NELSC. The apparently fissure fed lava flow (and the dive) followed the strike of the dominant ridgeline in the area forming a south rift of Tafu itself. The dive headed upslope (generally north) on a ridgeline parallel to the ridgeline where the Puipui 2008 eruption occurred (which is further south on the NELSC). We observed young basalt lava, very steep sided pillow mounds (some vertical with in place pillow lava "drips" and elephant trunk-elongated pillows). The pillow mounds often had flatter tops. A series of vent structures with agglutinated spatter, and collapsed lava structures, were found at the higher elevations of the lava flow near the end of the dive.

S099 North Tafu Objectives:

1. This dive will explore the back-arc spreading axis north of Tafu cone (yesterday's dive was south of Tafu cone. We will visit two young eruption sites, one constrained by before-and-after bathymetric surveys between 2010-2017, and the other between 2006-2009. Similar to yesterday's dive, we expect to see and sample young basalt lava and pyroclasts.
2. Opportunistically sample vent fluids or biota if observed (minimum fluids config.).

S099 Summary:

This second dive on the north side of Tafu Cone was designed to look at two young eruption deposits on the northern rift. One was emplaced sometime after 2010 and before our 2017 Falkor survey, and the other (deeper, near the start of the dive), was emplaced a few years before 2010 (we imaged it by Towcam and dredged it in 2010). ROV navigation was particularly bad on parts of this dive, especially at the dive start and midway through the dive. The older/deeper young flow already had some sediment dusting on it as well as sparse benthic non-vent fauna living on it. The younger of the two flows was similar to that observed the day before, with steep sides and flatter tops.

S100 Mata Ua Objectives:

1. This dive will visit flank sites on the Northeast flank of Mata Ua young volcanic for geological observations over a 1 km track. It will then traverse over the venting site, exploring along the way, over an additional 0.6 km of track. We will include some sort of 100th dive ceremony near the vents.
2. Several hundred meters NE of the known vent sites we will look for additional chimney as we move into the Temple of Smoke area, after which we will observe and sample vent fluids, chimneys, and biota (maximum fluids config.).

S100 Summary:

A scenic finish at the Temple of Smoke vent field was chosen for this dive, with a start exploring the saddle between Tolu and Ua, and a part of a northeast-trending, linear ridge extending from the main structure of the volcano. The navigation system performed especially poorly on this dive, and gave mostly spurious fixes. The dive mostly headed upslope to the south from the saddle to the ridge line, then crabbed back down the slope heading due west to approach the Temple of Smoke field 500m or so west of where we had previously encountered it. Some inactive chimneys were observed on the margins, but many active chimneys were observed and sampled in the field. A metal "banner" was briefly deployed and photographed near the top a chimney in celebration of the 100th SuBastian dive. This was recovered and returned to the ship.

S101 Mata Ono Objectives:

1. This dive will be the first ROV dive on Mata Ono volcano, one of the North Mata Group. The dive will start on a constructional cone on the west flank, then ascend along a ridge and traverse the south flank at ~2500 m for geological observations. It will then visit a constructional cone on the east flank and from there will ascend the east ridge up to the summit.
2. A CTD tow-yo in 2010 detected a hydrothermal plume over Mata Ono, extending from 2400-2500 m depth (below the summit, mostly on the N side), but a hydrothermal site has never been looked for on the seafloor. We will search for this vent site during the latter part of the dive, particularly on the traverse up the east ridge toward the summit. If a new vent site is found, we will plan to have a second dive at Mata Ono for fluid sampling.

S101 Summary:

This dive started on the SW flank of the Mata Ono, encountering fresh, unsedimented lava right at the start of the dive. These lavas contain extremely rare enstatite phenocrysts and megacrysts. The dive progressed upslope to the east, traversing the south face of the summit cone well below the summit in mostly old-looking lava or lava debris, approached a small depression and satellite cone east of the main summit edifice (where a significant abundance of deep sea corals was observed), and then ascend to the summit from the east. A diffuse flow vent field with abundant snails and smokey water, rimmed by areas venting clear fluids and extensively colonized by anemones. Near the western end of the summit platform two large (>10m tall) active compound hydrothermal chimney structures were discovered and sampled.

S102 Mata Ono Objectives:

1. This dive will be the second ROV dive on Mata Ono volcano. The dive will start on a constructional cone on the west flank, then ascend along a ridge and traverse the west and north flanks at depths ranging up to 2500m from ~2525 m for geological/rock observations. It will then visit a constructional cone on the east flank and from there will ascend the west ridge upslope a bit.

2. We will then run a series of lines traversing the west and north face of the cone at depths of 2525m, 2500m, 2475m, etc.. looking at chimney structures, and identifying sampling sites. We plan to traverse the area beneath the summit and identify where chimneys are and aren't BEFORE stopping to sample.
3. Sampling will commence once the field is evaluated and defined.

S102 Summary:

This return dive to Mata Ono started on an elongate ridge structure heading east from the northern part of the volcano, and then traversed the northern face of the summit cones multiple times in search of more substantial venting, anticipated from the fairly robust chronic plume detected in the water column above the volcano. Rock units were generally very old looking, with extensive faulting and fissuring on this part of the volcano, and variably heavy sediment cover. After a lot of searching the northern and western faces of the summit cone, and nothing more than limited diffuse flow venting, the ROV returned to the summit vent field for additional sampling.

S103 West Mata Upper East Rift Objectives:

1. This dive will be a geo-traverse primarily to sample lavas and sediments on three recent eruption sites on the upper east rift zone of West Mata volcano. The dive starts at the 2016-2017 eruption site about 1.5 km NE of the summit, then will visit the two 2012-2016 eruptions sites further upslope (which may be the same event).
2. A secondary goal will be to sample fluids and biology late in the dive at the southern of two 2012-2016 eruption sites, just east of the summit.

S103 Summary:

This dive was a return to the shallower reaches of the 2016-2017 eruption at West Mata deposit to examine and sample pyroclastic deposits, diffuse flow venting, the northern flow margin, and then also to traverse along the NE rift zone to visit the 2012-2016 lava flow that was briefly seen at the end of dive S85. The dive crabbed a debris slope below the summit to enter the young lava flow field mid slope, and then headed due south to move up through the flow field to observe and sample on a geo-transect, confirming multiple very steep tall flow fronts with debris at their bases.

S104 Mata Taha Objectives:

1. This dive will be the first ROV dive on Mata Taha volcano, another one of the North Mata Group of volcanoes. The dive will be a geo-traverse starting on the north flanks and visiting several constructional cones on the way up to the summit.
2. Main goal will be rock and sediment sampling, but there is also a weak hydrothermal plume over Mata Taha (probably from diffuse vents), so we will sample fluids and biology if we encounter any hydrothermal vent sites.

S104 Summary:

This dive started on a small mound structure NE of the main volcano edifice at Mata Taha, traversed west to another volcanic mound. Both mounds were extensively sedimented but did have rocky volcanic outcrops too. The westward traverse from this second cone to a third satellite cone to the NW of the summit was largely sediment covered, with occasional rocky outcrops. A fourth, somewhat larger satellite cone west of the summit was visited, followed by a turn due east, to approach and ascend the summit. A single extinct hydrothermal chimney was encountered on the edge of a fissure below the summit in the area. The dive then visited two cones on the summit, finding heavily sedimented volcanic outcrops. The dive was not able to visit the steep south face of the summit cone, or the elongate east-west trending ridgeline to the east of the summit, both of which have steeper terrain and might be good targets for a future dive in the area.

S105 Northern Dacite Objectives:

1. This dive will be the first ROV dive on a deep dacite lava flow adjacent to the North Mata Volcanoes. It is similar in size and character to the dive 92 dacite lava, but deeper and of higher acoustic backscatter. We hope to learn if the latter is from a younger lava surface or several other possible causes as well as to look for pyroclasts in lower backscatter parts of the lava flow. The objective of the dive is to examine several

different flow areas to examine lava morphology starting deep and moving shallower, including a traverse up a nearly 100m high escarpment that forms the edge of what looks like a lava drainout structure.

2. The main goal will be rock and sediment sampling, but we expect to sample some as well.

S105 Summary:

The last dive of the program was a short geo-transect through the northern portions of the LL_D dacite lava flow. The dive began in rock debris in the center of a half-crater (unbounded on the west side), then ascended a small elongate ridge in the crater, finding small amounts of in place lava at the top of the ridge. It then traversed south of that cone, finding and sampling volcanic sediments containing pumice and scoria in several places before ascending the steep south wall of the half-crater. The wall was angular volcanic debris at the base, transitioning into several in place lava flows visible in the wall, and culminating in following one of several sheeted dikes upward to the top of the wall, where the dike was found to feed a lava flow. The presence of the dike suggest that this lava flow was fed by a north-south trending fissure, rather than a point source vent at the shallower southern portion of the lava flow. Once on top of the wall, several small cones, debris fields and intervening depressions were visited in an area we had interpreted as lava channels in the bathy but no traditional lava channel structures were observed. Before leaving the bottom the ROV pilots unfurled a banner with Christmas wishes for their families.

6.3 SuBastian Dive Maps

Maps are in geographic (unprojected coordinates). ROV positions and samples have been edited to remove some of the worst navigation.

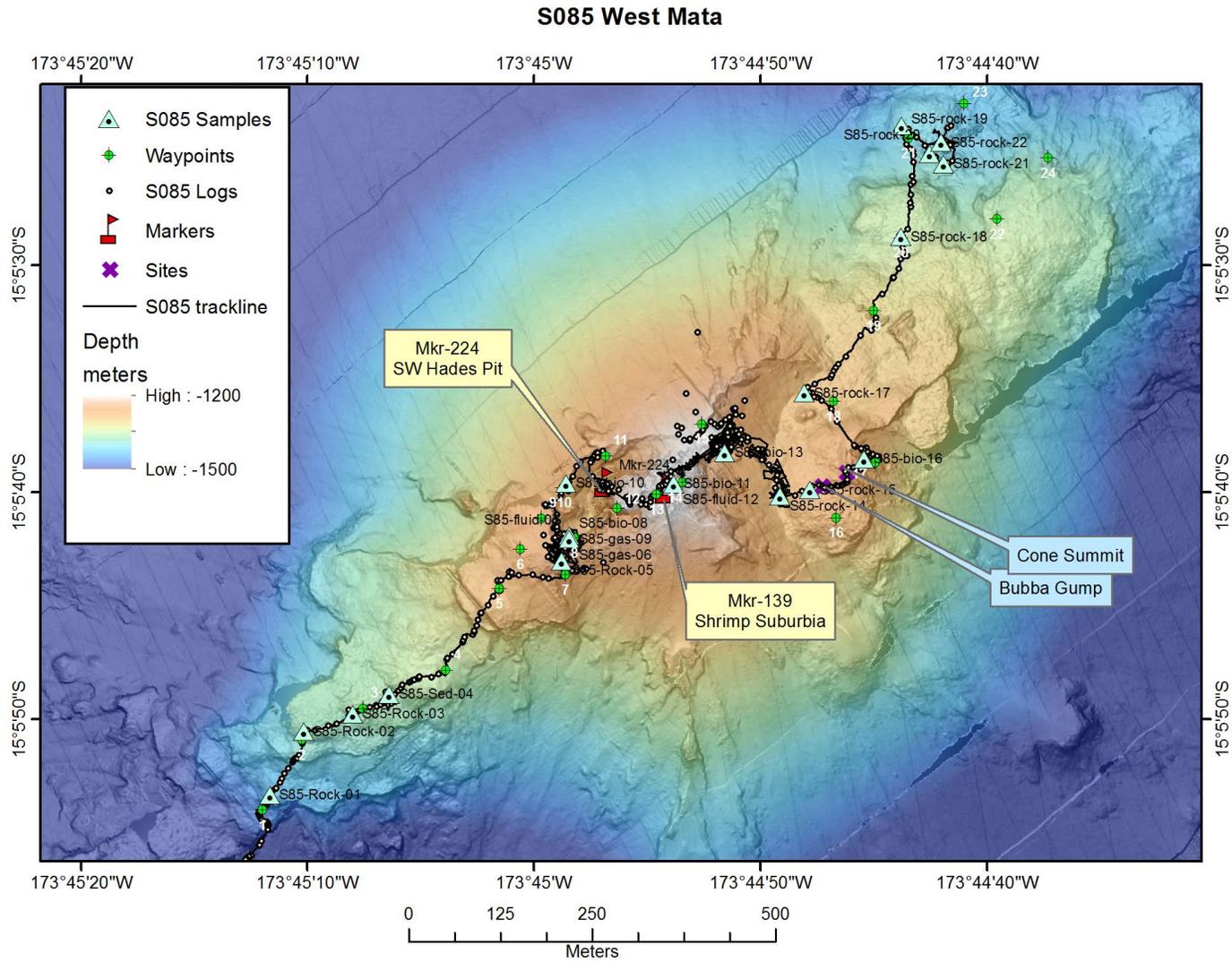


Figure 6.3-1 S085

S086 West Mata

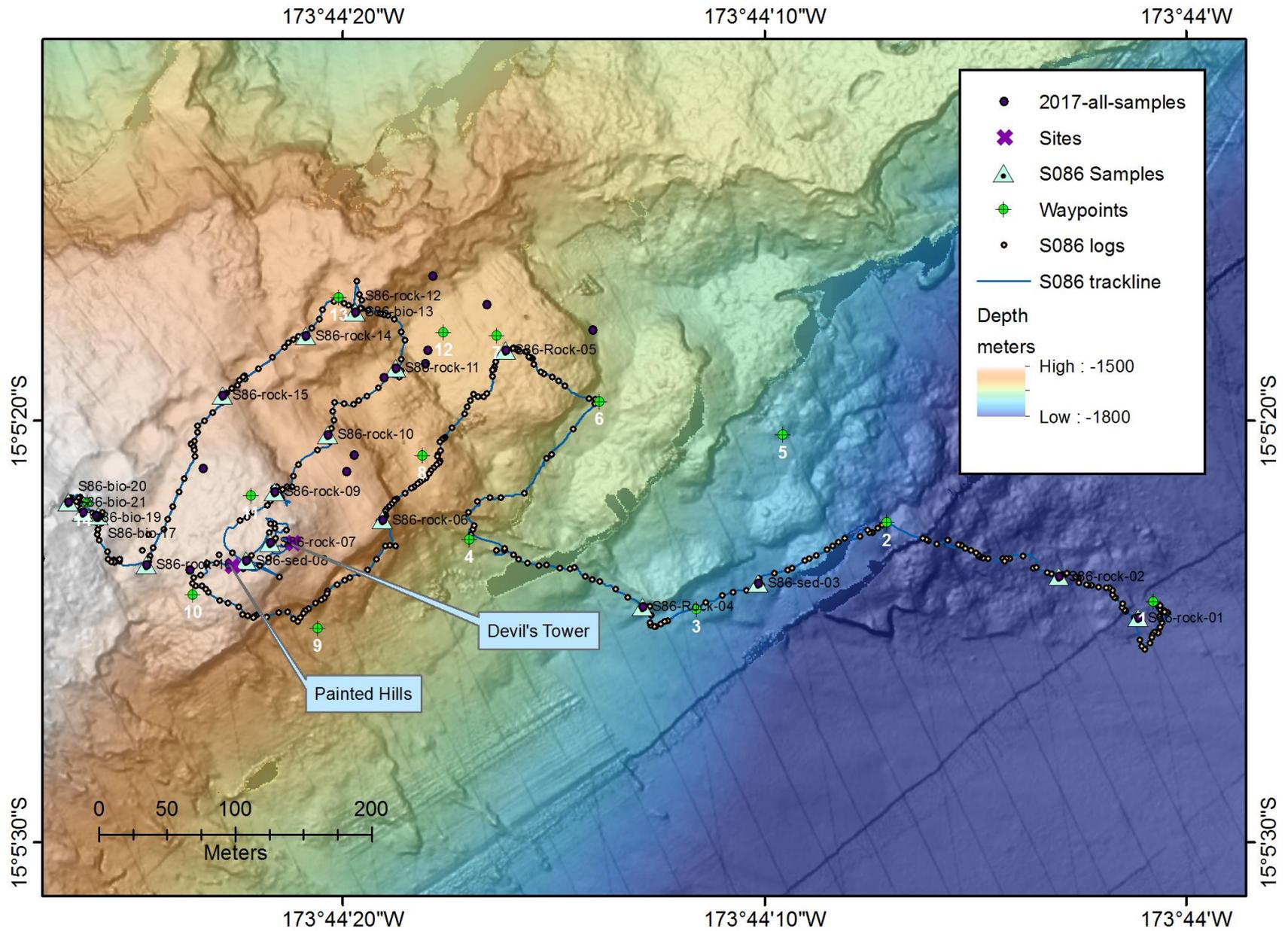


Figure 6.3-6 S086

S087 West Mata

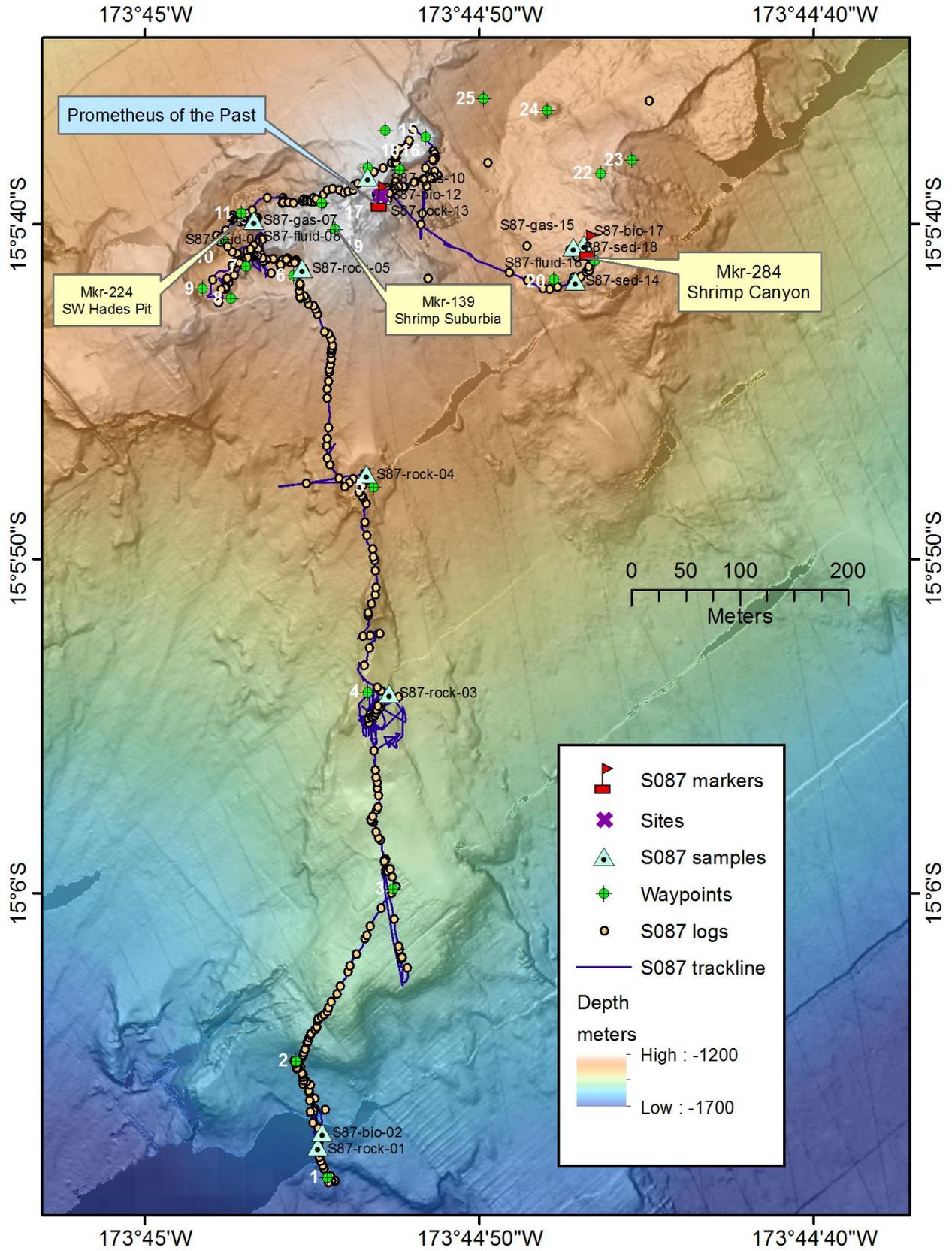


Figure 6.3-7 S087

S088 West Mata "Muffin"

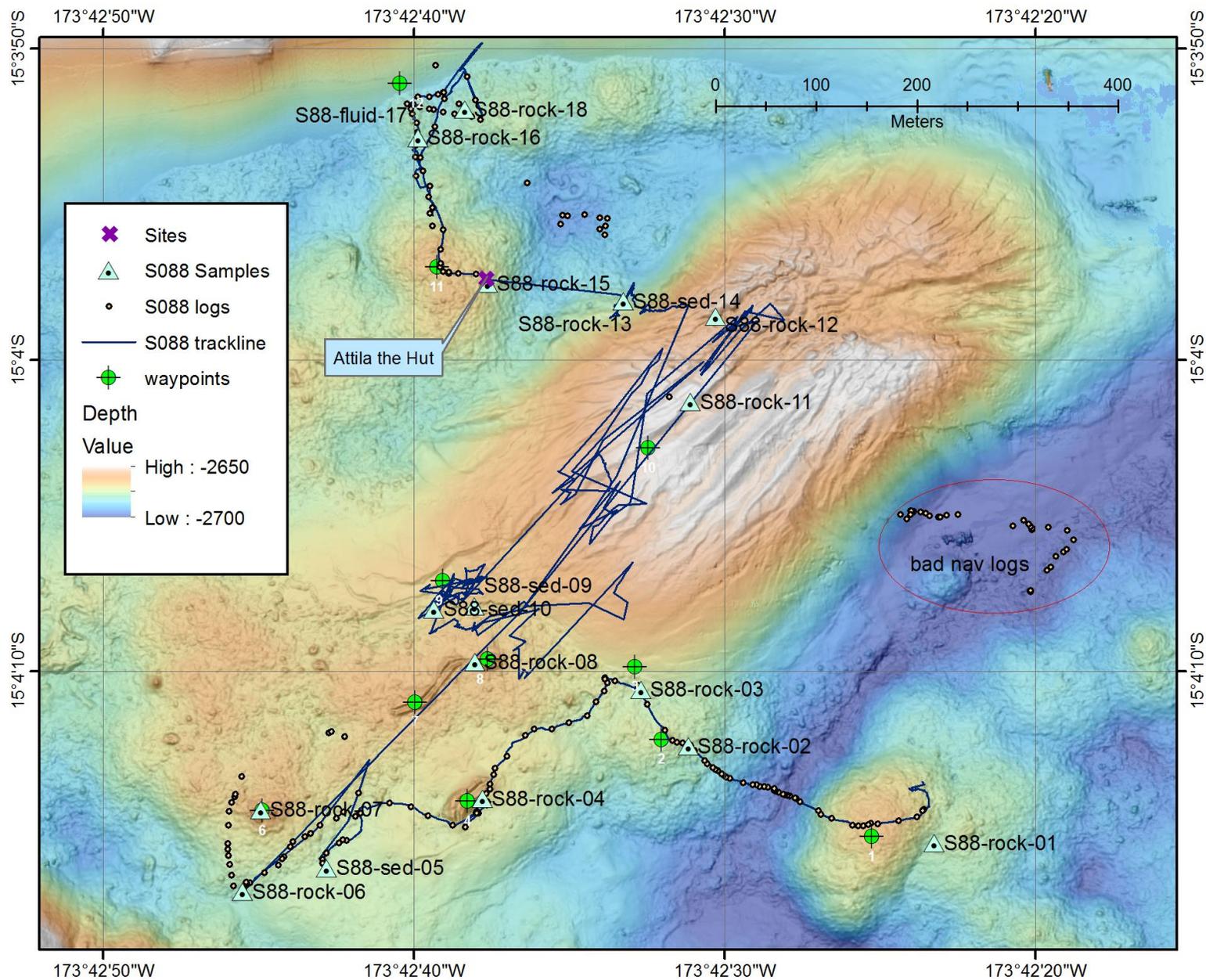


Figure 6.3-8 S088

S089 Mata Ua

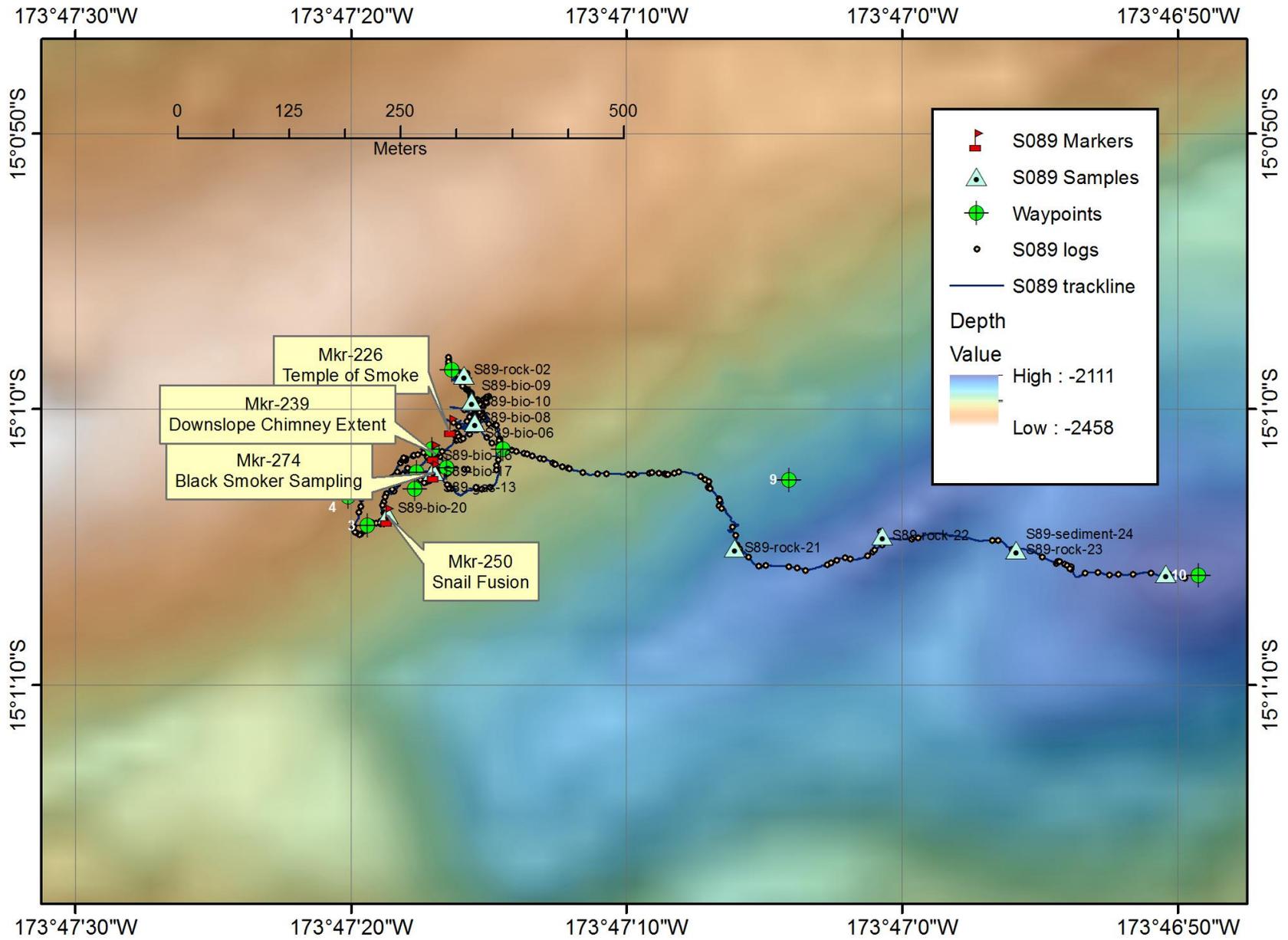


Figure 6.3-9 S089

S090 Mata Fitu

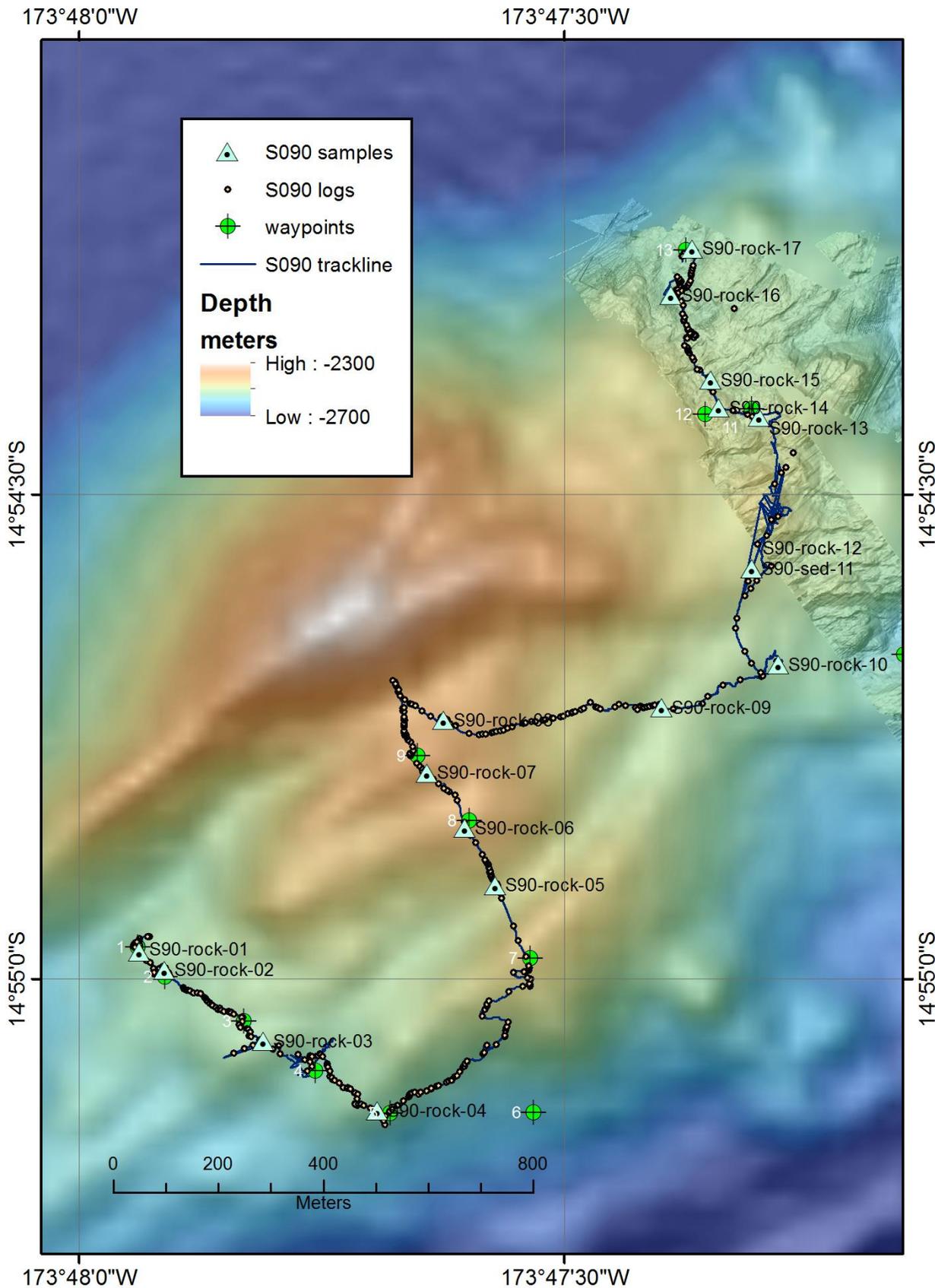


Figure 6.3-10 S090

S091 Mata Tolu

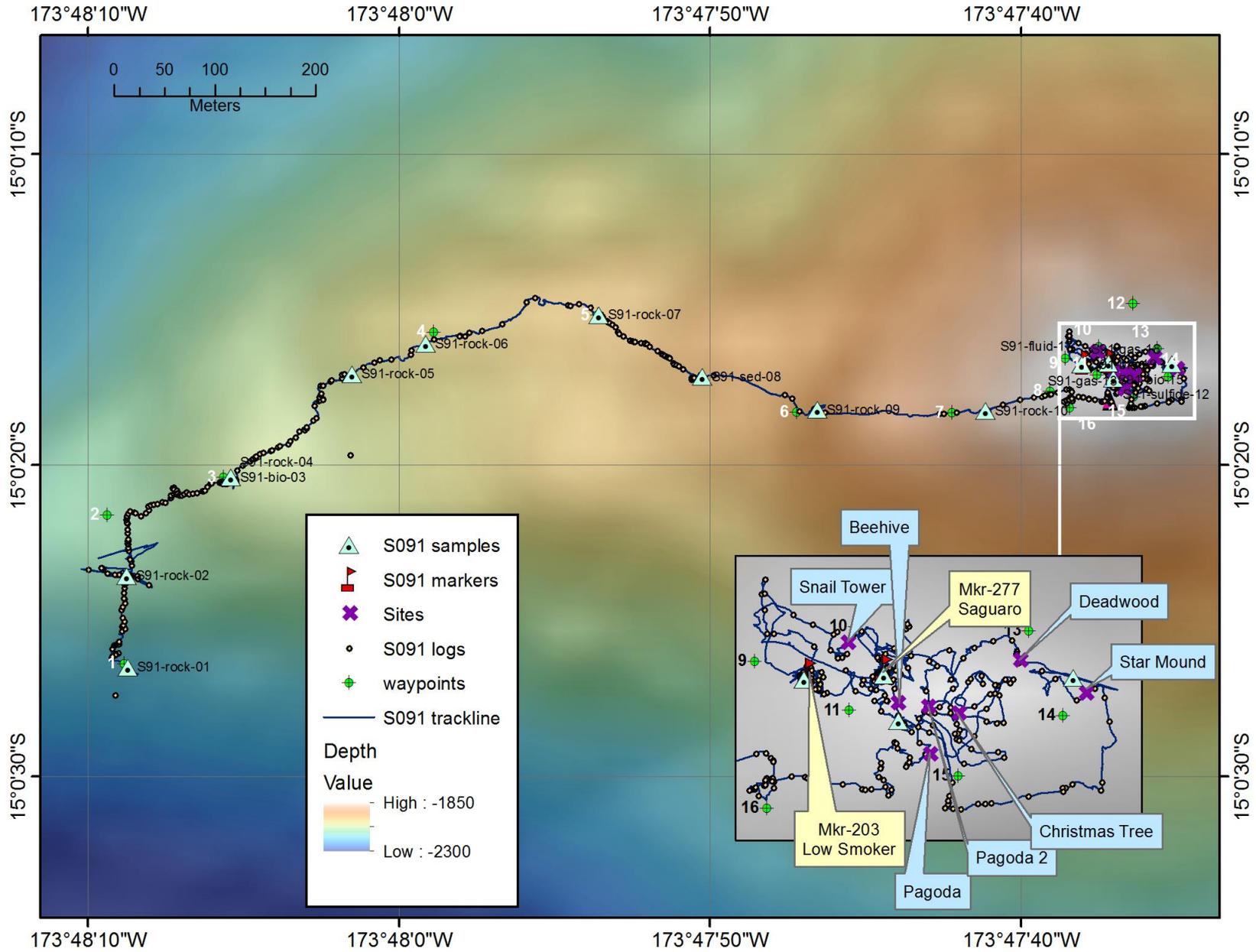


Figure 6.3-11 S091

S092 Dacite Flow

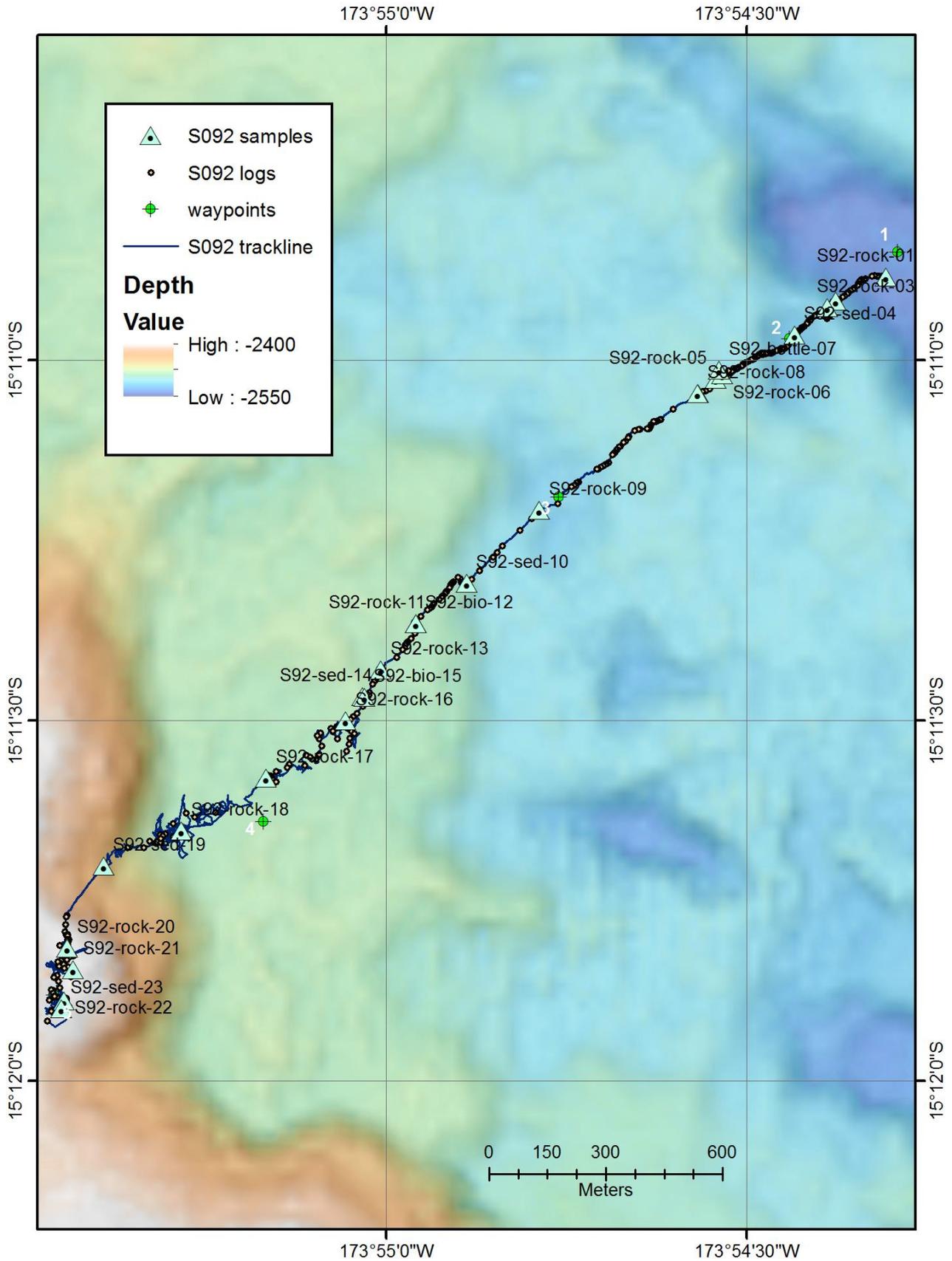


Figure 6.3-12 S092

S093 West Mata

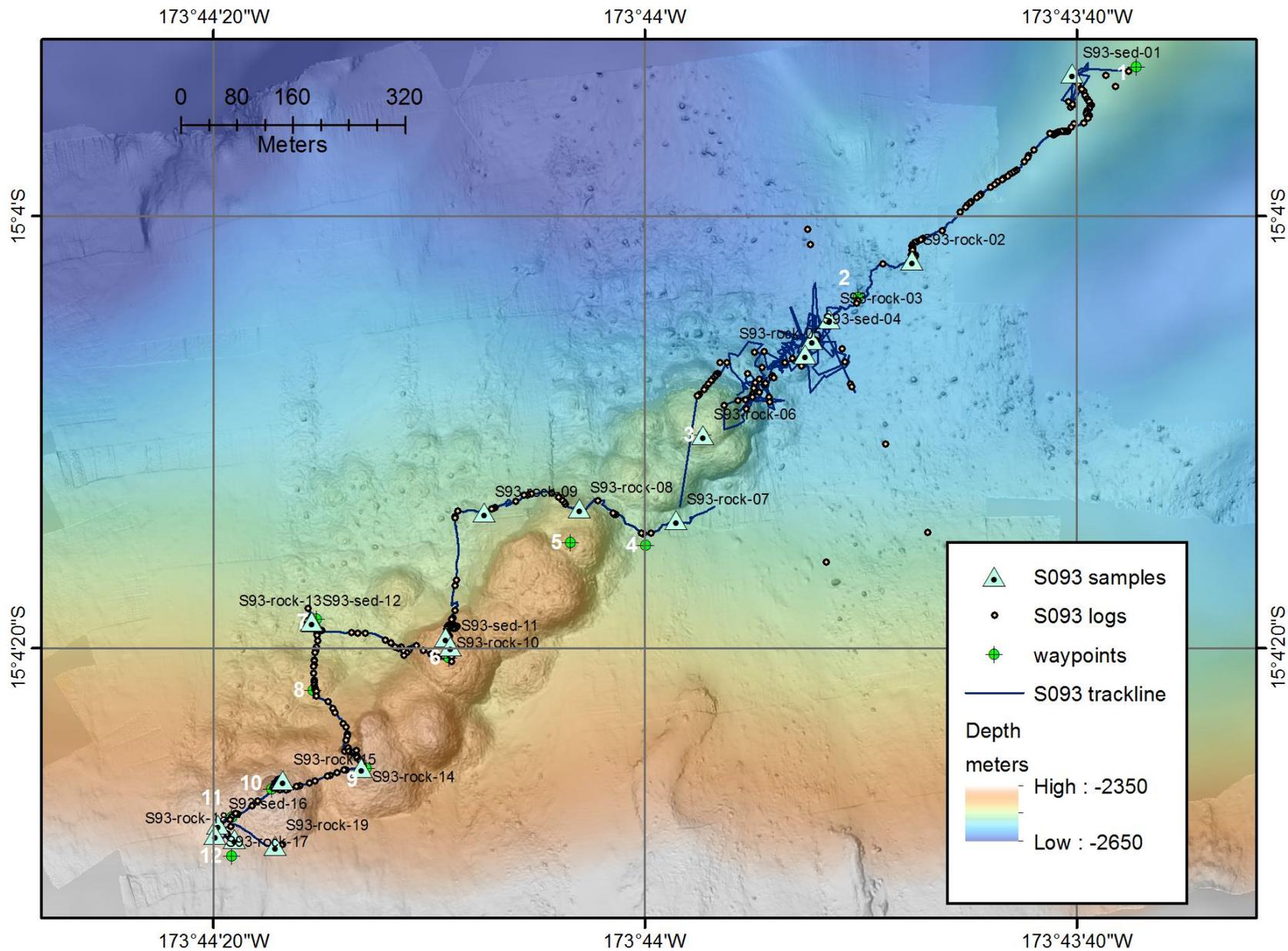


Figure 6.3-13 S093

S094 Mata Tolu

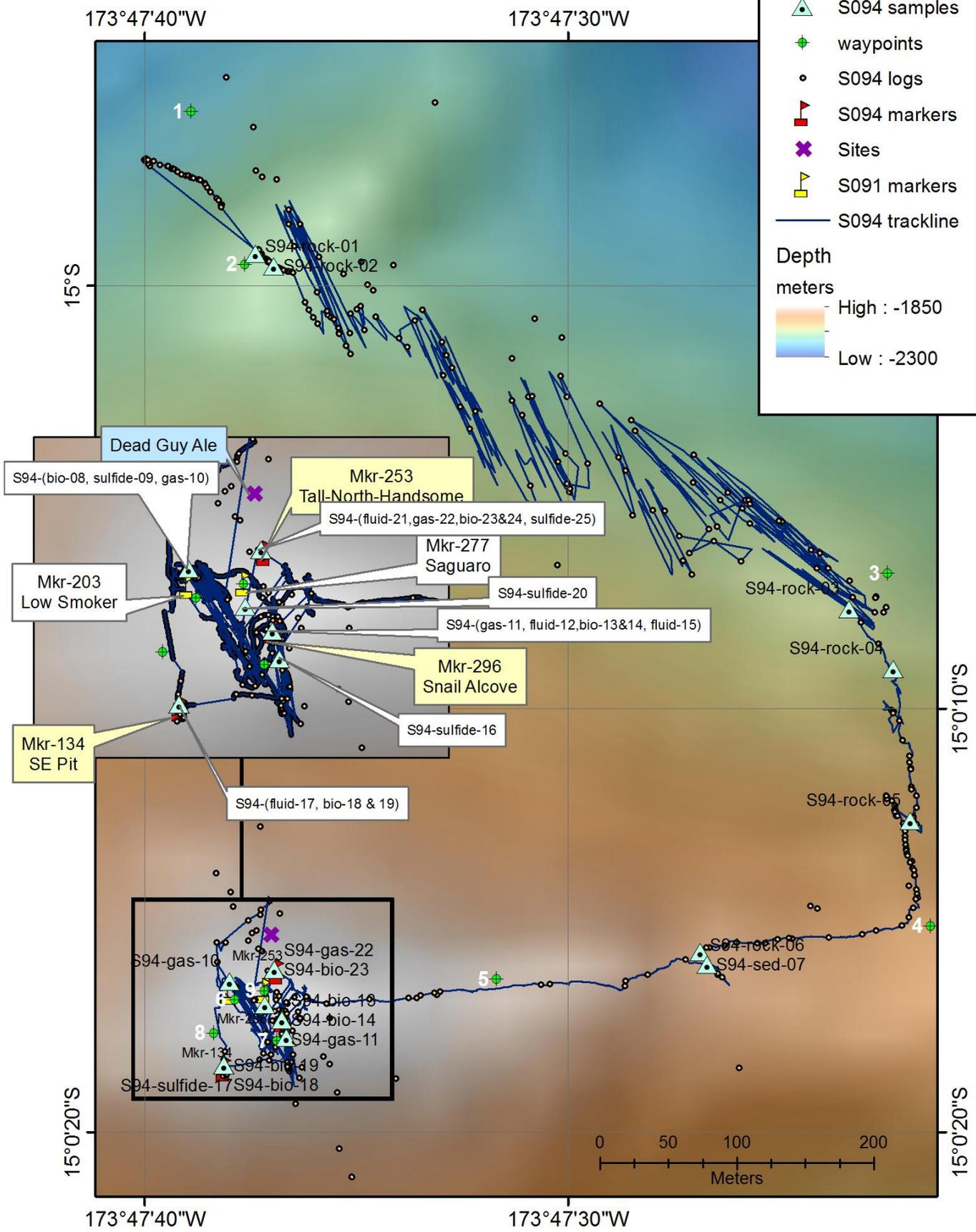


Figure 6.3-14 S094

S095 West Mata

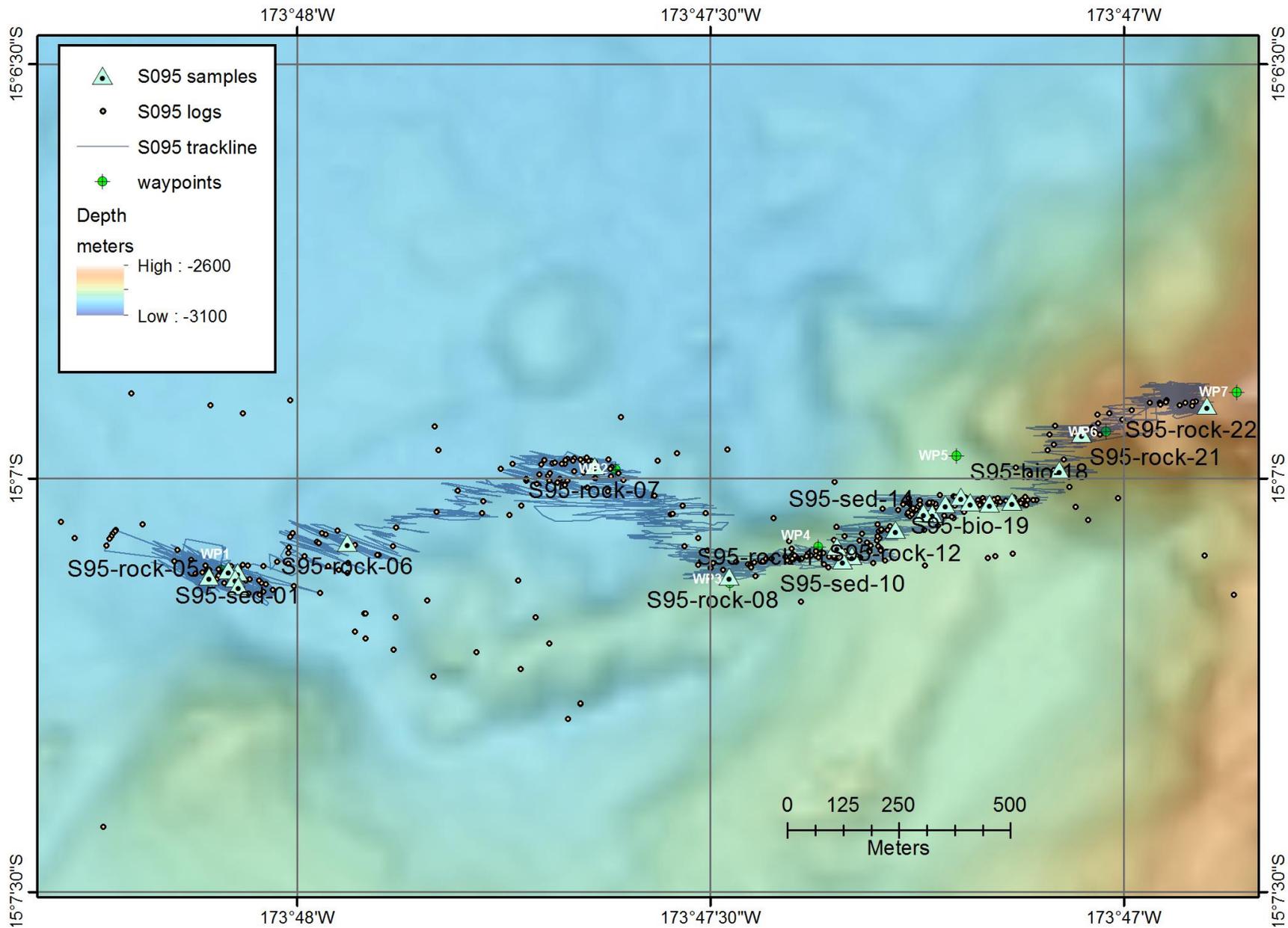


Figure 6.3-15 S095

S096 Mata Fa

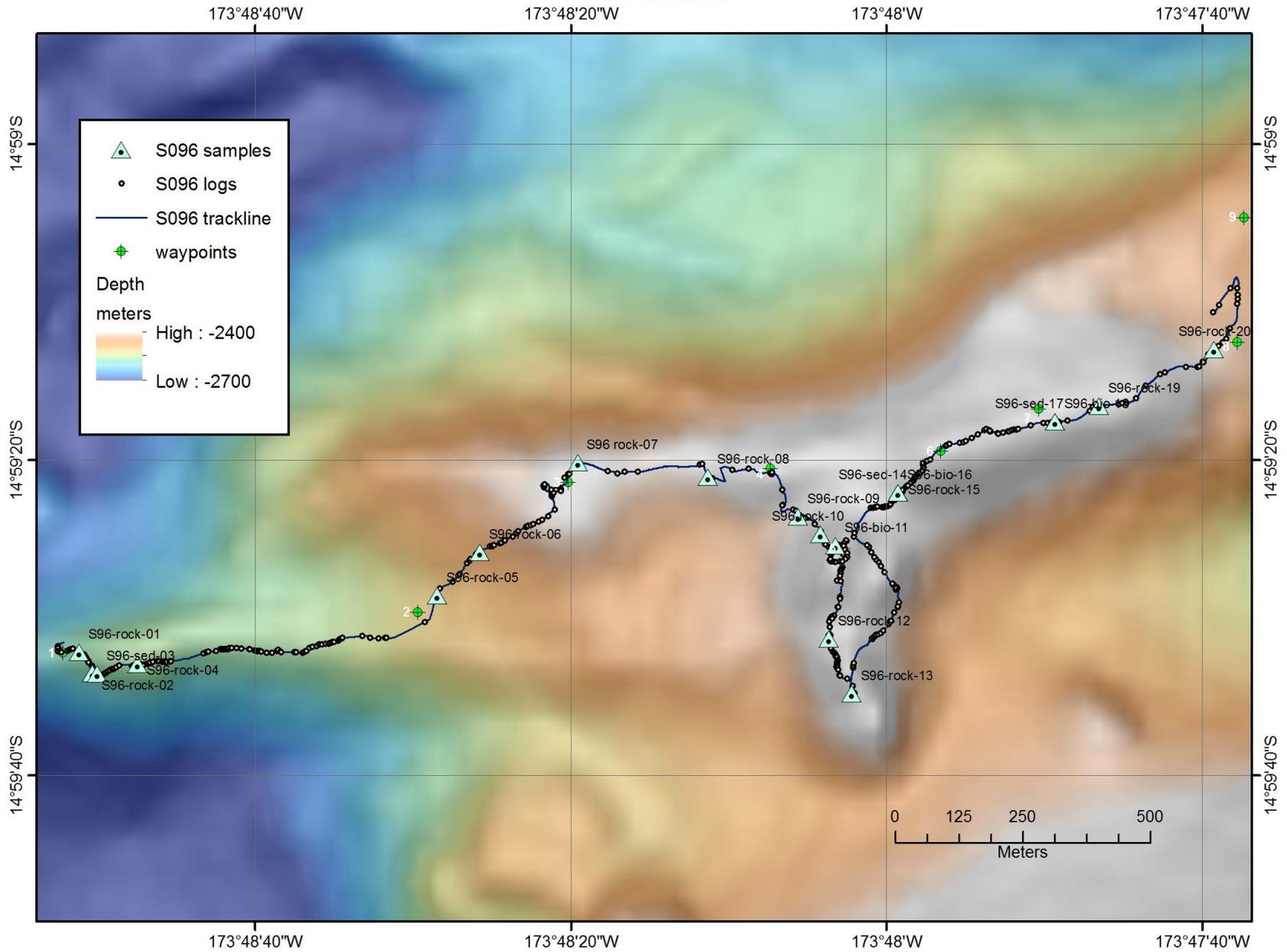


Figure 6.3-16 S096

S097 Mata Fitu

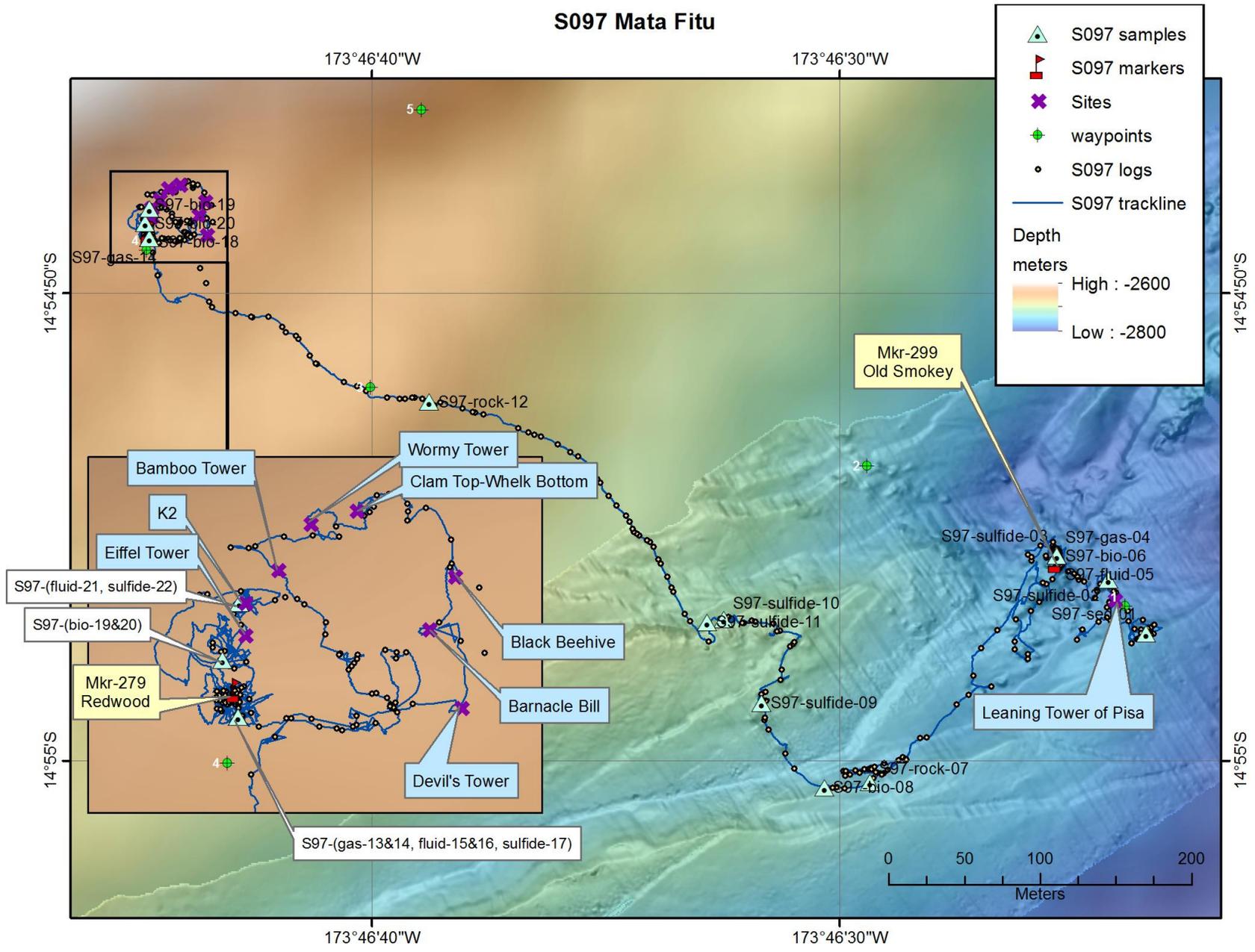


Figure 6.3-17 S097

S098 South Tafu

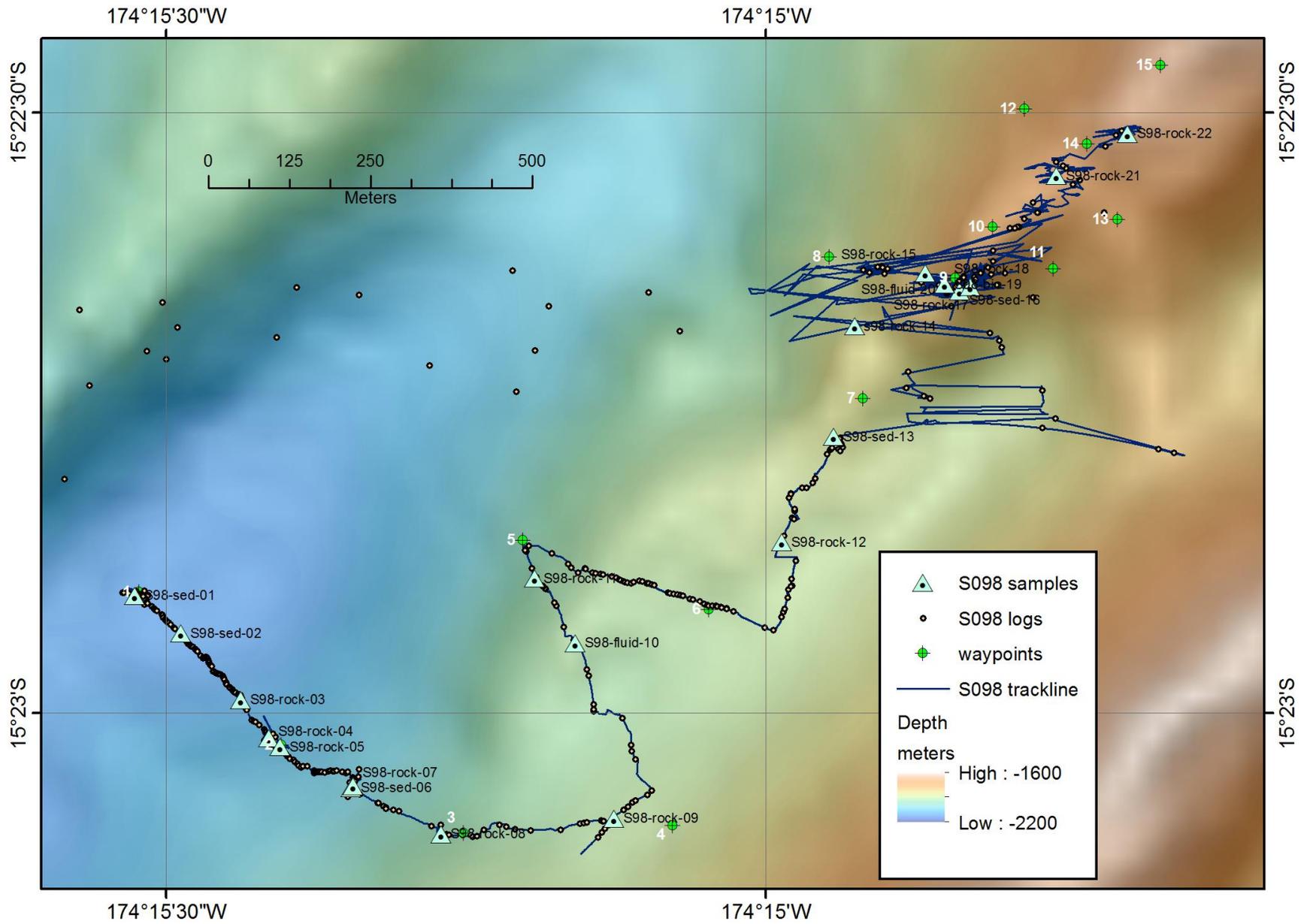


Figure 6.3-14 S098

S099 North Tafu

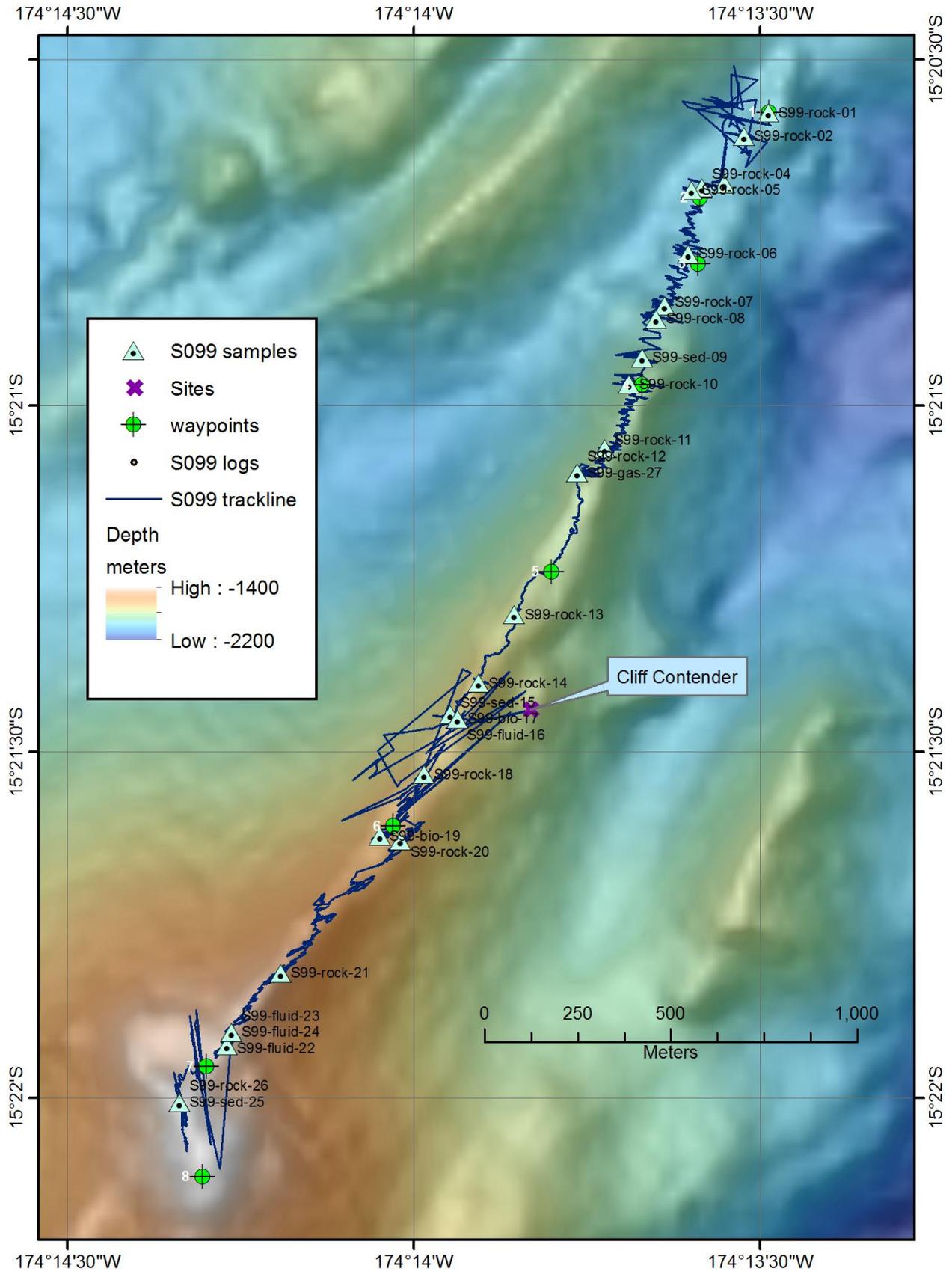


Figure 6.3-15 S099

S100 Mata Ua

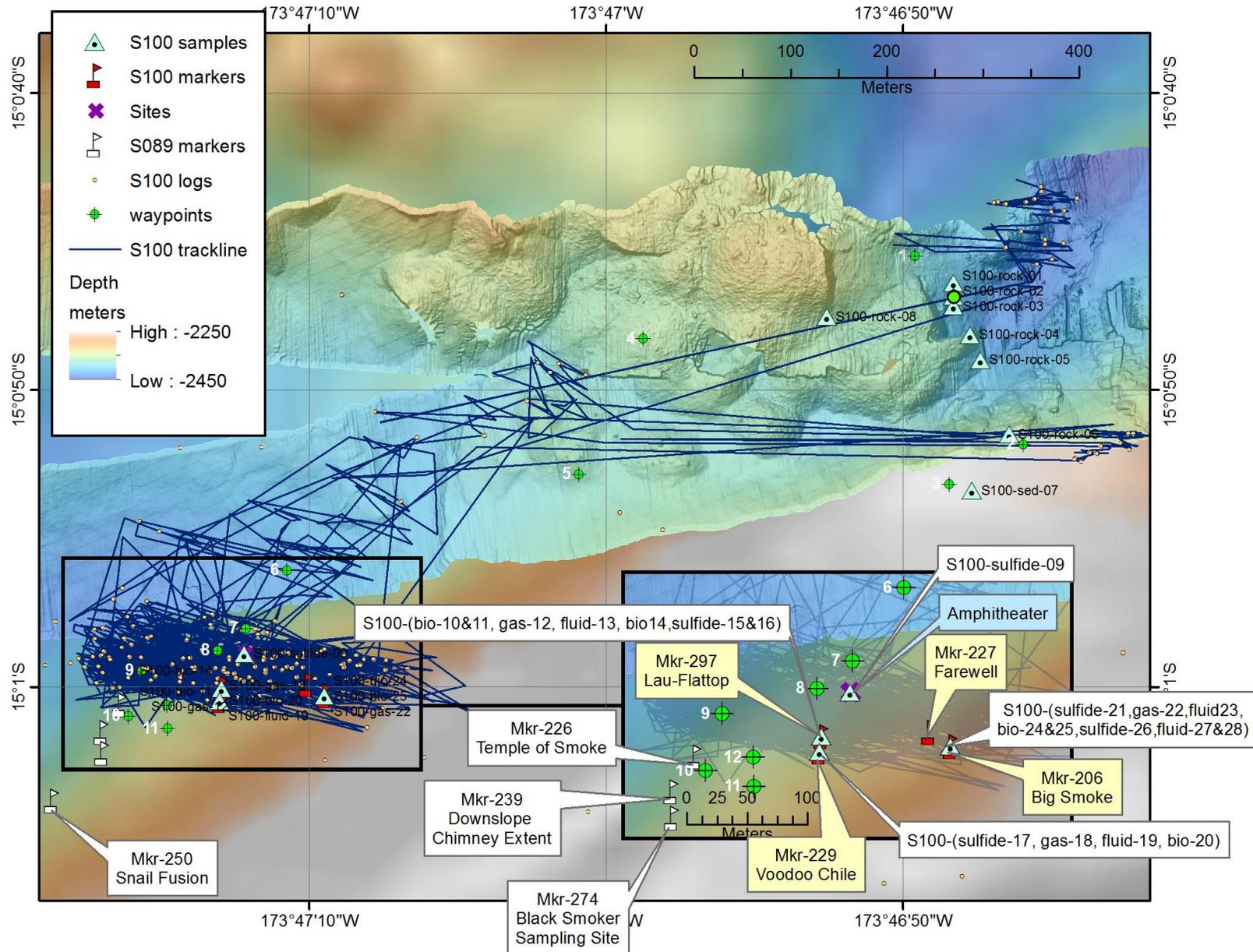


Figure 6.3-16 S100

S101 Mata Ono

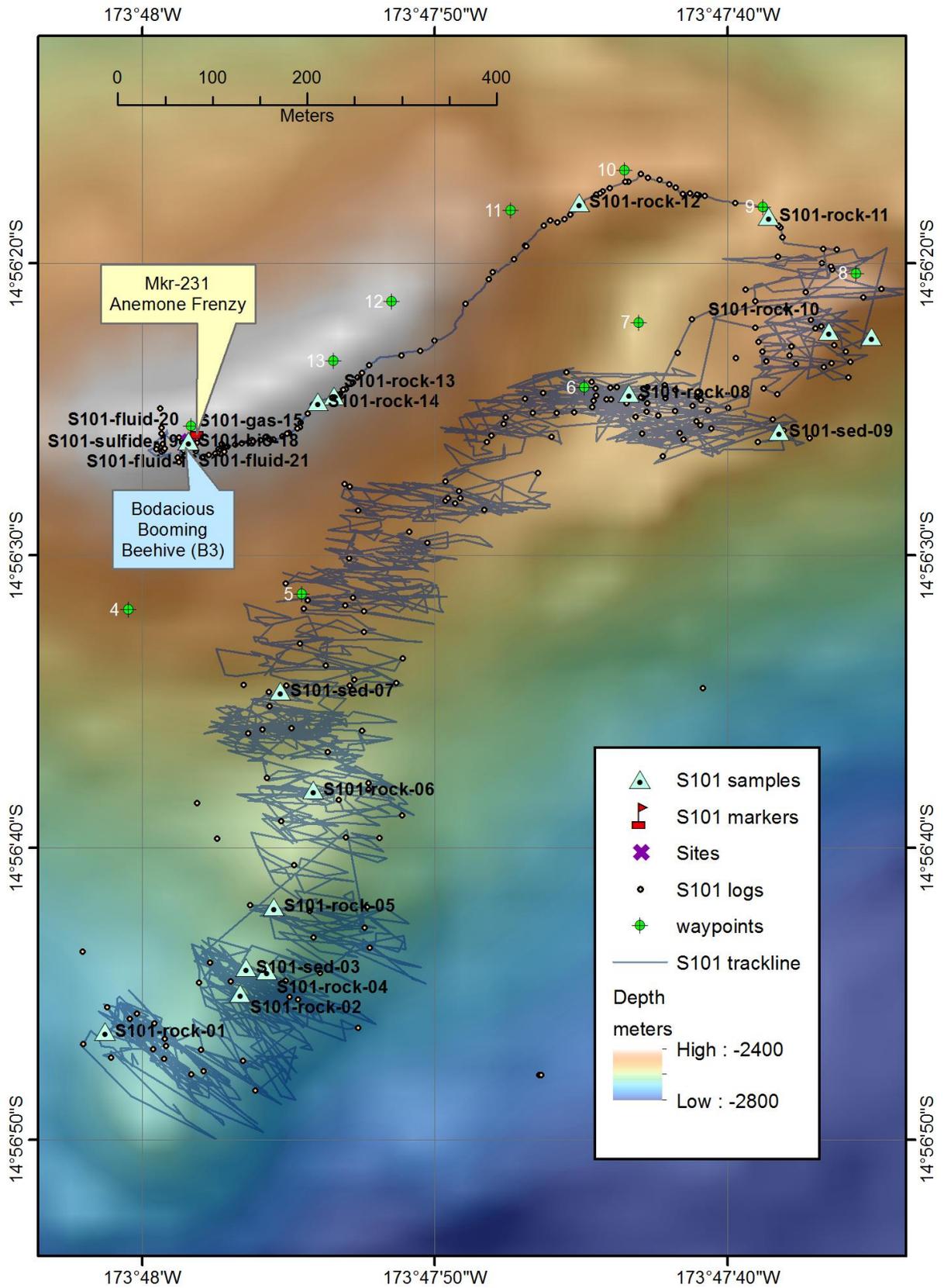


Figure 6.3-17 S101

S102 Mata Ono

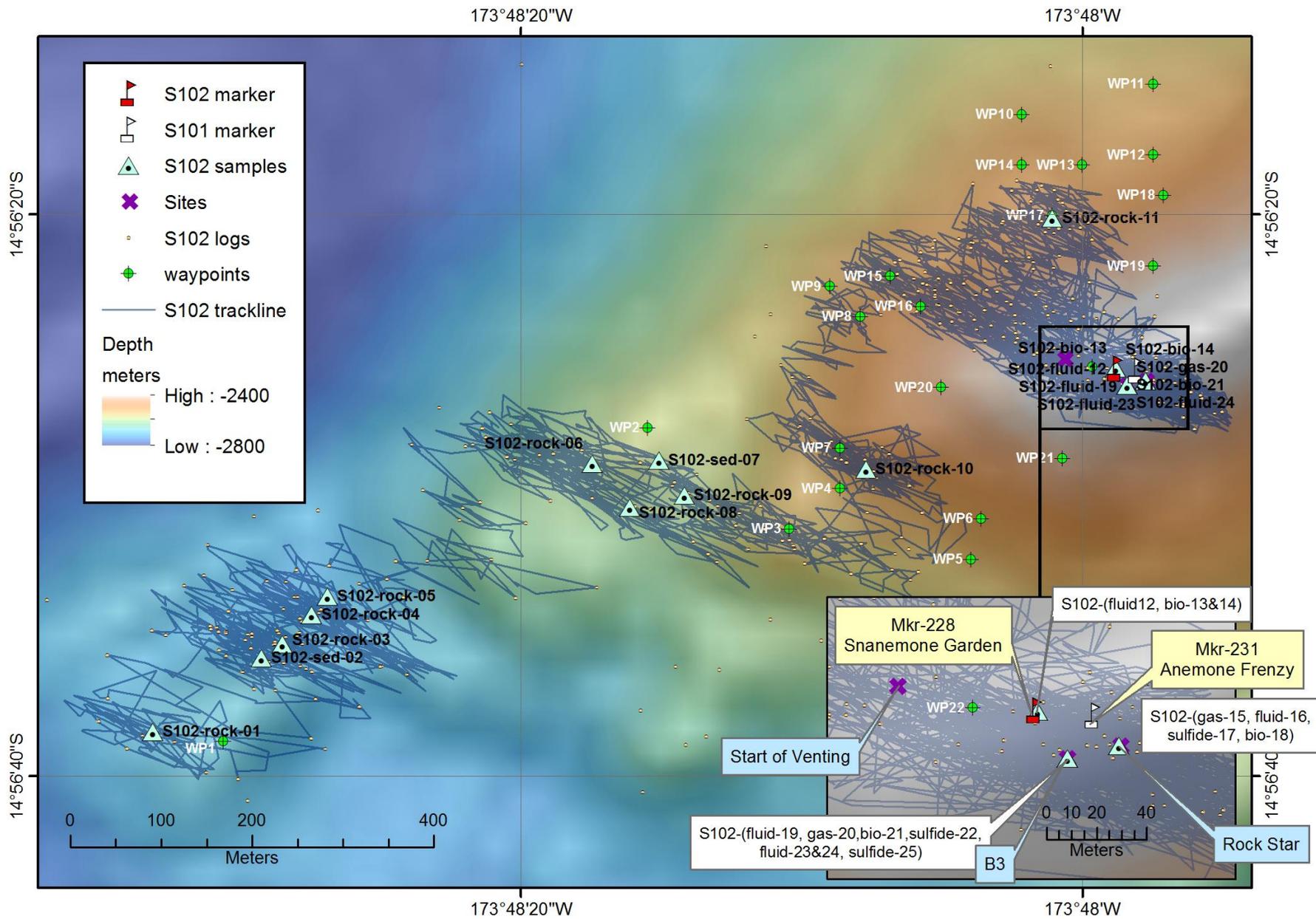


Figure 6.3-18 S102

S103 West Mata

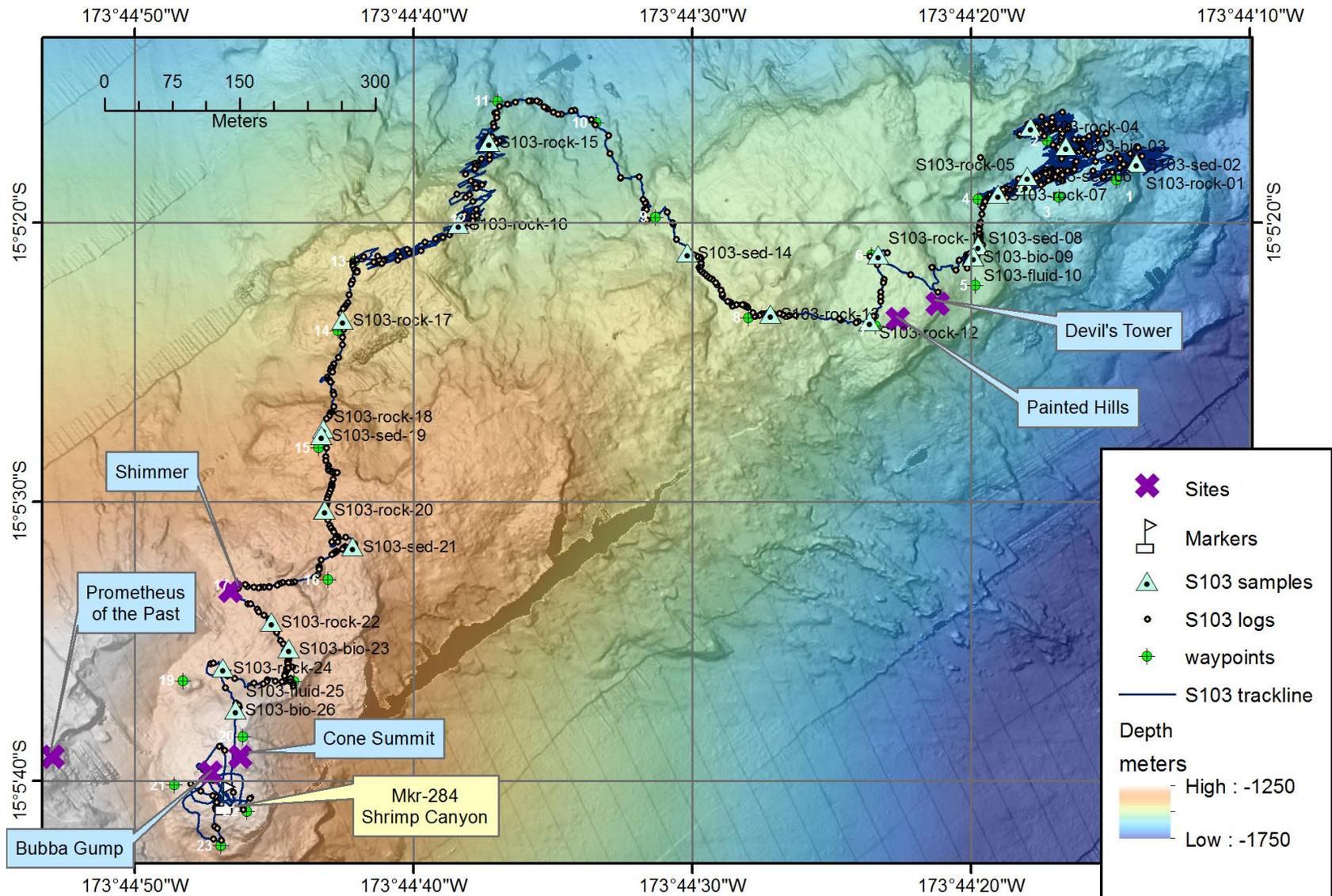


Figure 6.3-189 S103

S104 Mata Taha

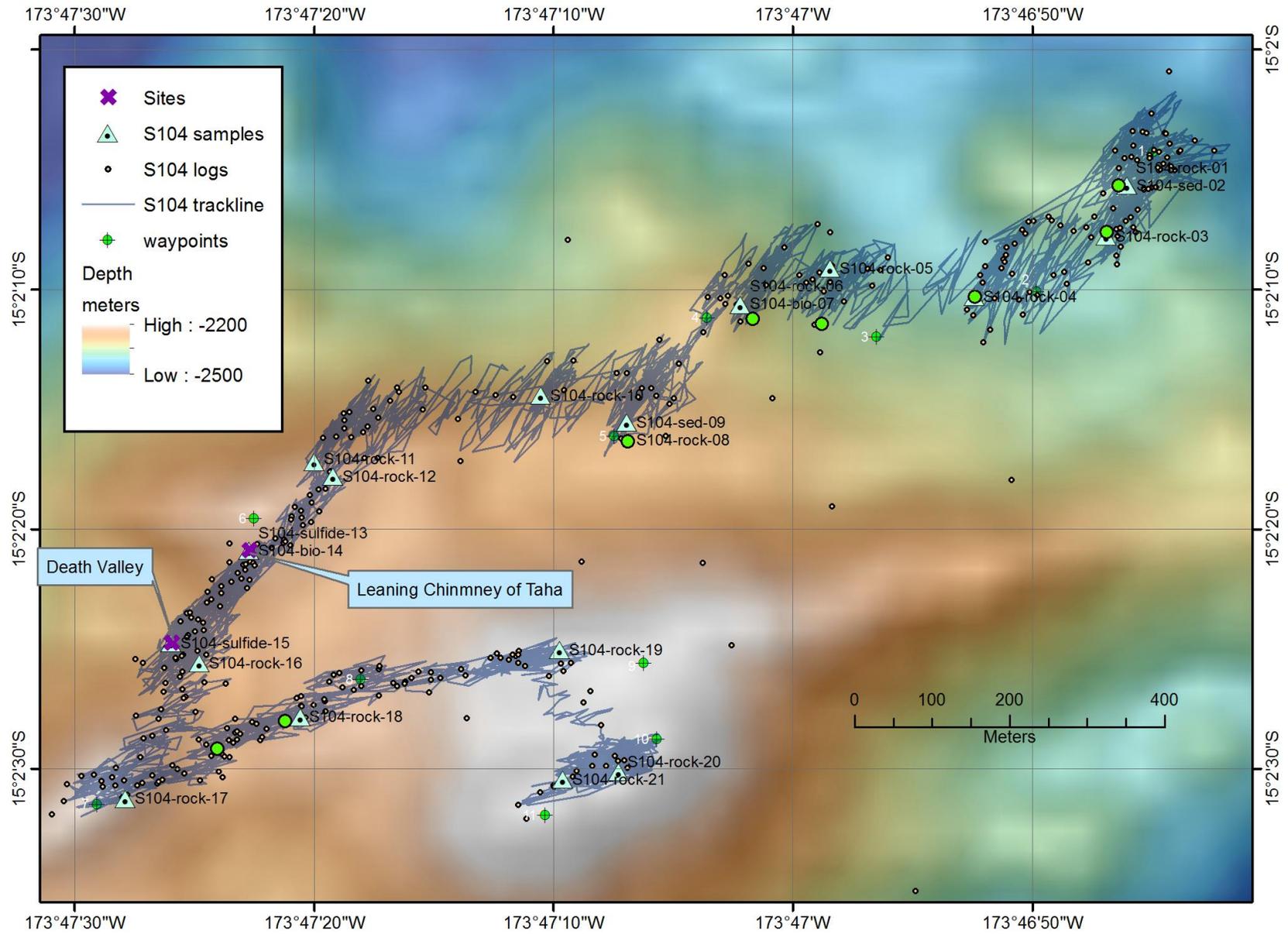


Figure 6.3-20 S104

S105 Dacite Flow

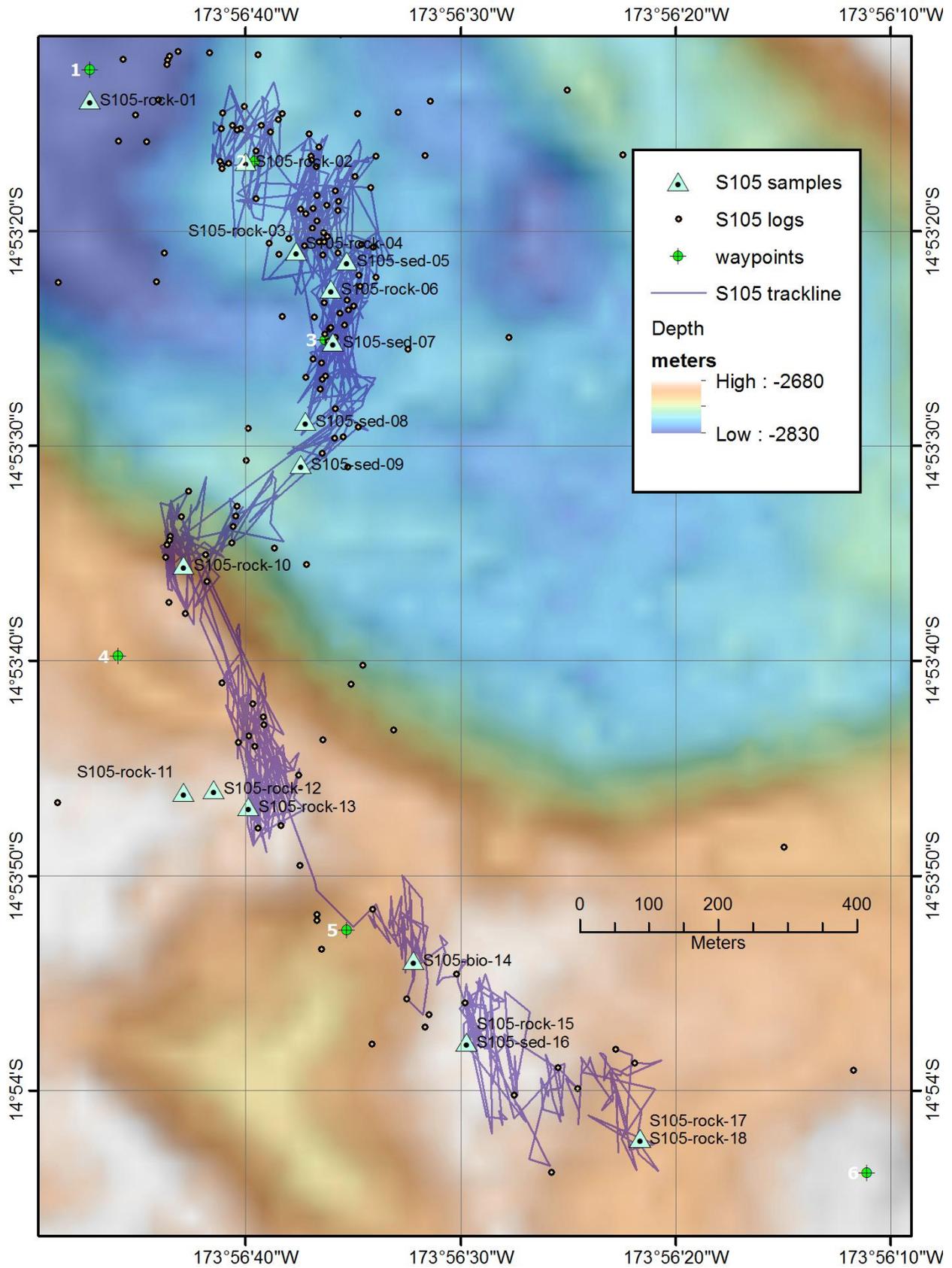


Figure 1921 S105

6.4 SuBastian Markers-Vents

Physical markers (provided by NOAA PMEL EOI Program) were placed at several sites during the SuBastian Dives. Markers were used to denote some of the sampling sites and areas that may be of interest for return expeditions. The depths for markers deployed on S85-S89 have been corrected to the PAROS depth values (bold-italics), replacing the Squidle-logged depths which were 10+ meters deeper.

Table 6.4-1 Markers deployed on FK171110 by SuBastian.

Marker	Edifice	Site	Latitude	Longitude	Depth	Dive Deployed	Logger Comments	Heading	Record Number
Mkr-224	W Mata	SW Hades Pit	-15.09432	-173.74915	1282	S85	Up the wall a bit (on N/NE wall) on the slope of the pit in shimmer and bacmat.	40	289
Mkr-139	W Mata	Shrimp Suburbia	-15.09440	-173.74840	1188	S85	Area of intense venting and lots of shrimp. Marker 10 m upslope from sampling site - half way between Prometheus and Shrimp City.	68	325
Mkr-284	W Mata	Shrimp Canyon	-15.09462	-173.74631	1266	S87	On new flow (2017-2011) lots of shrimp and squat lobsters. Diffuse 9°C flow.	335	494
Mkr-226	Mata Ua	Temple of Smoke	-15.01683	-173.78788	2356	S89	No words for this wonder. Deployed on steep slope in smoker field. Sampled black smoker just downslope from marker.	196	146
Mkr-239	Mata Ua	Downslope Chimney Extent	-15.01710	-173.78805	2358	S89	Edge of vent field (chimney line - largely inactive). Sampled sulfide worms and polynoids ~ 20 m SW of the marker	180	169
Mkr-274	Mata Ua	Black Smoker Sampling Site	-15.01729	-173.78805	2350	S89	Huge sulfides 17 m high. In the vicinity of 2012 Flashing site. Sampled.	32	234
Mkr-250	Mata Ua	Snail Fusion	-15.01774	-173.78852	2360	S89	Huge diffuse site with lots of biota Snails living together sampled	156	282
Mkr-277	Mata Tolu	Saguaro	-15.00463	-173.79366	1820	S91	At the summit. 250°C. Black smoker chimneys. About 3 m high "steeper on N face. Wide with a couple areas of black smokers and a little piece on top that looks like a Saguaro cactus.	351	552
Mkr-203	Mata Tolu	Low Smoker	-15.00464	-173.79389	1824	S91	T=260°C. Sampled. NW edge of venting.	192	570
Mkr-296	Mata Tolu	Snail Alcove	-15.00482	-173.79354	1813	S94	201°C. At the vent fields just up from the eastern side of the pit. Huge structure with lots of snails. Sampled.	214	442
Mkr-134	Mata Tolu	SE Pit	-15.00514	-173.79392	1843	S94	Tmax=23°C at sampling site but higher temps in surrounding area (43°C). At the base of the wall. Mussels above. Max=23°C. Stubby marker.	156	449

Marker	Edifice	Site	Latitude	Longitude	Depth	Dive Deployed	Logger Comments	Heading	Record Number
Mkr-253	Mata Tolu	Tall-North-Handsome	-15.00349	-173.79326	1822	S94	Handsome is huge with funny flange at top. Lots of black smokers and biota. Sampled. Tmax=204°C but not a good reading. Probably much hotter. Marker placed on extinct chimney to the SW (?) right next door.	249	486
Mkr-299	Mata Fitu	Old Smokey	-14.91548	-173.77371	2765	S97	275°C. 2765 m at the base. ~8m high. Tall and crusty. Sampled	290	133
Mkr-279	Mata Fitu	Redwood	-14.91352	-173.77911		S97	Tmax=295°C but probably hotter. 17+ meters high. No broad base - rises out of the ground like a redwood tree. 2 main black smoker beehives at top and lots of smaller ones. Base is 2630m. Marker deployed at 2633m.	19	405
Mkr-297	Mata Ua	Lau-Flatop	-15.01668	-173.78693	2340	S100	327°C. Sampled	130	262
Mkr-229	Mata Ua	Voodoo Child	-15.01680	-173.78695	2340	S100	322°C Sampled	82	367
Mkr-206	Mata Ua	Big Smoke	-15.01675	-173.78597	2330	S100	324°C Sampled	155	411
Mkr-227	Mata Ua	Farewell	-15.01665	-173.78613	2322	S100	Beautiful smoker on our way out of the field. Not sampled.	324	431
Mkr-231	Mata Ono	Anemone Frenzy	-14.94043	-173.79947	2358	S101	Diffuse flow site at summit. Did not sample. Anemones everywhere.	261	305
Mkr-228	Mata Ono	Snanemone Garden	-14.94941	-173.79967	2358	S102	Sampled water and biology. Area of diffuse flow with lots of anemones and Alvinococoncha snails. C=12.3°C .	148	386

Table 6.4-2 Named sites (without physical markers) during FK171110 SuBastian dives

Edifice	Site	Latitude	Longitude	Depth	Dive	Logger Comments	Record #
W Mata	Bubba Gump	-15.09437	-173.74647	1267.4	S85	Shrimp everywhere as well as squat lobsters. Nav marker here called "Bubba Gump"	427
W Mata	Cone Summit	-15.09421	-173.74617	1251.1	S85	Adding nav target called "Cone Summit" - when we get to the highest point..	438
W Mata	Painted Hills	-15.08985	-173.73962	1513.3	S86	Hydrothermal staining on rolling hills. Putting down a nav marker called "Painted Hills". Looks like a Monet painting.....	303
W Mata	Devil's Tower	-15.08970	-173.73922	1515.3	S86	Devils Tower is about 5 m high at least with lots of yellow staining. Some microbial mat and lots of yellow floc. It's a Hornito. Can see little peak in the bathy.	306
W Mata	Prometheus of the Past	-15.09421	-173.74804	1186	S87	Sampled but did not deploy a marker. 24C fluid. Spectacular site with biota and lots of flow.	418

Edifice	Site	Latitude	Longitude	Depth	Dive	Logger Comments	Record #
W Mata	Attila the Hut	-15.06595	-173.71048	2671.9	S88	Local high surround by smooth lava.	401
Mata Tolu	Pagoda Chimney	-15.00488	-173.79353	1819	S91	This is probably what we called Pagoda chimney in 2012.	356
Mata Tolu	Pagoda Chimney2	-15.00474	-173.79353	1819.5	S91	This one looks like a pagoda too. The altitude is about 8 meters. Put in dive target Pagoda Chimney 2.	363
Mata Tolu	Beehive	-15.00473	-173.79362	1815.4	S91	Fairly big beehive (not 2012 Smoker Chimney)	379
Mata Tolu	Snail Tower	-15.00455	-173.79377	1825.1	S91	Snail Tower nav target. Looking to the SE.	418
Mata Tolu	Deadwood	-15.00460	-173.79326	1837	S91	Inactive sulfides. Calling this place "Deadwood". 15.0046031 173.7932566. Z=1837 at the base of this structure. (Sampled)	444
Mata Tolu	Star Mound	-15.00470	-173.79306	1838.9	S91	"Star mound" this sulfide chimney with no venting and the sea stars.	450
Mata Tolu	Christmas Tree	-15.00476	-173.79344	1820	S91	Christmas tree - massive sulfide: The base is probably 10 meters wide. Christmas tree pos: 15.00476 173.79344. Z=1820 at top and > 6 m tall.	488
Mata Tolu	Dead Guy Ale	-15.00426	-173.79362	1821	S94	Dead Guy Ale: 15.0042613 173.7936195 Z=1821 m This sulfide structure is ~ 5m high. Stored in partition 11. The sampling site was maybe Lawrence Whelk.	486
Mata Fitu	Leaning Tower of Pisa	-14.91572	-173.77336	2767	S97	14.915716 S 173.7733645 Chris fix for this leaning old extinct chimney structure. "Leaning Tower of Pisa". Sampled	57
Mata Fitu	Devil's Tower	-14.91355	-173.77876	2622.2	S97	Devils Tower. 14.9135370 173.778768. Z=2622. Alt=13m.	292
Mata Fitu	Barnacle Bill	-14.91343	-173.77881	2618.1	S97	Still moving up this large chimney. Barnacle Bill. 14.9134250 173.7788214. 15 meters high. Smokers. Tall and skinny.	297
Mata Fitu	Black Beehive	-14.91335	-173.77877	2624.8	S97	Now we're heading NW. Black smoker beehive on top. Black beehive. Hdg is 29614.013355 173.778777. Hdg = 9m. Iron encrusted tower.	300
Mata Fitu	Clam Top - Whelk Bottom	-14.91325	-173.77892	2627.3	S97	Anemones and whelks galore here. Dubbing this "Clam Top - Whelk Bottom".	309
Mata Fitu	Wormy Tower	-14.91327	-173.77899	2626.5	S97	Scale worms; shrimp; squat lobsters; Just one area of venting up top. Black smoker bee hives near the bottom. Dubbed "Wormy Tower" 14.9132515 173.7789774 Z=2630 at the base.	315
Mata Fitu	Bamboo Tower	-14.91334	-173.77904	2628.3	S97	Beyond it is another monster tower. Bamboo Tower??	322
Mata Fitu	Eiffel Tower	-14.91344	-173.77909	2624.6	S97	Eiffel Tower target: 14.913457 173.7791502. Z=2623 at the top. It's about 9 m high. Eiffel Tower has lots of orifices - some big beehives with gray smoke. Sampled.	407
Mata Fitu	K2	-14.91339	-173.77909	2631.7	S97	Found a fairly tall chimney ~10m west of Bamboo Tower. Terry suggests "K2". Sampled.	419
North Tafu	Cliff Contender	-15.35732	-174.23052	1676	S99	Nav fix for Cliff Could Have Been a Contender (Cliff Contender) site: 15.357548 174.232277 Z=1671. "Cliff Could Have Been a Contender" site. That's probably a little patch of sulfur with some white filamentous mat on edge. Sampled.	400
Mata Ua	Amphitheater	-15.01635	-173.78672	2346.7	S100	S100-sulfide-09 Location: 15.0163547 173.7867155 depth 2348m "The Amphitheatre". ~7m tall chimney. Sampled.	214

Edifice	Site	Latitude	Longitude	Depth	Dive	Logger Comments	Record #
Mata Ono	Giant Beehive - Renamed Bodacious Booming Beehive (B3)	-14.94058	-173.79956	2361	S101	The largest beehive structure we've ever seen. 40+ cm across. Lots of secondary beehives and spires. Position on S101: 14.9405783 173.7995584. Sampled.	347
Mata Ono	Start of Venting	-14.94032	-173.80017	2380	S102	Putting a nav marker in here where the hydrothermal venting starts - at least the animals. Started at about 2380 m.	360
Mata Ono	Rock Star Chimney	-14.94054	-173.79938	2361	S102	Summit of Mata Ona. Castle-looking feature with a broad base and lots of spires. Sampled. T=238C. Sampled at 2354 m Alt=7.5m at sampling site. Edifice ht = ? (see log).	392
W Mata	Shimmer	-15.09256	-173.74627	1285	S103	NAV TARGET: SHIMMER 15.0925316 173.7461874. Z=1287 m. A little bit of shimmering water; some shrimp; polynoids; brachyuran crab;	537
Mata Taha	Leaning Chimney of Taha	-15.03914	-173.78965	2261	S104	This extinct chimney is 6 meters tall - the consensus of the ROV pilot. This is an odd tilted crooked chimney - all by itself. At least for now. Sampled.	252
Mata Taha	Death Valley	-15.04021	-173.79055	2252	S104	Chimney spire - weathered and covered in sediment. Intact? 15.038254 173.798012. Probably a 9 m high chimney. Sampled.	265

2017 Markers and named Sites

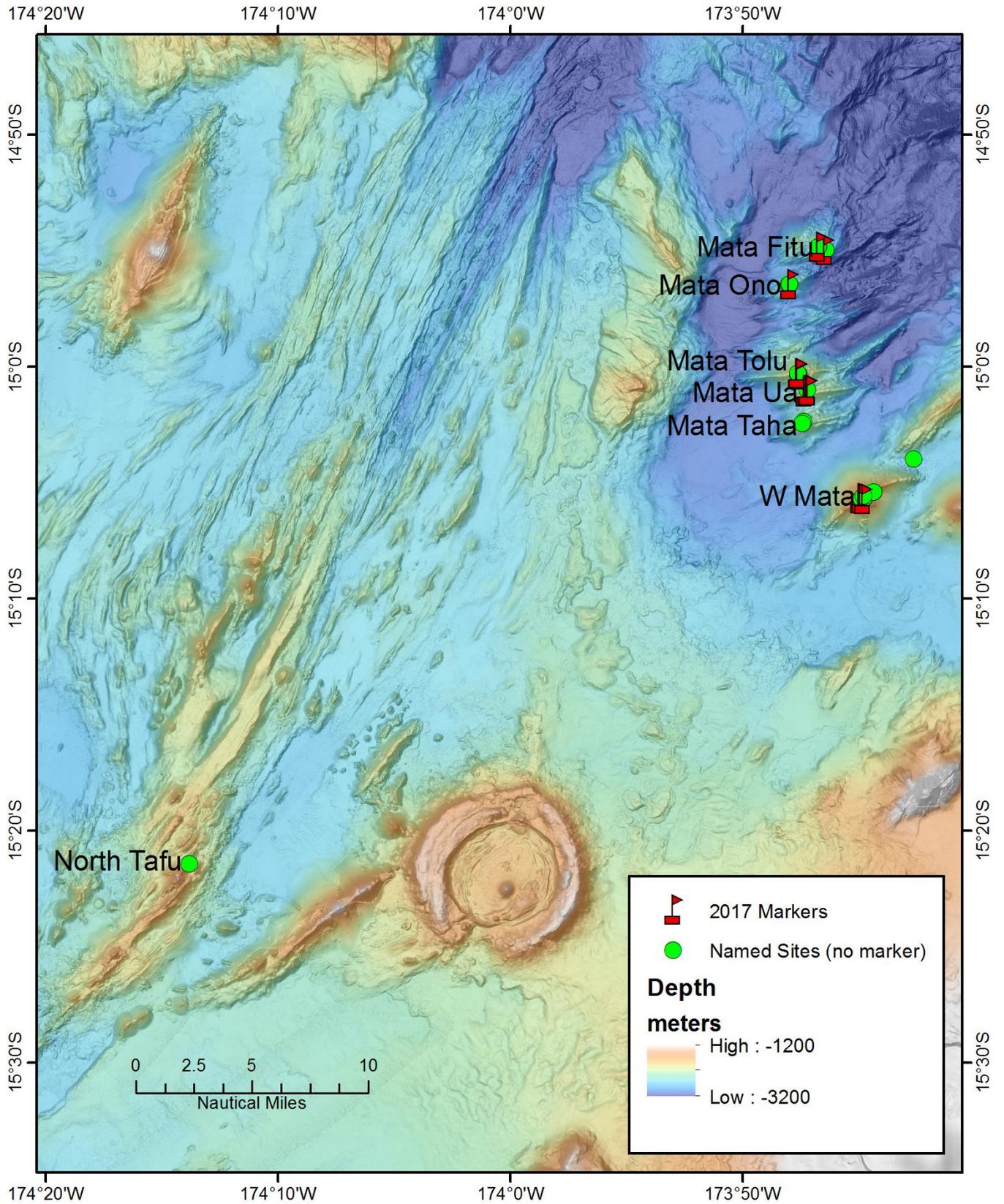


Figure 6.4-1 Markers and sites named on FK171110. See individual dive maps for marker numbers and names.

6.5 SuBastian Samples

SuBastian samples were collected on each dive and numbered sequentially as collected. Samples are named by dive, type and their collection number: Dive-type-Number, S085-rock-01 for example. The type in the name indicates the primary purpose of the sample and the description will indicate if there were subsamples of different types (such as rock collected that had biology on it). The time and date are GMT, not local times. Position information was evaluated after the dive to determine the best latitude/longitude between Greensea and the navigator's written positions then adjusted as displayed on the dive maps. For more information see Section 5.0 regarding navigation issues and examine each dive's map for navigation quality during sampling. Depths for dives S085-S088 and a sample logs are incorrect for depths for these dives as well.) Sample metadata is submitted to SESAR (System for Earth Sample Registration) at www.geosamples.org.

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S85-Rock-01	Sample S85-Rock-01. Piece of disgorged pillow and its boninite glassy lava rind (very circular) covered in volcanoclastic sediments. Pillow ~5cm thick and rind about 10cm long by 5cm thick. Can see pyroxene crystals. Probably fell from pillow piece directly above it. ~22m NE of waypoint 1. Going in the biobox partition 1.	-15.09815	-173.75324	1443.5	1.1	40	2017-11-26	19:27:35	S85	55
S85-Rock-02	S85-rock-02. ~20 cm long x 10 wide cm x 10 cm thick. All glassy rind with lava drips. Disgorged pillow lava piece probably from pillow directly above it. The piece is glassy and fragile. Looks like lava drips on top. Placed in rock box section 1. ~11m NNE of waypoint 2.	-15.09737	-173.75282	1403.0	2.0	43	2017-11-26	19:59:28	S85	88
S85-Rock-03	S85-rock-03. Grabbed a piece of altered rock, pillow rind. 40cm long w0cm wide by 1cm thick glass rind. Pillow rind. Huge rock with orange alteration. Placed in stbd rock box. ~15m SW of waypoint 3.	-15.09716	-173.75222	1374.8	2.6	36	2017-11-26	20:16:49	S85	103
S85-Sed-04	S85-Sed-04. Three sample attempts with core tube #4, ultimately using tube as scoop and sample placed in core holder. Coarse volcanic sand. 36m NE of waypoint 3.	-15.09691	-173.75178	1368.7	0.0	137	2017-11-26	20:43:52	S85	130
S85-Rock-05	S85-rock-05. 15cm Pillow fragment with glassy rind and orange staining. Second piece of boninite. Very vesicular. Put in rock box partition 2. From top of pinnacle SW of Hades pit rim. ~19m N of waypoint 7.	-15.09529	-173.74966	1231.6	0.0	34	2017-11-26	21:44:20	S85	194
S85-gas-06	Collecting sample S85-Gas-06 in green gas tight sampler. From strongly shimmering water on SW wall of Hades pit. Temperature measured at 17.7degC. (Waypoint 8).	-15.09502	-173.74957	1277.5	1.5	188	2017-11-26	22:41:52	S85	234
S85-fluid-07	S85-fluid-07. Major sampler yellow is in position inside the vent where GTB collected. Collecting sample S85-fluid-07. Location: SW Hades Pit wall.	-15.09502	-173.74957	1277.5	1.5	188	2017-11-26	22:57:46	S85	240

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S85-bio-08	S85-bio-08 Collecting shrimp samples via suction from inside Hades pit. ROV came off bottom from previous samples and slightly different location/heading for this sample. Sample is located in Canister 7.	-15.09497	-173.74956	1273.9	6.5	263	2017-11-26	23:10:44	S85	245
S85-gas-09	S85-gas-09. Yellow Gastight that was inadvertently tripped at SW Hades Pit. Tripped right at same time as sampling with green gastight S85-gas06 (sample out of sequence). Background sample.	-15.09502	-173.74957	1258.3	4.6	188	2017-11-26	23:32:17	S85	262
S85-bio-10	S85-bio-10. Suction sample of biology from NNW rim of Hades pit. Sucking up a shrimp (Opaepele); 2 scaleworms into Canister 6. (Waypoint 10).	-15.09433	-173.74960	1255.3	2.7	21	2017-11-26	23:42:45	S85	272
S85-bio-11	S85-bio-11. 10m NE of Mkr-139 at "Shrimp Suburbia". Area of intense venting and milky water. Suction of shrimp into Canister 5. Z=1190. ~15m NE of Mkr-139 between waypoints 13 and 14.	-15.09434	-173.74829	1178.7	1.7	356	2017-11-27	00:35:03	S85	334
S85-fluid-12	S85-fluid-12. Major sampler 4. Huge amount of flow. Same location at Shrimp Suburbia as the previous bio sample (#11). Temperature measured at 22.5degC after sampling.	-15.09434	-173.74829	1180.6	1.0	298	2017-11-27	00:40:48	S85	337
S85-bio-13	S85-bio-13. Squat lobster sample taken after trying to sample very fast shrimp (Opaepele). ~48m SE of waypoint 15. Substrate is brownish pillow lavas with sulfur stain.	-15.09396	-173.74766	1180.7	85.1	335	2017-11-27	01:28:34	S85	378
S85-rock-14	S85-rock-14. On the new lava cone-in place lava. Z=1293. 15.09471 173.74618. Going in middle biobox partition 4. Near base of slope with new/old contact of new cone. ~80m NW of waypoint 16.	-15.09449	-173.74698	1279.3	1.9	92	2017-11-27	01:58:42	S85	410
S85-rock-15	S85-rock-15. Lobate lava with drain-out features. Grabbing a piece of the lava rind/crust on the roof. Z=1281. Lava drips all over the bottom. Sample broken to fit in rock box partition 4. 1cm or so thick lava glass layer on top. Sample about 25cm or more. ~51m NW of waypoint 16 (which is near nav marker of Bubba Gump.)	-15.09441	-173.74662	1270.2	1.7	89	2017-11-27	02:07:23	S85	418
S85-bio-16	S85-bio-16. Suction of shrimp (Alvinocaris) and 2-3 squat lobsters from ridge Ken and Bill believe is spatter. Behind this spatter are large pillow lobes. Location named "Spatter site". Into chamber 3. Just west of waypoint 17.	-15.09404	-173.74595	1262.3	8.0	212	2017-11-27	02:36:05	S85	448

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S85-rock-17	Sample S85-rock-17. Heavily sedimented lobates at new cone. Position 15.0932647 173.7466466. Depth 1298m. ~35m N of W of waypoint 18. Placed in rock box 3.	-15.09323	-173.74669	1287.7	0.0	330	2017-11-27	03:09:36	S85	476
S85-rock-18	Sample S85-rock-18. Sedimented pillow-lobate structures with large fracture in flow. Location at waypoint 20; depth 1358m. Placed in biobox partition 2. May not be new flow.	-15.09131	-173.74550	1347.5	0.0	57	2017-11-27	03:39:12	S85	501
S85-rock-19	S85-Rock-19 from flatter lobate newer flows (clear signs of hydrothermal activity with some sediment). 20-25cm across with nice glass rind. At waypoint 21.	-15.08995	-173.74549	1419.1	0.8	154	2017-11-27	04:06:38	S85	518
S85-rock-20	S85-Rock-20 taken from young-jumbled-fragmented flow with large pillow sticking out. 35m SE of waypoint 21-heading toward waypoint 22.	-15.09029	-173.74514	1417.7	0.5	145	2017-11-27	04:15:56	S85	527
S85-rock-21	S85-Rock-21. Broken pillow that partially drained. Fragile-took 2 attempts. Area of truncated and non-truncated pillows with orange staining. Placed in forward basket (marker storage). Almost halfway between waypoints 21 and 22.	-15.09042	-173.74498	1412.4	0.0	154	2017-11-27	04:22:19	S85	531
S85-rock-22	S85-rock-22. Heavily crystalline with lots of olivine and pyroxene. Being placed in marker box with sample 21. From moderately sedimented pillows on gentler slope from opposing slope of Rock-21 (~28m north of that sample). Closer to waypoint 21 (~43m east of #21) Taken to compare if same lava flow.	-15.09016	-173.74501	1421.8	0.9	296	2017-11-27	04:39:13	S85	538
S86-rock-01	S86-Rock-01. Angular piece of broken in-place boninite pillow. 25 cm with thick glass rind. Squat pillow fragment very angular. Piece is from the center of pillow all the way to rind. Olivine and pyroxene crystal visible in this boninite. Banding on bottom and top. Small amount of aluminum sulfur staining. At distal edge of lava flow near waypoint 1.	-15.09019	-173.73365	1927.9	1.9	284	2017-11-27	19:05:50	S86	34
S86-rock-02	S86-Rock-02. From this "sheet/lobate" flow (a short little rivulet in the midst of these pillows) Jumbled on the edges. Fragile and crumbly from "ribbon edge" of sheet-ish flow. Glass and green olivine/pyroxene crystals. 3 pieces. 10cm curvilinear crystal-rich; mostly glass; broke into 2 pieces . Piece 3 30cmx20cmx15. Rectangular preserved folded surface of sheet . Lots of crystals near glass. Not as many in interior. Supreme boninite. Placed in partition 5. Between waypoint 1 & 2.	-15.08992	-173.73417	1875.9	1.8	336	2017-11-27	19:31:40	S86	59

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S86-sed-03	S86-Sed-03. Scoop with push core #2 of coarse black sediment from landslide debris. Lots of crystals in the sediment. Fine component as well but most particles are several mm in diameter to 1 cm fragments. Pile of volcanoclastic seds in core. Placed in compartment #4. Between waypoint 2 & 3.	-15.08996	-173.73615	1745.5	2.1	294	2017-11-27	20:42:06	S86	125
S86-Rock-04	S86-rock-04. Piece of pillow. ~10cm-crystal rich; irregularly shaped. Above the steep slope of the landslide - on a more gentle slope. ~35m west of waypoint 3. In partition 6.	-15.09012	-173.73691	1696.5	1.7	275	2017-11-27	21:00:03	S86	144
S86-Rock-05	S86-rock-05. Large piece of top crust or huge pillow from new lava flow area (40-45m thick) with thick sediment and depressions containing gold floc. Green crystals in the boninite are probably clinopyroxene. Lots of vesicles in the lava. In area of deep sediments. Very vesicular on the bottom. Glassy on the top. ~30 cm broken in half. ~10m SE of waypoint 7.	-15.08843	-173.73782	1592.2	1.2	312	2017-11-27	21:53:43	S86	201
S86-rock-06	S86-rock-06. Rim of disgorged pillow lava. Crumbly; sediment cover; Z=1565. Good grab. Crystals and crumbly. Glassy outer rind of disgorged pillow from in place pillows on steep slope. In biobox partition 1. Between waypoints 8 & 9.	-15.08955	-173.73863	1551.5	0.0	226	2017-11-27	22:46:20	S86	258
S86-rock-07	S86-rock-007. Piece of pillow crust - not intact from pillows flowing down Devils Tower Hornito. Tetragonal with vesicles and crystals. 30+ cm long - nearly half of a pillows rind. Glass on both ends. Lots of phenocrysts. Pipe-like elongated vesicles. ~37m SE of waypoint 11.	-15.08969	-173.73937	1516.8	2.6	80	2017-11-27	23:30:06	S86	310
S86-sed-08	S86-Sed-08 Dark ash below surface where took temperature of 2.6degC. Lunar-esque landscape ~23m SW of Devils Tower sample. Scoop with push core 1 (no catcher). Very coarse. Volcanic ash and crystals. Bubble wall fragments; glass; hair. Put into tube 3. ~47m NE of waypoint 10 & ~47m SE of waypoint 11.	-15.08981	-173.73953	1516.1	0.0	221	2017-11-27	23:50:45	S86	324
S86-rock-09	S86-rock-09. Grabbing the rind of a disgorged pillow. From next deeper lava terrace (2nd terrace) of previous samples. Piece 1: Very thin piece of rind. Crumbly. Small (fist-sized) fragment of pillow crust. 2nd piece is glass fragments and vesicular rock ~15cmlong. 3rd piece angular glassy rind ~15cm long and thicker than other pieces. Going into biobox partition 4. ~17m due E of waypoint 11.	-15.08936	-173.73934	1529.8	4.0	250	2017-11-28	00:05:19	S86	337

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S86-rock-10	S86-rock-10. Flow front of 2nd terrace. (at the base of the slope). Odd disgorged pillow. Z=1574m. Crumbly. Piece of pillow rind (from the top of a weird-misshapen pillow. ~ 10cm long - almost cube-shaped we think. Going into partition 7. A few flakes got into 8. 80m NE of waypoint 11.	-15.08898	-173.73899	1559.1	1.7	222	2017-11-28	00:35:05	S86	353
S86-rock-11	S86-rock-11. Beautiful piece of pre-fractured pillow hanging down this flow front. Great pillow cross section. 30x15 cm. Glass on the top and bottom. Vesicular angular. Shape of large piece of pie. 42m SW of waypoint 12.	-15.08855	-173.73854	1583.4	4.5	249	2017-11-28	00:51:59	S86	373
S86-rock-12	S86-rock-12. On the old lavas above the new lava flows at the top of a cliff. Sample of huge old pillow. Vesicular rind and brownish-yellow stain with lava drips. ~ 10cm x 10cm. Putting it into partition 2 in the biobox. Sort of shaped like a fashionable boot. ~63m N of W of waypoint 12.	-15.08818	-173.73881	1551.7	1.1	323	2017-11-28	01:09:49	S86	392
S86-bio-13	S86-bio-13. Gorgonian corals with mysid's. Collected from pillow sample 12. Put in biobox #2.	-15.08818	-173.73881	1551.7	6.6	270	2017-11-28	01:20:32	S86	397
S86-rock-14	S86-rock-14. From the outer surface of the pillow in area just SW of easternmost collapse pit. Very crystal-rich and crumbly. Tube-like vesicles "Weathered". Don't see any glass. 10 cm long. Into biobox 3. ~37m SW of waypoint 13.	-15.08833	-173.73913	1555.9	0.9	242	2017-11-28	01:35:28	S86	409
S86-rock-15	S86-rock-15. Hollow tube-like inside with yellow staining and secondary mineralization. Outcrop of older lavas with broken/drained pillows. Part of the sample broke off on top the marker box - two small pieces; might be further fractured. Midway between waypoint 13 & 14.	-15.08872	-173.73968	1533.9	6.3	233	2017-11-28	01:54:30	S86	421
S86-rock-16	Sample S86-rock-16. Distinctive red altered streak at glass-groundmass transition. 20-25cm wide. Near small cone with fresh pillow lavas and microbial mats. Most are intact and in place. Placed in gastight box. Between waypoints 10 & 14.	-15.08984	-173.74018	1515.0	1.7	220	2017-11-28	02:25:33	S86	448
S86-bio-17	S86-bio-17 bamboo coral; white with nodules and small rock attached to base from older flow. Placed in biobox 1. ~14mSW of waypoint 14.	-15.08952	-173.74050	1500.8	0.0	319	2017-11-28	02:49:54	S86	465
S86-rock-18	S86-rock-18. Piece of older lava flow that also hosted the previous sample (coral). Rock has a sponge attached. Sample size roughly 10 cm. Into at least two pieces in box 10. Same location as bio-17.	-15.08952	-173.74052	1500.7	3.2	319	2017-11-28	02:55:33	S86	467

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S86-bio-19	Sample S86-bio-19. Coral and TWO squat lobsters growing on side of older lava. Into biobox 2. Along ridge of older flow (same flow as last samples).	-15.08949	-173.74060	1495.6	1.4	279	2017-11-28	03:03:33	S86	471
S86-bio-20	S86-bio-20. Suction of partial and whole anemone in jar 4 from near vertical wall of older flow. ~10m west of waypoint 14.	-15.08943	-173.74070	1493.7	4.3	153	2017-11-28	03:17:34	S86	481
S86-bio-21	Sample S86-bio-21. Whole anemone sample. Sample jar also 4. Also sample S86-bio-20. Location 15d5m21.910s 173d44m26.521 depth 1511m.	-15.08945	-173.74071	1493.4	2.1	123.2	2017-11-28	03:18:42	S86	2.1
S87-rock-01	S87-rock-01. Grabbing a large piece of in place lava on this slope. Fairly altered with manganese and iron oxides. Layer of glass as well. Lots of iron staining. Probably several hundred years old. Rock is greater than fist size into partition 5. Pillow lava fragment. Radially cracked. 20 cm in diameter. On South Rift Zone just north of waypoint 1.	-15.10211	-173.74856	1617.7	2.8	355	2017-11-28	18:48:18	S87	14
S87-bio-02	S87-bio-02. Bubble gum coral (pink) with ophioroid (brittle star) on old pillow. In BioBox partition 1. Just upslope from rock-01.	-15.10199	-173.74852	1603.9	2.6	12	2017-11-28	19:02:21	S87	25
S87-rock-03	S87-rock-03. About 8cm pillow rind with some iron-manganese coating. Fragile with glass. Several pieces into biobox 2. In location of outcrops after traversing volcanoclastic sands from waypoints 2-4. Location ~20m E of waypoint 4. -15.0987168 - 173.7465791 depth 1420m	-15.09834	-173.74797	1404.5	3.2	309	2017-11-28	21:17:54	S87	146
S87-rock-04	S87-rock-04. Jabba the pillow contains a lot of volcanoclastic sediment and may have a small dune formation in the cavity. Amygdules on sample surface described as "lizard skin" texture. Sample split and keeping right hand piece with less iron staining. In biobox partition 6. Near waypoint 5.	-15.09652	-173.74816	1299.6	3.2	306	2017-11-28	21:48:40	S87	173
S87-rock-05	S87-rock-05. Olivine crystals on fresh rock surfaces. Glassy rind. Triangish shape. ~15 cm longest. 3cm glass rind. Tan color. Boninite lava. These lavas are much younger than the previous samples. From piece of lava on cliff of stacked pillows with white microbial mat on rock faces. Into partition 7. Just E of waypoint 6.	-15.09481	-173.74869	1198.6	2.5	4	2017-11-28	22:20:18	S87	214

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S87-fluid-06	S87-fluid-06 Major #1 in white (hair-like) & orange bacterial mat under a red rock. Highest temp reading of 24.02C in sediments. Water temp ~7degC. Fired at 2347-had to hit ram second time. ~12m SE of Mkr-224 on the NNE pit (waypoint #11).	-15.09441	-173.74909	1283.4	1.3	80	2017-11-28	23:47:17	S87	301
S87-gas-07	S87-Gas 07. Same location as fluid-06. Fired at 0006:47.	-15.09441	-173.74909	1283.4	1.3	78	2017-11-29	00:02:45	S87	313
S87-fluid-08	S87-fluid-08. Major #2 sampler in 22degC area of white bacterial floc. Same position as previous 2 samples (6 and 7). Fired at 0028:17. Ram hit twice to fill.	-15.09441	-173.74909	1283.6	1.2	78	2017-11-29	00:22:52	S87	328
S87-bio-09	S87-bio-09. Suction into chamber 8. ~10 - 15 Opaepele and 1 zoarcid on steep cliff in Shrimp Suburbia area at waypoint 13.	-15.09405	-173.74814	1189.1	0.0	118	2017-11-29	00:55:17	S87	369
S87-gas-10	S87-gas-10. GTB 6 (yellow). Temperature of 27.55degC. Taken at Prometheus site.	-15.09420	-173.74804	1175.7	0.0	49	2017-11-29	01:55:58	S87	431
S87-fluid-11	S87-Fluid-11. Major sampler #3. In same position as previous gas sample. Start 0212.	-15.09420	-173.74804	1175.6	0.0	49	2017-11-29	02:09:05	S87	437
S87-bio-12	S87-Bio-12. Suction of shrimp (mostly opaepele) at Prometheus. Sampled the top of the pillow here. Sampled into canister 1.	-15.09420	-173.74804	1175.8	0.0	49	2017-11-29	02:21:15	S87	443
S87-rock-13	S87-Rock-13. Pillow lava with glass rind and sulfur coating. 10x15cm conical with whitish surface. Piece of boninite pillow with some sulfur coating. Expecting low levels of alteration. Same location as previous Prometheus samples. In partition 8.	-15.09420	-173.74804	1175.8	0.0	50	2017-11-29	02:27:11	S87	445
S87-sed-14	S87-Sed-14. Bag #1 Scoop of the mixed variation of light and dark volcanoclastic sediments. Probably some shell fragments and sulfur particles. Into partition 9. On new mound ~20m E of Waypoint 20.	-15.09491	-173.74642	1270.9	0.0	68	2017-11-29	02:57:16	S87	463
S87-gas-15	S87-gas-15 Green GT 2 temp in vent is 9C. At Shrimp Canyon ~10m NW of waypoint 21 (Mkr-284).	-15.09461	-173.74635	1265.7	0.9	335	2017-11-29	03:37:50	S87	484
S87-fluid-16	S87-Fluid-16 Major 4. Same location at Shrimp Canyon.	-15.09461	-173.74635	1265.7	0.9	335	2017-11-29	03:46:56	S87	488
S87-bio-17	S87-Bio-17 Shrimp suction into chamber 2. Looks like there are both types of shrimp and a couple scale worms. Polynoids. Same location at Shrimp Canyon.	-15.09461	-173.74635	1265.7	0.0	334	2017-11-29	03:51:55	S87	491
S87-sed-18	S87-Sed-18. Slightly SW of previous samples in area with more ash. Volcanoclastic sediments in the dip between the "rolling hills" Pillow lobes. Scoop bag #2. 15.0946339S -173.7464384 Z=1277m.	-15.09464	-173.74644	1266.8	0.6	289	2017-11-29	04:00:45	S87	497

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S88-rock-01	S88-Rock-01. Upper piece of pillow crust with glass. 40cm long. Tabular piece. Orange stain inside with vesicles with thin sedimentary cover. Ken guess it's a century or two old. Into partition 5. From landing site (bad nav fixes-using GIS guess).	-15.07097	-173.70646	2673.6	0.6	298	2017-11-29	19:17:29	S88	13
S88-rock-02	S88-rock-02. Piece of large cracked pillow. Very crystal rich and glassy. Some orange staining. From a flat pillow - almost lobate transitional. 15cm. ~27m SE of waypoint 2.	-15.07011	-173.70865	2673.6	0.0	14	2017-11-29	19:17:29	S88	90
S88-rock-03	S88-rock-03. Radial pillow bud at lava/sediment contact. Fine sediment on this. Curvilinear external crust. Olivine and clinopyroxene. Center is gray. Glassy exterior. 50% crystal. Lack of vesicles. Porphyritic. Partition 7. ~35m S of waypoint 3.	-15.06960	-173.70908	2676.4	0.0	221	2017-11-29	20:15:02	S88	101
S88-rock-04	S88-rock-04. Exterior of this older lava on tumuli. Pie shaped. Not as crystal rich as previous sample. More iron staining. Glass in the interior. Not nearly as many crystals. Some vesicles. Brownish rind (MnOX) 20cm long from folded ripple on surface of jumbled lava. From waypoint 4 at the parallel ridge.	-15.07058	-173.71050	2673.7	2.7	186	2017-11-29	20:21:33	S88	126
S88-sed-05	S88-sed-05. Four scoops of fine sediment. Possible co-ignimbrite-like feature. Into box 9. ~75m SE of waypoint 56.	-15.07120	-173.71189	2663.4	0.0	244	2017-11-29	20:40:58	S88	151
S88-rock-06	S88-rock-06 Inflated cracked pillow. Large piece of pillow with attached coral. 47 cm pillow interior fragment. Manganese coating with some fresh glass. Not many phenocrysts visible. Center of unpartitioned basket. From north rift of W Mata ERZ.	-15.07141	-173.71264	2675.6	0.7	227	2017-11-29	21:21:14	S88	178
S88-rock-07	S88-rock-07 Outer pillow tumulus pillow crust from area of multiple textures and degrees of inflation in a small area of stacked lava flows. 10x15cm glassy rind and crystalline content. (Bad nav-heading toward waypoint 6-using WP6 for position.)	-15.07068	-173.71248	2676.6			2017-11-29	21:54:21	S88	196
S88-rock-08	S88-rock-08. Upper crust of this tumulus feature (between WP 7 & 8). Weathered with vesicles mitten shaped. 30cm round and egg shaped roundish. No obvious glassy crust. Crystalline and not a lot of vesicles. In the crack between the tumulus's ~ 10m W of WP8. 15d 4' 9.693" 173d 42' 38.043". In bin 2.	-15.06936	-173.71056	2667.8	2.1	108	2017-11-29	22:21:38	S88	241

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S88-sed-09	J88-Sed-09. Push core 4. Thick sediments of the Muffin adjacent to lava. Made it into the tube; but lots of the sediment is escaping.~30m SW of waypoint 9.	-15.06886	-173.71057	2661.9	0.0	136	2017-11-29	23:22:11	S88	263
S88-sed-10	S88-Sed-10. In thick sediments on the muffin. The Core is over half full. Light-colored layer on the top. Navigator position is SE of waypoint 9.	-15.06889	-173.71093	2668.7	0.4	60	2017-11-29	23:43:26	S88	284
S88-rock-11	S88-rock-11 Chalky piece from the base of Pagoda-looking stratographic feature on top of Muffin's ridges. 5cm cubic piece of probably ash (white colored). Broke in 2 pieces into biobox 3. Took second piece. No ROV nav-probably somewhere between waypoint 10 and ship's position (15d 4' 0.386" 173d 42' 29.63")	-15.06704	-173.70864	2668.1	0.7	323	2017-11-29	23:59:44	S88	337
S88-rock-12	S88-rock-12. 15-10 cm. Crystal-rich vesicular lava. Mineralization on the surface. Some vesicles. Orange staining. Pie shaped. Going into partition 7. Multi-colored green yellow and orange-stained rock from striped glassy background. Irregular shape. Brown on one face. From side of one of Muffin's ridges. Using Navigators estimated location: 15d 3' 58.57' 173d 42' 30.294"	-15.06628	-173.70842	2658.1	0.0	341	2017-11-30	00:53:55	S88	361
S88-rock-13	S88-rock-13 20x15cm roughly. Phyric with thick glass rind and large vesicles up to cm scale. Sampled from the NW muffin contact of sediment and lava. Into box 9. Position is GIS guess post-cruise.	-15.06614	-173.70924	2660.1	1.0	209	2017-11-30	01:24:54	S88	375
S88-sed-14	S88-sed-14 Scoop 2. (Location 15.0681 173.70671 BAD position-don't use-using GIS guess for rock-13) Repositioned from rock-13 to nearby ledge to sample on flat surface. Put in between biobox and center sample box.	-15.06614	-173.70924	2682.9	0.0	183	2017-11-30	01:44:29	S88	382
S88-rock-15	S88-rock-15. Multiple jagged pieces of rock from the side of Attila the Hut (local high surrounded by smooth lava flows). Second piece is 15x10cm with elongated vesicles-very friable. Placed into biobox 4. location -15.06598 -173.71047 depth 2669m	-15.06598	-173.71045	2680.1	2.2	261	2017-11-30	01:59:38	S88	407
S88-rock-16	S88-rock-16 Piece of collapsed pillow in area of endless pillows. Large scoop like underside with large several cm bubble. Into forward marker box. Between waypoint 11 & 12.	-15.06468	-173.71107	2669.4	1.6	340	2017-11-30	02:37:28	S88	424
S88-fluid-17	S88-fluid-17 Sampling bottom water in basket. Major 2 at same location as rock-16.	-15.06468	-173.71107	2681.4	2.7	339	2017-11-30	03:09:41	S88	425

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S88-rock-18	Sample S88-rock-18. Roughly 10x5cm into box 10. Very glassy and highly phytic 40-50% with large phenos. East of waypoint 12 near contact.	-15.06443	-173.71066	2679.1	0.5	28	2017-11-30	03:12:03	S88	436
S89-rock-01	S89-rock-01 Grabbing crumbly oxidized sulfide. Chimney? Orange staining. Mineral rich. Roundish black and orange. 8-10cm in longest direction. Sample pulverized. ~15m SE of waypoint 1.	-15.01632	-173.78775	2380.9	0.0	181	2017-11-30	03:31:08	S89	45
S89-rock-02	S89-rock-02 Grabbing a piece of weathered grayish lava (on the surface). Stained rock. Oxidized and crumbly. Microbial material on it. Vesicular and angular pie shaped. 30 - 35 cm. No glass. Tabular fragment. Same location as rock-01.	-15.01632	-173.78775	2381.0	0.0	181	2017-11-30	19:35:15	S89	50
S89-sulfide-03	S89-sulfide-03. 3 pieces. Piece 1 beehive-spewing hot water and black smoke; Piece 2 from base (10cm); 3rd piece (15cm) more grayish (sulfide and participates of barium). Chimney is flashing. Chalcopyrite in the center. Taken from Temple of Smoke complex on steep slope. Between waypoint 1 & 2.	-15.01680	-173.78764	2356.1	2.9	193	2017-11-30	20:13:35	S89	117
S89-gas-04	S89-gas-04. Gastight (yellow #6) in orifice of black smoker that was broken off - sulfide-03 location. Fired at 2934. Snorkel black-good sample. (Same location at Temple of Smoke).	-15.01680	-173.78764	2356.0	4.3	194	2017-11-30	20:33:54	S89	129
S89-fluid-05	S89-fluid-05. Major sampler #1 in same black smoker orifice as the previous samples (3 and 4). Nozzle in the flow. Looks good.	-15.01680	-173.78764	2356.0	0.0	194	2017-11-30	20:41:03	S89	134
S89-bio-06	S89-bio-06. Stalked barnacles just to the right of the black smoker chimney just sampled. Nice grab of several stalked barnacles. ~10m S of waypoint 5.	-15.01680	-173.78764	2356.0	3.8	193	2017-11-30	20:47:02	S89	139
S89-bio-07	S89-bio-07. Just upslope from flashing black smoker sampled earlier. 3 Ifremer snails.	-15.01659	-173.78767	2355.4	0.0	192	2017-11-30	21:01:32	S89	145
S89-bio-08	S89-bio-08. Suction of sulfide worms and polynoids. Canister 6. Same location. (Later noticed nothing in canister).	-15.01659	-173.78767	2356.0	3.3	154	2017-11-30	21:58:14	S89	174
S89-bio-09	S89-bio-09. Suctioning Ifremeria snails into canister 6. Also getting white bac mat; Possibly got Opapele shrimp. Several large snails going into biobox 3. Same location.	-15.01659	-173.78767	2355.9	0.0	155	2017-11-30	22:02:09	S89	175
S89-bio-10	S89-bio-10. Large single mussel with barnacles and limpets attached. Same location as previous bio samples 08 & 09.	-15.01659	-173.78767	2355.9	3.3	153	2017-11-30	22:06:55	S89	179

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S89-sulfide-11	S89-sulfide-11. Weathered extinct small sulfide chimney with mat and scaleworms on top. Bulgy; orange/gray. Got the top portion. > 40cm long and 20cm wide. Into partition 9. Same location as bio samples.	-15.01659	-173.78767	2355.9	0.0	153	2017-11-30	22:09:17	S89	180
S89-fluid-12	S89-fluid-12. Major 2 water sample from active black smoker. Tmax ~405C ambient ~0.3C. Probe not calibrated so temperature readings probably too high. Location -15.01729 -173.7880455 depth 2350m. Halfway between waypoints 6 and 8.	-15.01729	-173.78805	2349.9	1.9	29	2017-11-30	22:47:20	S89	196
S89-gas-13	S89-gas-13. Gastight fired at 230622. Vigorous black smoke flow. Same location as fluid sample.	-15.01729	-173.78805	2350.0	1.2	32	2017-11-30	23:06:52	S89	204
S89-sulfide-14	S89-sulfide-14. Pieces of whitish chimney base that fell down while fluid/gas sampling with lots of silica and cement with black sulfides in between. Crumbly craggy 15 cm in longest distance. Same location as previous fluid and gas samples.	-15.01729	-173.78805	2350.2	1.3	31	2017-11-30	23:22:31	S89	216
S89-fluid-15	S89-fluid-15. Major sampler #3 in same location and same black smoker orifice. Start at 2327 UTC. Z=2350m. This vent is boiling. Great sample.	-15.01729	-173.78805	2350.2	1.7	32	2017-11-30	23:29:00	S89	218
S89-bio-16	S89-bio-16. Scoop bag 1 of Ifremeria snails on chimney just to the left of the black smoker previously sampled. Same sample position as previous. 3-4 snails in bag.	-15.01729	-173.78805	2350.3	1.5	31	2017-11-30	23:36:09	S89	224
S89-bio-17	S89-bio-17. Opapele shrimp and into chamber 8. Suction of volcanoclastic sed next to the black smoker orifice and slow shrimp. Same location.	-15.01729	-173.78805	2350.3	1.7	32	2017-11-30	23:45:50	S89	232
S89-fluid-18	S89-fluid-18. Major sampler #4 at diffuse site with lots of biota. Large diffuse flow area SW of previous samples (~70m) and ~21m NE of waypoint 3. Snail Fusion Site. -15.017736 S -173.7885168 W. Z=2340m	-15.01773	-173.78852	2359.9	1.0	157	2017-12-01	0:19:13	S89	264
S89-gas-19	S89-gas-19. Gastight Green #2 at "Snail Fusion". In same spot as Major sampler. Diffuse flow in area of lots of snails. Fired at 0033:45.	-15.01773	-173.78852	2360.0	1.0	157	2017-12-01	0:33:38	S89	270
S89-bio-20	S89-bio-20. Scoop bag #2 of both species of snails Ifremer (black) snails and the Alvinococoncha (white) snails collected. That bag is nearly full. Same location.	-15.01773	-173.78852	2360.1	0.0	156	2017-12-01	0:52:26	S89	280
S89-rock-21	S89-rock-21. In place rock with sponge growth above talus. 10x5cm roughly triangular rough surface with some orange sediment or discoloration. East of vent sampling sites heading upslope. ~95m SW of waypoint 9.	-15.01806	-173.78502	2164.3	2.6	166	2017-12-01	2:21:03	S89	397

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S89-rock-22	S89-rock-22. 20x15cm piece with radial fracture and possible glass rind. Upslope and ~120m SE of waypoint 9.	-15.01794	-173.78353	2118.3	1.9	107	2017-12-01	2:48:46	S89	417
S89-rock-23	S89-rock-23. Piece from flow contact with in place striated/smooth pillows under sediment. 30x30cm square blocky pillow fragment and some orange sediment. Halfway between waypoints 9 & 10.	-15.01808	-173.78218	2144.2	0.4	122	2017-12-01	3:06:12	S89	427
S89-sed-24	S89-sediment-24. Sediment at base of lava flow where sample 23 was collected.	-15.01808	-173.78218	2144.2	0.4	117	2017-12-01	3:15:13	S89	431
S89-rock-25	S89-rock-25. 50cm half-pillow large irregular vesicles with patchy orange alteration. Possibly glass crust. In talus. ~40m W of waypoint 10.	-15.01832	-173.78067	2101.9	3.7	94	2017-12-01	3:38:30	S89	449
S90-rock-01	S90-rock-01. In area of ropey lava. Fine sediment coating. 20 cm radially fractured pillow fragment with iron staining on the exterior. 1 glassy rind layer 1cm thick. In partition 5 rock box. At landing site waypoint 1.	-14.91620	-173.79896	2520.5	3.0	158.093	2017-12-01	19:08:33	S90	33
S90-rock-02	S90-rock-02. Shelly-outer rind of pillow lava in place. Brownish patina on surface. Glassy surface with lots of vesicles. Grayish interior. Older more altered rock. Large very vesicular 50 cm arcuate shape. More than 1 cm glass. Manganese staining. In unpartitioned box. Near waypoint 2.	-14.91652	-173.79852	2521.1	1.2	141.647	2017-12-01	19:30:36	S90	58
S90-rock-03	S90-rock-03. Flat-lobate-like lava. Striated crust. Sedimented. Outer surface has striations. Top of a lobate crust. 15cm thick. Glass crust. Not many vesicles or large phenocrysts. ~50m SW of waypoint 3.	-14.91774	-173.79683	2509.7	1.7	107.847	2017-12-01	20:06:46	S90	118
S90-rock-04	S90-rock-04. Older sedimented pillow lava with bread-crust surface. Cracked and radial morphology. Manganese crust and iron oxide staining on broken surface. 30 cm long. Don't see much of vesicles or crystals. Glass rind. On top of partition 7. ~24m W of waypoint 5.	-14.91894	-173.79487	2533.1	0.4	111.143	2017-12-01	20:38:01	S90	168
S90-rock-05	S90-rock-05. Old weathered pillow lava on this steep slope just to the north of the middle ridge. Weathered. Largish piece with glass on 2 surfaces- crumbly exterior. Old and fuzzy. 15 cm with sediment adhering. Into partition 8. Between waypoint 7 & 8.	-14.91507	-173.79285	2449.2	0.8	5.21851	2017-12-01	22:08:55	S90	247
S90-rock-06	S90-rock-06. Piece of large in-place pillow (Big Bertha). 15x10cm blocky with oxide coating and maybe some Fe-Mn crust. Near waypoint 8.	-14.91408	-173.79338	2400.9	2.6	343.768	2017-12-01	22:36:14	S90	272

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S90-rock-07	S90-rock-07. ~35m SE of waypoint 9. Roughly 10x15cm some orange sediment in vesicles and possible glass rind? Fe-Mn staining on crust. In area of broken up rock with some in place.	-14.91313	-173.79402	2378.6	4.1	316.978	2017-12-01	23:01:10	S90	283
S90-rock-08	S90-rock-08. Piece of intact pillow . Vesicular and really friable. 10cm x 5cm. Narrower. Lightly sedimented pillow fragment. Banded in the center. Orange weathered layer under the glass. Into partition 3. ~80m NE of waypoint 9.	-14.91222	-173.79373	2402.2	0.0	160.724	2017-12-02	0:12:07	S90	367
S90-rock-09	S90-rock-09. Cracked in-place pillow on ridge top. Grabbed small-ish piece wedged in crack. This piece tumbled off from slightly farther up the extrusion. ~40 cm long. Some vesicles. Outer surface. Extensive magnesium coating and sediment. In gastight milk crate. Halfway between waypoint 9 & 10.	-14.91201	-173.78999	2496.8	1.7	112.659	2017-12-02	0:49:06	S90	423
S90-rock-10	S90-rock-10. Area of in-place pillows. 30x10cm pillow rind with some alteration in core to slight yellow-green color. Large internal vesicles grading to smaller at edge. 2/3 the distance from waypoint 9 to 10.	-14.91127	-173.78799	2515.3	0.0	250.433	2017-12-02	1:29:13	S90	434
S90-sed-11	S90-sed-11. Volcaniclastic/pelagic sediment pile. Location is ~180m north of previous sample.	-14.90962	-173.78844	2459.0	0.0	347.322	2017-12-02	1:59:27	S90	449
S90-rock-12	S90-rock-12. Flat-topped altered pillow lava crust with whip coral attached. Dual rock-bio sample. 10x15cm approx. Same location as sed-11.	-14.90962	-173.78844	2459.0	0.0	306.782	2017-12-02	2:10:10	S90	452
S90-rock-13	S90-rock-13. Piece 1: piece of pillow toe with large olivines and <1cm glass rind. Fresh. 10-15cm on a side. Piece 2: Giant olivine and lots of sediment. 10x10cm or smaller. Area of lava flow with sediment. ~20m SE of waypoint 11.	-14.90701	-173.78832	2490.4	1.1	279.965	2017-12-02	2:34:29	S90	457
S90-rock-14	S90-rock-14. Highly vesicular chunk with Mn crust and glassy rind. ~35cm across. Area of fractured pillow flows between waypoint 11 & 12. Sample taken at ~30m ENE of waypoint 12.	-14.90685	-173.78901	2473.7	2.2	295.241	2017-12-02	3:00:02	S90	465
S90-rock-15	S90-rock-15. Ropey lava. Must have been really fluid when it came out. Baby rock. Thin glassy surface. Altered. Manganese and iron crust. Irregularly shaped. 15 cm long. Went into gastight box. Area of ropey/jumbled lavas on a mound with sediment. ~65m NNE of waypoint 12.	-14.90637	-173.78915	2489.6	1.3	301.415	2017-12-02	3:08:07	S90	475

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S90-rock-16	S90-rock-16. Not in place but from this flow. Weathered interior. Orange wedge shaped. 20 cm. Manganese and iron oxide coating. Outer rounded surface of a pillow. Glass? In basket behind majors. ~90m SSE or waypoint 13.	-14.90492	-173.78983	2533.4	0.0	23.8184	2017-12-02	3:40:37	S90	528
S90-rock-17	S90-rock-17. Huge toe of pillow that is chicken-breast shaped. Large piece with altered crust. 45-50 cm long. Glass all around with 2 broken surfaces. Came off the larger inflated striated pillow at the top of mound. ~12m W of waypoint 13.	-14.90411	-173.78946	2538.4	0.7	6.90491	2017-12-02	3:52:09	S90	548
S91-rock-01	S91-rock-01. Old pillow at landing site. Crumbly. Disgorged striated pillow. Angular flat piece. Crust 25cm slab 5-6 cm thick. Lava drips. Some vesicles. Mn oxide coating. Into partition 9. At waypoint 1.	-15.00736	-173.80242	2147.3	3.6	351.019	2017-12-02	19:20:27	S91	33
S91-rock-02	S91-rock-02. Hollowed out - outer shell of folded sheet flow. Shelly part of flow. Black glass. Outer Mn oxide crust. Black shiny lava with phenocrysts. Area of coherent bands of folded sheet flow. In partition 5. 3 pieces: 10x5cm squarish slab; 6-7cm long-skinny and crystal rich; 20cm circular with fracture pattern. Between waypoints 1 & 2.	-15.00654	-173.80243	2112.6	0.0	355.952	2017-12-02	19:42:16	S91	76
S91-bio-03	S91-bio-03. Coral (?) that looks like a palm tree. Intact in the claw. Long narrow stalk with what looks like palm fronds on top. In partition 1 biobox (taller). In swirly lobate flow within meters E of waypoint 3.	-15.00566	-173.80150	2058.4	0.0	32.981	2017-12-02	20:31:20	S91	170
S91-rock-04	S91-rock-04. In place fragile "Ribbon" of lobate/sheet lava just downslope of lava slabs. Pretty crunchy rock. Large crystals. Vesicles. Manganese oxide coating. Green crystals. 30 cm long 19 cm thick. Into partition 10. East within meters of location as bio-03.	-15.00566	-173.80150	2058.3	0.0	8.05298	2017-12-02	20:39:40	S91	174
S91-rock-05	S91-rock-05. Pillow toe sample 10x15cm in elongated pillows with lots of anemones. Vesicular with large olivines and patchy Fe staining Between waypoints 3 and 4.	-15.00474	-173.80042	2024.8	8.3	1.90613	2017-12-02	21:18:44	S91	223
S91-rock-06	S91-rock-06. 10x15cm chunk relatively fresh interior with biology on crust. In area with patchy sediments with microbial growth (riddled with diffuse flow?). Orange alteration under glass and large olivines. Just W of waypoint 4.	-15.00447	-173.79976	2003.2	3.6	101.25	2017-12-02	21:32:08	S91	233

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S91-rock-07	Tip of pillow lobe from large pillow with striations and bread crust rind. Area with sponges and corals. 8 cm or so. A little manganese coating. Vesicular. Z=1995m. 15.00421 S 173.79821 W. At waypoint 5.	-15.00422	-173.79821	1995.6	0.9	134.275	2017-12-02	22:06:44	S91	249
S91-sed-08	S91-sed-08. Sample of coarse sediment on this debris-strewn slope. Black sediment with rock fragments Between waypoints 5 and 6.	-15.00477	-173.79729	1961.9	1.4	48.0817	2017-12-02	22:28:31	S91	288
S91-rock-09	S91-rock-09. 40 cm long arrowhead shaped with Mn crust and lots of oxide staining. From intact pillows with broken faces on slope. ~20m E of waypoint 6.	-15.00506	-173.79626	1925.6	0.9	116.84	2017-12-02	22:45:52	S91	295
S91-rock-10	S91-rock-10. 2 pieces: 7x7cm two glass rinds with green-grey ground mass center and thin crust ~7cm across. Abundant mm-scale olivines more typical of boninite. Mix of talus and in place flows; anemones at waypoint 7.	-15.00507	-173.79476	1861.9	1.4	79.3652	2017-12-02	23:02:45	S91	300
S91-sulfide-11	S91-sulfide-11. Sulfide spire 40x15cm. Manganese coating. Large extinct chimney sample. Copper (blues and greens) and purple. Colorful mineral-rich. Some cavities inside. From inactive chimney site "Deadwood" on NE side of summit and ~15m south of waypoint 13.	-15.00465	-173.79310	1836.8	0.0	141.553	2017-12-03	0:44:56	S91	446
S91-sulfide-12	S91-sulfide-12. Sulfide chimney grab. Highly oxidized on the outside (orange crust) Roundish 10 cm. Sparkling gray center with 2 central fluid outflow zones. Second piece of this sulfide that is extending down (not up) from the massive structure. 25 cm squarish from side of larger mound. Orange coating. Gray center. Minerals in there. Into biobox partition 2. At Bee Hive Chimney complex; E of Waypoint 11.	-15.00478	-173.79362	1821.4	2.0	9.43176	2017-12-03	1:34:59	S91	503
S91-gas-13	S91-gas-13. Sample from vent of black smoker in hottest orifice (top center) measured at 314degC. Saguaro Chimney. Location 15.004629 173.79366 depth 1820m	-15.00465	-173.79366	1821.0	1.7	46.0327	2017-12-03	2:41:44	S91	547
S91-fluid-14	S91-fluid-14. Water sample from same vent as gas-13. Same location as gas-13.	-15.00465	-173.79366	1821.0	1.7	44.1211	2017-12-03	2:52:09	S91	548
S91-bio-15	S91-bio-15. Two crabs plus at least one scale worm and some shrimp. Also a mollusk all into biobox 2. Same location at Saguaro.	-15.00465	-173.79366	1821.1	1.7	45.5933	2017-12-03	3:06:34	S91	549
S91-sulfide-16	S91-sulfide-16. Piece of sulfide broken off of vent where gas and fluid samples were taken. Dark grey and less than 10x10cm. Broke into several small pieces. Saguaro Vent.	-15.00465	-173.79366	1819.4	3.1	27.2351	2017-12-03	3:18:40	S91	551

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S91-fluid-17	S91-fluid-17. Major sampler 4 in the black smoker orifice where the temp spiked up to 260C. Fired at 0353. At Low Smoker site NW of Saguaro.	-15.00466	-173.79390	1824.0	0.0	140.444	2017-12-03	3:54:11	S91	563
S91-gas-18	S91-gas-18. Gas tight from Low Smoker where fluid-17 taken.	-15.00466	-173.79390	1823.8	0.0	183.06	2017-12-03	4:24:19	S91	568
S91-bio-19	S91-bio-19. Big old scoop of snails at Low Smoker vent (Mkr-203).	-15.00466	-173.79390	1824.6	0.0	245.226	2017-12-03	4:36:19	S91	571
S92-rock-01	S92-rock-01. Black glassy rock. Nearly aphyric (no crystals). This piece is all glass. Looks more like obsidian. Sharp angular surface thick glass coating. 26x15cm. From jumbled sheet flow. ~70m SW of waypoint 1.	-15.18141	-173.90511	2564.7	0.8	216.656	2017-12-03	19:25:12	S92	56
S92-rock-02	S92-rock-02. Crumbly lava. Hole in the middle. 10 cm upper surface fragment of pressure ridge. Striated dacite lava on side. Thick blocky glass. 2nd piece: Yellow-brown staining on inner surface. Huge glassy rind. 20 cm thick glassy outer surface. Angular flat-ish. Into partition 5. Between waypoints 1 & 2.	-15.18195	-173.90627	2552.5	1.1	232.372	2017-12-03	19:48:51	S92	97
S92-rock-03	S92-rock-03. Crust / upper plate from large elongated pillow at top of ridge slope. Fragile; glassy; 5 cm spherical piece of glass from pillow exterior. 2nd piece of elongate pillow lobe: Upper surface with interior. Glass on the side. Bulbous piece with ridges. No evidence of vesicles or crystals. 20 cm x 15 cm. Wedge-shaped rounded on side. Into partition 6. ~25m SW of rock-02.	-15.18210	-173.90647	2531.4	3.5	232.723	2017-12-03	20:05:32	S92	119
S92-sed-04	S92-sed-04. Push core #4 into fine-grained deep sediment on flat-ish highly sedimented plain here. The core is full (~25 cm in there). Fairly light buff-colored material. In the pit. At waypoint 2.	-15.18274	-173.90722	2548.1	0.0	213.278	2017-12-03	20:37:05	S92	170
S92-rock-05	S92-rock-05. 15x10 piece of dacite from edge of jumbled (in-place) lava flow. Angular and glassy; vesicular. Likely will have orange sediment stuck to it. (Outside of the pit). Between waypoint 2 & 3.	-15.18377	-173.90905	2524.6	0.0	212.992	2017-12-03	21:10:42	S92	228
S92-rock-06	S92-rock-06. 10x10cm glassy edge of pillow just under jumbled sheet flows. Some sediment and microbial filament on surface. One tiny extra piece. ~15mNE of rock-05 after coming off bottom to get mud off of ROV.	-15.18367	-173.90888	2525.0	0.4	150.32	2017-12-03	21:24:19	S92	232
S92-bottle-07	S92-bottle-07. Antique wide-mouth bottle 5x20cm. Same general location as rock-06.	-15.18355	-173.90897	2522.2	4.2	167.454	2017-12-03	21:27:19	S92	233

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
	Approaching bulbous striated pillow with smooth pillow flows coming off of it. First one we've encountered today so setting down for a sample	-15.18409	-173.90945	2523.4	2.8	220.32	2017-12-03	21:34:17		238
S92-rock-08	S92-rock-08. Piece of highstanding bulbous-striated pillow; first encountered in this dacite flow. 10x15cm angular w brown stain on side. Couple of 0.5cm vesicles. Between waypoint 2 & 3.	-15.18410	-173.90946	2524.8	1.3	214.167	2017-12-03	21:43:30	S92	240
S92-rock-09	S92-rock-09. Piece of ropy jumbled lava. Brown-red surface staining with patchy exposed glass. 1cm ropes on surface. 5x15cm. From area of burrows in sediment between boulders. ~60m SW of waypoint 3.	-15.18679	-173.91313	2537.9	0.0	231.586	2017-12-03	22:35:05	S92	280
S92-sed-10	S92-sed-10. Scoop bag 4 into the sediments (fine; beige-ish in color) at the base of these bulbous pillows. Thin veneer of sediments ~10cm with rock underneath. Full scoop into milk crate behind gastights. 1/3 distance between waypoint 3 to 4.	-15.18849	-173.91480	2522.8	0.4	167.948	2017-12-03	23:06:17	S92	304
S92-rock-11	S92-rock-11. Piece of striated broken pillow crust (plate) in area with worm trails & burrows. Fine sediment coating. Fragile; crumbly; 10 x 15 cm. Orange staining. Crumbled - 2 pieces. Angular. Brown staining on 1 side. Placed in biobox2. Little less than halfway between waypoints 3 & 4.	-15.18942	-173.91598	2508.3	1.1	173.018	2017-12-03	23:42:00	S92	335
S92-bio-12	S92-bio-12. Coral - stalked coral; probably a bamboo coral. Exact same position as sample 11. Z=2509 15.189418 173.916857. Went into biobox with the rock.	-15.18942	-173.91598	2508.6	0.8	172.315	2017-12-03	23:47:03	S92	338
S92-rock-13	S92-rock-13. Piece of jumbled flow with striations (fluid looking). Black glass interior with hollow areas. Angular. 5-30 cm on long side. Glassy with ropery surface texture. Plate of color on surface of glass. Rougher texture on outside. Chonchoidal fracture on inside. From thin pancakey flow. No visible vesicles. Into biobox 4. Halfway between waypoints 3 & 4.	-15.19049	-173.91679	2508.5	0.7	196.419	2017-12-04	0:04:54	S92	354
S92-sed-14	S92-sed-14. Push core 1 into the sediments on dune-like environment. Sands deeper than measuring stick of 30cm. Light brown - sandy colored seds. Fine-grained with no visible ash. ~80m SW of rock-13.	-15.19110	-173.91720	2500.3	0.3	189.146	2017-12-04	0:22:39	S92	375
S92-bio-15	S92-bio-15. Suction of big brittle star in dune area after cresting ridge. It's big, and stretched out across the segments. Very close to sed-14 location.	-15.19112	-173.91717	2495.8	4.8	128.546	2017-12-04	0:31:55	S92	382

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S92-rock-16	S92-rock-16. Ropey outer crust of lava rock on top of pillow lobe covered with sediment on sandy slope. Large rock with large visible hollow (eye) in rock center. Rolled up lava. Small stretched vesicles. Almost aphyric. Manganese coating on outside. 25 - 30 cm long; width at bottom is ~25 cm across. Into marker box. ~75mSW of samples 14 & 15.	-15.19167	-173.91760	2504.2	0.0	199.177	2017-12-04	0:35:46	S92	389
S92-rock-17	S92-rock-17. Arcuate fracture pattern on this blocky-jumbled-pressure ridge. Sediment coating. 10x10 cm with arcuate fracture surfaces. Softball sized in front stbd corner of box. Just over 100m north of waypoint 4.	-15.19298	-173.91945	2506.3	1.3	268.451	2017-12-04	1:05:16	S92	422
S92-rock-18	S92-rock-18. Edge of broken inflated tumuli-like lava flow sitting on top of lobate pillows. Trapezoidal 10x12cm. Vesicular with Mn-coat. Corner with Fe-staining. ~200m west of waypoint 4.	-15.19421	-173.92140	2508.4	0.9	247.714	2017-12-04	1:46:42	S92	429
S92-sed-19	S92-sed-19. Scoop-2 of volcanoclastic/pelagic sediment and some VERY viscous mud from top of small dune. ~200m SW of rock-18.	-15.19503	-173.92320	2464.3	1.4	223.824	2017-12-04	2:34:46	S92	444
S92-rock-20	Sheety-platy lava on highly sedimented seafloor. 15-20 cm piece relatively soft rock. Might be welded ash or fine grained volcanic rock. Crumbly. Going in for 2nd grab ~35cm long. Altered-log shaped. Dark banded layer. Into partition 10 and some pieces into 9. ~150m upslope of waypoint 5.	-15.19693	-173.92404	2419.0	0.0	180.082	2017-12-04	2:56:34	S92	455
S92-rock-21	S92-rock-21. In-place piece of rock near the summit of the largest hill so far. Well-consolidated. Orange-stained outer coating. Rock has a bit of a point at the end. 10x10 angular. Some black stain? Lighter colored. Near rock-20 moving upslope to waypoint 5.	-15.19742	-173.92391	2418.2	0.8	238.799	2017-12-04	3:14:38	S92	477
S92-rock-22	S92-rock-22. Near summit of mound. Odd-looking platy stuff. Rhombohedral cracks in this rock. Cracked down the middle. Sandstone colored interior. Into partition 5. 15x8 cm. Stayed together well. Z=2415m. Buff colored. At waypoint 5.	-15.19815	-173.92410	2414.8	0.5	248.84	2017-12-04	3:30:41	S92	491
S92-sed-23	S92-sed-23. Scoop bag #1 in sediments. Sticky somewhat consolidated gelatinous seds. Nothing dark in seds. Taken just below rock-22 on on sedimented/sandy slope.	-15.19832	-173.92417	2415.1	0.0	156.912	2017-12-04	3:36:34	S92	494

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S93-sed-01	S93-sed-01. Push core 1 of coarse volcanic sand from sedimented area of rippled sand. Went down 7-8cm. Black grains. Fresh and black with buff-colored pelagic seds on top. Looks like most of it dumped out. Nav bad-position about 90m W of waypoint 1.	-15.06483	-173.72783	2538.5	0.0	227	2017-12-04	19:11:03	S93	54
S93-rock-02	S93-rock-02. From saddle between No-Name and W Mata. Piece 1: Coating of precipitates out of sea water. Cracked. Fragile. Crystal-rich. Huge olivine crystal. > 1cm in diameter. Orange/grown staining on outside-fresh interior. Angular and small vesicles. Crystal rich. No glass. 2nd piece: Porphyritic. More crystal then rock. Deep green clinopyroxene. Sliver of the same rock. Cracked. Orange staining. Black manganese coating. 3rd piece with huge megacrysts (either one crystal or a combination of many fused crystals). Less than 5 cm. 4th: Circular piece. Huge crystals. Iron staining on the face. Just adjacent to previous pieces. Vesicles. Clinopyroxene. No glass. Partition 5. ~90m NE of waypoint 2.	-15.06723	-173.72989	2588.0	0.6	176	2017-12-04	20:42:01	S93	166
S93-rock-03	S93-rock-03. Edge of pillow flow in sedimented basin. 7x3cm wedge-shaped crust. Second piece of crust of this young pillow flow. 10x3cm with ribbon of white stain through center of crust. Third chunk of crust from pillow. Greenish-white stain on top surface. 4x6cm and squarish. ~50m SW of waypoint 2.	-15.06799	-173.73096	2596.8	2.0	224	2017-12-04	21:10:16	S93	180
S93-sed-04	S93-sed04. Scoop 2 of volcanic sediment immediately at base of young distal lava flow at NE flank of West Mata Volcano. (Just away from rock-03 outcrop). Two scoops	-15.06825	-173.73117	2598.1	0.0	269	2017-12-04	21:35:25	S93	187
S93-rock-05	S93-rock-05. Chunk of overhanging crust 10x15cm. Lots of glass and olivine and wedge-shaped. Delaware-looking with some groundmass. Area of stacked pillows with less sediment. Between waypoints 2 & 3.	-15.06844	-173.73127	2587.1	3.1	201	2017-12-04	21:51:18	S93	192
S93-rock-06	S93-rock-06. Very vesicular porphyritic glassy rind from inflated pillow at top of mound. Nav off so precise location uncertain at waypoint 3.	-15.06948	-173.73258	2508.4	0.0	222	2017-12-04	22:28:35	S93	251
S93-rock-07	S93-rock-07. 5x10cm vesicular with fresh glass and ropy surface. Grey groundmass. Blocky with large fresh olivines. Edge of flow and sediments after descending mound at waypoint 3.	-15.07057	-173.73293	2525.5	2.3	261	2017-12-04	22:55:09	S93	257

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S93-rock-08	S93-rock-08. Free-hanging pillow toe 50-60 cm and shaped like hairy mushroom. Steep slope with truncated pillows. ~70m NE of Waypoint 5.	-15.07042	-173.73417	2497.9	13.7	230	2017-12-04	23:16:49	S93	266
S93-rock-09	S93-rock-09. Vesicular pillow crust from field showing signs of hydrothermal alteration near base of mound. Orange and white stripe on edge 25x15cm. Area of intact pillows. ~125m WNW of waypoint 5.	-15.07047	-173.73540	2516.0	0.9	213	2017-12-04	23:38:50	S93	280
S93-rock-10	S93-rock-10. Inflated pillow crust with striae at the surface. 20x15cm piece. Lots of minerals; dark and glassy. Angular with striations. Banding is the flow on the outer edge. Into front of partition 10. Top of pillow mound ~25m N of waypoint 6.	-15.07208	-173.73590	2421.9	1.1	116	2017-12-05	0:09:17	S93	310
S93-sed-11	S93-sed-11. Volcaniclastic sediment scoop from pocket nearly surrounded by large pillow tubes. Dark sparkly grains. Gray dust rising. Black shiny sediment crystals. The volcaniclastic seds are really black beneath the pelagic marine snow area. 3in sediment in bag with hole. ~15m N of waypoint 6.	-15.07220	-173.73583	2419.6	0.0	158	2017-12-05	0:21:41	S93	319
S93-sed-12	S93-sed-12. Push core #2 with the core catcher in this very black volcaniclastic ash/sed layer at western edge of main flow. Sed thickness 20cm. Core is ~ 1/3 full. At waypoint 7.	-15.07188	-173.73762	2489.3	0.0	295	2017-12-05	1:03:08	S93	364
S93-rock-13	S93-rock-13. Small piece of thin lobe on edge of new flow. 5cm thin wedge. Lots of olivines. Small vesicles. Glass rind. Super fresh. Piece 2: Flat-ish rind from the top edge of long flat pillow. Glassy rind; Irregular shape. Some vesicles. Lots of green minerals. 8-10cm across. Into biobox 1. Same location as sed-12.	-15.07188	-173.73762	2490.2	0.4	334	2017-12-05	1:08:28	S93	369
S93-rock-14	S93-rock-14. Large pillow with platy exterior. A small hole in the bottom. Some striated surfaces. Crust with striations and banding. 3 cm in longest dimension. 2nd piece: Long narrow piece. 25 cm slab of glassy pillow rind. Can't see crystals from this side. Into biobox 2. Top of high at waypoint 9.	-15.07376	-173.73698	2379.9	0.8	160	2017-12-05	1:46:53	S93	425
S93-rock-15	S93-rock-15. 5x10cm phyric glass rind from pillow with some hydrothermal staining. Outside of pit on the edge near waypoint 10.	-15.07392	-173.73799	2376.8	0.0	140	2017-12-05	2:22:58	S93	462
S93-sed-16	S93-sed-16. Scoops of volcaniclastic sediment/ash next to collapse pit. Two good scoops. At waypoint 11.	-15.07449	-173.73882	2369.7	0.0	190	2017-12-05	2:53:26	S93	476

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S93-rock-17	S93-rock-17. 5x5cm half glass block with orange stripe at base. Vesicular and lots of olivine. Sampled from older crusty pillow with a lot of sediment. Near sed-16; ~30m SW of waypoint 11.	-15.07462	-173.73886	2369.5	0.4	194	2017-12-05	2:59:13	S93	479
S93-rock-18	S93-rock-18. 10x5 cm columnar shaped chunk of collapsed pillow. Tall and skinny with an orange stain at base. Highly vesicular. Between waypoints 11 & 12.	-15.07468	-173.73861	2371.6	0.5	294	2017-12-05	3:07:36	S93	483
S93-rock-19	S93-rock-19. 50x25 mace-like piece of crust from older sedimented lobate flow. Monster pillow rind. West of waypoint 12.	-15.07476	-173.73808	2375.5	0.0	51	2017-12-05	3:17:53	S93	486
S94-rock-01	Intact pillow knob from pile of pillows . Quite large. Small diameter pillow. 15 cm across. Surficial sediment -some iron staining. Glassy surface. Has a crack in it. Broke into 2 pieces. Crust on outside. See some phenocrysts. Olivine. Some vesicles. ~15m NE of waypoint 2.	-14.99979	-173.79372	2163.3	2.5	151.298	2017-12-05	19:26:49	S94	83
S94-rock-02	S94-rock-02. Disgorged pillow bud beneath large bulbous pillow from top of hill. Gray-ish interior. Quadrant of pillow bud. Spongy texture with volcanic glass. Vesicular. Not a lot of phenocrysts. 10-15 cm. Nice glassy upper surface. ~20m E of waypoint 2.	-14.99987	-173.79360	2136.1	1.8	122.657	2017-12-05	19:43:08	S94	107
S94-rock-03	S94-rock-03. Chunk of older shelly pahoehoe-like crust of jumbled sheet flow. Vesicular with thin glass. Med grey alt band under glass and pyric. Near waypoint 3--35m SW.	-15.00212	-173.78982	2042.9	3.7	222	2017-12-05	21:09:27	S94	264
S94-rock-04	S94-rock-04. Just above talus slope; in place bulbous pillow crust. Sampled 3 chunks of rock ranging from 5x7cm to 10x10cm. Vesicular sponge-like and pyric. ~70m S of waypoint 3.	-15.00252	-173.78953	2050.5	3.0	180	2017-12-05	21:22:13	S94	267
S94-rock-05	S94-rock-05. Upper crust of top of pillow tube. Flattish with rind. Vesicular. Orange stain. Glass. Green olivine crystals. Pretty vesicular. 7cm across 10-20 cm on long side. Up debris slope from rock-04. ~80m N or waypoint 4.	-15.00351	-173.78942	1974.1	4.5	211	2017-12-05	21:57:20	S94	288

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S94-rock-06	S94-rock06. Piece of ropy jumbled flow between two pillow deposits. Two pieces 5x7 and 5x7 should fit together and picked up a third. Large center vesicle and phytic. (Using logger position.) Between waypoints 4 & 5.	-15.00438	-173.79080	1906.2	0.5	319	2017-12-05	22:46:12	S94	333
S94-sed-07	S94-sed-07. Sediment sitting on top of jumbled lava flow near rock-06. (Bad nav position).	-15.00446	-173.79075	1905.7	0.7	327	2017-12-05	22:56:08	S94	336
S94-bio-08	S94-bio-08. Shrimp from Low Smoker Vent. ~15m N of waypoint 6. Low Boy Vent.	-15.00457	-173.79389	1823.4	0.8	259	2017-12-05	23:37:48	S94	357
S94-sulfide-09	S94-sulfide-09. Sample of chimney spire at Low Smoker. Nice little smoker. The top broke off. It was active. Not black smoke. Was 10 cm across but it broke. Into Partition 2. Broke into 3 pieces. At 1824m height on chimney. Black smoke came out of orifice after sampling.	-15.00457	-173.79389	1823.9	2.0	142	2017-12-05	23:51:15	S94	358
S94-gas-10	GT#6 in hot black beehive orifice at top of Low Boy. (Mkr-203 area-seen in background.) Fired at 0009:50. Nozzle was black. Temp reading of 260degC on previous dive; today highest 230degC. (Fluid sampled here on dive S91).	-15.00457	-173.79389	1823.2	0.0	247	2017-12-06	0:10:23	S94	372
S94-gas-11	S94-gas-11. GT #2 green. At the top of Snail Alcove in small beehive with vigorous flow. This beehive got up to 200C. Fired at 0055:35. Looks like a good sample. Snail Alcove: 15.0048215 S 173.7935434 W.	-15.00482	-173.79354	1813.4	4.0	327	2017-12-06	0:55:39	S94	412
S94-fluid-12	S94-fluid-12. Major sampler #3 in the same little smoker orifice where the gastight was taken. Snail Alcove. Looks good - right in the flow. Triggered at 01:07:21.	-15.00482	-173.79354	1813.3	0.0	327	2017-12-06	1:07:28	S94	416
S94-bio-13	S94-bio-13. Suction into Chamber #2. Opaepete shrimp; Alvinocaris (?). Shrimp Alcove top of chimney.	-15.00482	-173.79354	1813.3	4.0	327	2017-12-06	1:14:24	S94	419
S94-bio-14	S94-bio-14. Scoop bag #1 Alvinococoncha snails (~6) and Ifremeria snails (~?). Snail Alcove position on dive S96: 15.0048215 17.7935434 2nd scoop in same place after sulfide-16 of hairy snails.	-15.00482	-173.79354	1813.3	4.0	327	2017-12-06	1:16:10	S94	420
S94-fluid-15	S94-fluid-15. Sample in the area where the snails were living near the top of the chimney. Z=1813.4. ~ 30 cm from the top of the chimney where biology sampled. Fired.	-15.00482	-173.79354	1813.4	3.9	12	2017-12-06	1:43:52	S94	428
S94-sulfide-16	S94-sulfide-16. Beautiful active sulfide piece from the very top of the chimney. Pyramid-shaped. Gold interior 8 cm tall. Fluid outflows. Z=1813m.	-15.00493	-173.79351	1813.1	5.1	290	2017-12-06	1:55:20	S94	437

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S94-fluid-17	S94-fluid-17 Major sampler #4. In crack beneath the mussels where the temp was 23C. At base of south wall in pit. Fired at 0236. 15.005142 173.793922 Z=1843.	-15.00512	-173.79392	1842.4	0.5	184	2017-12-06	2:39:55	S94	470
S94-bio-18	S94-bio-18. Mussel scoop. At the Pit site just above fluid-17. Into biobox 3.	-15.00512	-173.79392	1842.7	0.0	159	2017-12-06	2:53:24	S94	474
S94-bio-19	S94-bio-19. Chamber 3 slurp: Opaepele shrimp. Alvinocaris shrimp; Ifremeria. The Pit site.	-15.00512	-173.79392	1842.8	0.0	159	2017-12-06	2:58:02	S94	476
S94-sulfide-20	S94-sulfide-20. Spire from inactive sulfide 40 cm tall 10-15 cm diameter from ~5m structure. Orange staining. Coating of iron oxide - gray interior Round spire with 2cm wide central fluid upflow zone. Into partition 11. Bee Hive Towers NE of The Pit at Deal Guy Ale.	-15.00472	-173.79365	1820.3	3.7	65	2017-12-06	3:08:38	S94	485
S94-fluid-21	S94-fluid-21. Major #2. near the top of Tall-North-Handsome. In clear vigorous fluids flowing from spigot. Fired 0333:30. Looks good. Tmaz 204degC but not far into flow.	-15.00449	-173.79359	1822.3	8.1	302	2017-12-06	3:34:46	S94	502
S94-gas-22	S94-gas-22. Gastight 12 yellow/green into same orifice at Tall-North-Handsome.	-15.00449	-173.79359	1822.4	7.3	313	2017-12-06	3:37:45	S94	504
S94-bio-23	S94-bio-23. Suction into Canister 4. Shrimp; Lots of them. From SE side of Tall-North-Handsome.	-15.00449	-173.79359	1822.5	3.7	334	2017-12-06	3:51:06	S94	511
S94-bio-24.	S94-bio-24. Suction into Canister 5: Branchinotogluma (the scale worm); Snail stuck in the intake valve. Tall-North-Handsome.	-15.00449	-173.79359	1821.3	7.2	323	2017-12-06	3:53:24	S94	512
S94-sulfide-25	S94-sulfide-25. Spire from inactive portion of Big-Tall-Handsome. Sort of pagoda shaped piece. Got the little tip. with a nice point on the top.	-15.00449	-173.79359	1821.7	7.2	318	2017-12-06	3:55:09	S94	513
S95-sed-01	Push core #3. Into the deep sed. 40+ cm of sediments. The sed. are black under the thin pelagic lighter sed. Coarse plug of dark volcanic sed. Upper part of tube has finer grain size. At landing site-really bad navigation. edge of a heavily sedimented area that looks like a contact. Flatter pillow lobes that are heavily sedimented next to more bulbous pillows up slope.	-15.11856	-173.80120	3011.8	0.0	149	2017-12-06	19:27:31	S95	37
S95-rock-02	S95-rock-02. High-standing pillow nub that is attached. In sandy bottom. Olivine-phyric. Green phenocrysts. No vesicles evident. Spectacular rock. 10x4cm with glassy shell. Grabbed pieces that broke off nearby rock as well. Into partition 5. Same location as sed-01.	-15.11852	-173.80138	3011.8	0.0	149	2017-12-06	19:31:04	S95	39

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S95-rock-03	S95-rock-03. Pillow bud-like feature sticking out from a more extruded bit of lava. Still has lots of crystals with some orange staining. See crystals in the glass. About 10% vesicular. 2nd piece 7x3cm with more glassy exterior. Not far from rock-02.	-15.11869	-173.80123	3007.1	1.0	156	2017-12-06	19:52:01	S95	59
S95-rock-04	S95-rock-04. Cracked pillow with 1-2cm of sediment cover. At contact? Grab of pillow rind. Extra flaky slab of glass. Less than cm thick 10-ish cm long. Upper surface of young sediment coated pillow at the flow margin of 2010/2011 eruption. Crystals on surface and glass flakes separating. 2 flaky pieces of the upper surface of pillow.	-15.11884	-173.80118	3008.3	0.6	84	2017-12-06	20:18:15	S95	83
S95-rock-05	S95-rock-05. Pillow bud under thick-ish seds. 2m from rock-04. Circular. 15 cm long. Radial. Green crystals. Wow super packed with crystals. Porphyritic. Olivine and clinopyroxene. Small vesicles. Rocky interior. Into partition 8.	-15.11865	-173.80177	3009.0	0.0	114	2017-12-06	20:27:51	S95	90
S95-rock-06	S95-rock-06. Environment is at a Spur - small section of jumbled up curtain-folded sheets: Thicker rind on this lava: Frothier interiors. Two pieces of a broken flow. 3x5cm and 10x15cm. Larger piece has a lot of hydrothermal staining. At jumbled flow pressure ridge. (No navigator position-east from Waypoint 1).	-15.11796	-173.79899	2953.3	2.9	105	2017-12-06	20:54:08	S95	129
S95-rock-07	S95-rock-07. Sheet flow surface plate. Iron staining on the bottom. See fresh glass on the corner. Flat elongate slab - broke into 25-30cm piece. ~20m W waypoint 2.	-15.11643	-173.79400	2955.2	1.9	114	2017-12-06	22:06:50	S95	166
S95-rock-08	S95-rock-08. Crust of collapsed pillow. Phyric 5x20cm with very fresh glass rind. Area with pillows flattening out into meandering lobes.	-15.11864	-173.79129	2894.9	0.7	141	2017-12-06	23:23:16	S95	216
S95-rock-09	S95-rock-09. Outer edge / rind of collapsed lobate pillow. 7 cm thick. Pie sliced. Vesicles and crystals. Broken edge is black - exposed edge is brown. On the little high ~25 m SE of waypoint 4.	-15.11824	-173.78881	2877.8	0.8	76	2017-12-06	23:54:24	S95	245
S95-sed-10	S95-sed-10. Scoop bag 1. We're on the edge of this lava flow in sediments that are light and dark banded ripples near a contact..	-15.11831	-173.78900	2889.1	0.7	97	2017-12-07	0:11:11	S95	260

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S95-rock-11	S95-rock-11. Older lava flow to the east. From older broken up eroded pillow piece at top of old wall. Intact. Quite altered. Nice glass rind. 20cm by 10cm. Plug - thick glass at the top. Some vesicles. Lots of the interior. Orange staining - has a pillow toe-like feature. Into partition 9.	-15.11804	-173.78911	2885.9	0.9	76	2017-12-07	0:24:16	S95	277
S95-rock-12	S95-rock-12. Piece of large cracked weathered older (Corals growing on it) pillow. Outer piece: 10x8 cm piece. One nice fresh face. Crystals in there. Weathered sed and crud in to biobox 3. Somewhere between waypoint 4 & 5.	-15.11770	-173.78793	2881.6	0.0	101	2017-12-07	0:44:37	S95	295
S95-rock-13	S95-rock-13. Platey sheet of the outer crust of edge of rippled slope sheety/platey flow with some buds around the edge. Seeing some crystals in this thin plate of glassy cruse. Circular- 10 cm by 1cm thick. 15.117412 173.786810 Z=2889m	-15.11737	-173.78719	2888.7	0.0	138	2017-12-07	1:03:27	S95	311
S95-sed-14	S95-sed-14. Push core #2 with the core catcher. Deep sediments on this flatish plain. From edge of flow up against sedimented ridge. That core is full - at least upon collection. Uniform black volcanic sed. No internal stratigraphy. 15.117374 173.787272.	-15.11736	-173.78736	2887.1	0.0	141	2017-12-07	1:18:09	S95	320
S95-rock-15	S95-rock-15. Jumbled sheet flow with drain-out bathtub features (shelves) along side of fissure. . Z=2890 m. Slab is 7 cm thick. 2 layers. Lava drips. Ridged pattern. Very crystal rich. Olivine and some pyroxine. 15.117259 173.786498.	-15.11718	-173.78692	2889.5	0.0	92	2017-12-07	1:29:42	S95	333
S95-rock-16	S95-rock-16. Sample from jumbled pillow lava; full with crystal. porphyritic; glassy and arcuate shaped; 20-25 cm. 15.1172125 173.7859079 Z=2880m	-15.11717	-173.78603	2880.2	0.9	59	2017-12-07	1:59:16	S95	361
S95-rock-17	S95-rock-17. Piece of rind and small amount of interior. 25 cm long by 10 cm thick. Crystal-rich. Upper 1 cm thick glassy rind. Not as crystal rich as the sheet we just sampled (rock-16). 15.1171499 173.7862279.	-15.11714	-173.78558	2874.5	4.1	101	2017-12-07	2:09:52	S95	372
S95-bio-18	S95-bio-18. Pencil tube worm (carnivorous polychaete) attached to top of large pillow on a slope. Got it all. It's about 10 cm long and skinny (toothpick thick). Biobox 2. 15.117066 173.786620.	-15.11704	-173.78661	2863.5	1.1	138	2017-12-07	2:21:37	S95	384

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S95-bio-19	S95-bio-19. Suction into Jar 2: Unidentified tunicate? Or sea pen? Red interior with something that resembles polyps on the outside. Bluish overall color. White eggs (?) at base. Well-connected to rock. 15.1171764 173.786405. Z=2854 m. From 2 overlapping young flows.	-15.11715	-173.78642	2853.7	0.0	59	2017-12-07	2:31:37	S95	392
S95-rock-20	S95-rock-20. Flow-talus contact as moved upslope. Another dangler. Phyrlic telescoping pillow lava. 15.1167031 173.7846586 depth 2804m	-15.11650	-173.78462	2804.0	8.6	111	2017-12-07	2:52:10	S95	400
S95-rock-21	S95-rock-21. From top of cliff. Chunk of fresh pillow rind 3x5cm. 15.1157597 173.7838459 depth 2704m	-15.11576	-173.78417	2704.9	0.0	63	2017-12-07	3:11:47	S95	410
S95-rock-22	S95-rock-22. Ingrown pillow toe inside partly drained pillow at top of pile. Phyrlic and two 5x5 chunks. Third piece ~5x10cm. 15.1152122 173.7620305 depth 2702m	-15.11521	-173.78164	2701.9	0.0	118	2017-12-07	3:41:41	S95	426
S96-rock-01	S96-rock-01. 20 cm pillow fragment from lower edge of a unit of piled up pillows on a steep slope. Vesicles. Looks like crystals. Bio stain with sediment and manganese coating. Looks more like 20 cm. Wedge-shaped. 14.9922924 173.18142087. 30 m east of WP1.	-14.99227	-173.81421	2584.1	5.4	142	2017-12-07	19:03:51	S96	48
S96-rock-02	S96-rock-02. Broken-up massive pillow from old ridge. Cracked and altered on its exterior surface. Looks like it shattered in place. Volcanic glass (crumbly) from exterior. A few fragments of exterior. 4 cm in length. 2nd grab: 5 cm with glassy surface and a bit of interior with it. Some occasional green crystals and glassy exterior surface. Into biobox 1. ~70m SE of waypoint 1.	-14.99264	-173.81398	2554.5	0.0	172	2017-12-07	19:17:17	S96	81
S96-sed-03	S96-sed-03. Sediment scoop with bag #3. Area of coarse black shiny sed and lighter pelagic (?) sed in rippled area (the ripples are not very high). Next to rock-02.	-14.99265	-173.81390	2554.2	0.0	2	2017-12-07	19:41:23	S96	92
S96-rock-04	S96-rock-04. Elongate flattened pillow as moved up WRZ. Grabbing a sheet-ish looking piece from the surface. Piece 1: Glassy with crystals. Small piece. 4-5 cm Arcuate shape. Glassy surface. Some minor crystal content. Piece 2: Fairly vesicular - small bubbles. 2-fer. Nice pieces. Manganese oxide surface. Blacker piece on top from fresh exterior. Piece 3: 10 cm irregularly shaped with curved exterior surface. Smaller rock with fresher surface - angular	-14.99248	-173.81318	2552.5	0.8	66	2017-12-07	20:05:32	S96	119

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S96-rock-05	S96-rock-05. Pillow lava from in-place outcrop among the infinite sediments. 10x7. Fe oxide stain on one face and Mn on another. Vesicular and phyric with slightly more xtals in glass rind. ~40mNE of waypoint 2.	-14.99127	-173.80790	2482.1	0.9	35	2017-12-07	21:22:04	S96	199
S96-rock-06	S96-rock-06. Rind of fractured-bulbous pillow in outcrop above talus slope. Light sediment. Midway between waypoints 2 & 3.	-14.99051	-173.80716	2430.0	0.8	53	2017-12-07	21:43:20	S96	213
S96 rock-07	S96-rock-07. 20x15cm piece with Mn coating. One fresh face. From ridge crest ~20m N waypoint 3.	-14.98893	-173.80543	2393.6	0.0	104	2017-12-07	22:18:54	S96 rock	256
S96-rock-08	S96-rock-08. Small 5x5cm vesicular and phyric. Mn-crust and Fe staining but VERY fresh interior. Second 5x5cm that broke in two. ~100m ESE of waypoint 4.	-14.98919	-173.80314	2385.2	2.9	63	2017-12-07	22:47:09	S96	264
S96-rock-09	S96-rock-09. Pillow toe 2 pieces with orange staining on glass rind from stack of pillows with little sediment. 20x10cm. Midway between waypoints 4 & 5.	-14.98988	-173.80155	2392.2	9.9	124	2017-12-07	23:05:36	S96	279
S96-rock-10	S96-rock-10. Pillow ornament from large striated pillow. 10x20 vesicular and nearly aphyric. Peanut-shaped with biota. Orange staining on glass rind. ~50m NW of waypoint 5.	-14.99020	-173.80116	2329.1	47.6	167	2017-12-07	23:18:20	S96	283
S96-bio-11	S96-bio-11. Bamboo skeleton with 2 ophiroids (brittle stars). On young-ish pillow lava rind near top of cone. ~15m NW of waypoint 5.	-14.99039	-173.80089	2320.5	9.0	98	2017-12-07	23:33:03	S96	308
S96-rock-12	S96-rock-12. N base of southern cone. Pillow bud (severed the head). Vesicular grayish interior. Lots of gas pockets. Melon sized. Manganese staining on outer edges. Black glass. Circular. Brown clay. 40x20cm.	-14.99203	-173.80101	2375.8	1.3	174	2017-12-08	0:01:08	S96	348
S96-rock-13	S96-rock-13. Really black interior. Angular large wedge. Gray staining on exterior. Large patch of black interior exposed. Interior looks vesicular and porphyritic. Brown coating. Fresh face on one side. 20x10cm.	-14.99300	-173.80060	2328.9	1.0	163	2017-12-08	0:23:03	S96	378
S96-sed-14	S96-sed-14. Scoop 1. Below summit on sandy slope (80m SW of summit cone). Buff-colored seds on top. Seds are dark in color. Z=2344. Between waypoints 5 & 6.	-14.98946	-173.79979	2343.4	0.0	54	2017-12-08	1:22:27	S96	440
S96-rock-15	S96-rock-15. Taken next to sed-14. Glassy angular vesicular crystal rich piece of pillow lava. 10 cm long and 4 cm wide?	-14.98946	-173.79979	2341.6	1.3	344	2017-12-08	1:33:38	S96	441

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S96-bio-16	S96-bio-16. Chrysogorgia coral with squat lobster. We only see 1 squat lobster but may be more. Nicely plucked off the holdfast rock. ~10cm tall. In biobox 1.	-14.98946	-173.79979	2341.0	0.0	311	2017-12-08	1:39:24	S96	444
S96-sed-17	S96-sed-17. Scoop into bag #2. Z=2340. T14.9882115 173.7970433. Coarse volcanic deposit on little ridge. Banding of light/dark.	-14.98821	-173.79703	2339.1	1.1	98	2017-12-08	2:24:17	S96	508
S96-bio-18	S96-bio-18. Suction of brittle star off sandy seafloor. Brittle star is poking out the suction hose. Suctioned off sandy seafloor here. Same location as previous sample. Into biobox 2.	-14.98821	-173.79703	2340.0	0.0	91	2017-12-08	2:31:05	S96	511
S96-rock-19	S96-rock-19. Pillow fragment with ~1cm glass rind. 10x15cm and large vesicles full of sediment. 1/3 distance between waypoint 7 & 8.	-14.98793	-173.79625	2343.8	1.6	51	2017-12-08	2:50:41	S96	517
S96-rock-20	S96-rock-20. Rind of an intact huge pillow. 8x5cm vesicular with Mn-coat and some sediment infill in the vesicles. ~40m W of waypoint 8.	-14.98694	-173.79423	2410.1	0.0	129	2017-12-08	3:19:08	S96	532
S97-sed-01	S97-sed-01. Scoop 1 of light-brown sediment from sandy hillock. 10 micron fraction. Sediment is not very dark even under the surface layer. Orangish iron oxide colored fine seds. ~20m SE of waypoint 1.	-14.91591	-173.77318	2764.8	0.0	68	2017-12-08	19:06:05	S97	42
S97-sulfide-02	S97-sulfide-02. 12cm of top of extinct weathered chimney. ~4 m tall. Cross section is pretty solid. Several upflow zones. White zones of anhydrite and barite with dispersed crystals. Lots of white anhydrite and chalcopyrite. Possibly barite and bornite? Orange coating. Hydroids and bryosinids on top. Leaning Tower of Pisa. Partition 9. ~20m NW of waypoint 1.	-14.91559	-173.77340	2766.6	0.0	323	2017-12-08	19:23:37	S97	63
S97-sulfide-03	S97-sulfide-03. 5 cm piece of central black smoker vent. 2mm - cm thick zone of chalcopyrite. Brown alteration on exterior. Friable into biobox 2. Old Smokey site (8m chimney with 2 spires) about 30m NW of sulfide02.	-14.91545	-173.77371	2757.8	5.2	295	2017-12-08	19:52:29	S97	96
S97-gas-04	S97-gas-04. Gastight #16 Orange. In orifice where the temp reached 274.5C. Depth at the top is 2758 (~ 8m tall sulfide). Old and crusty. Sample questionable-had to use manip for ram.	-14.91545	-173.77371	2757.9	6.8	222	2017-12-08	20:23:31	S97	110
S97-fluid-05	S97-fluid-05. Major fluid sampler #4. In same orifice as the gastight - Tmax=274.5C. On top of "Old Smokey". Fired at 2050:55.	-14.91545	-173.77371	2758.0	6.9	225	2017-12-08	20:50:59	S97	122

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S97-bio-06	S97-bio-06. Shrimp suction on iron oxide coated area - at 2759 m. Some white wispy bac mat. Got quite a few shrimp. 1 large polynoid. At Old Smokey chimney.	-14.91545	-173.77371	2757.0	8.6	222	2017-12-08	21:06:00	S97	132
S97-rock-07	S97-rock-07. Piece of weathered; old and sediment covered - outer glassy surface suspected. Black-ish interior. Beat-up outer glass. 7 cm fragment. Upper glassy surface. Alteration-probably boninite. Came from outer rind of partially drained out pillow from area of faulted up pillow pile in sand swale. 2nd piece: glassy rind-altered area under glass. Vesicle but no crystals. In biobox 2.	-14.91679	-173.77482	2740.8	0.8	270	2017-12-08	22:09:00	S97	178
S97-bio-08	S97-bio-08. Large barnacle on glassy rock. Rock not included.	-14.91683	-173.77509	2734.1	1.2	316	2017-12-08	22:24:37	S97	186
S97-sulfide-09	S97-sulfide-09. Chimlet sample from tall extinct hydrothermal chimney. Blood-orange surface deposits. 5x20cm chimlet of chimlet	-14.91632	-173.77546	2717.9	6.5	12	2017-12-08	22:39:21	S97	196
S97-sulfide-10	S97-sulfide-10. Chimlet spire from extinct chimney. ~60mNW of sulfide-09.	-14.91583	-173.77569	2708.1	1.5	82	2017-12-08	23:07:15	S97	212
S97-sulfide-11	S97-sulfide-11. Sampling an extinct chimney with pinecone-shaped chimlets. Got piece of pinecones 15x20cm. Black outer coat with Fe staining in inner rim. Dense. ~10m W of sulfide-10.	-14.91584	-173.77578	2708.0	0.0	219	2017-12-08	23:25:08	S97	214
S97-rock-12	S97-rock-12. Piece of pillow from jumbled debris. Supposedly in place. Iron oxide coating. 30x20 cm long pillow fragment. Outer crust and some hollow inside. ~40m ESE of waypoint 3. In behind major #4.	-14.91454	-173.77744	2651.8	2.0	288	2017-12-09	0:00:18	S97	256
S97-gas-13	S97-gas-13. Gastight bottle #6 - yellow. In orifice where Tmax=295C. It's in there. Fired at 0139:40. At Redwood chimney in area of many active chimneys just 10m north of waypoint 4. Sample probably not good.	-14.91356	-173.77910	2615.9	17.2	18	2017-12-09	1:39:54	S97	377
S97-gas-14	S97-gas-14. GTB-2 green. Fired in the milk crate. Not a hydrothermal sample. Will process it anyway for background sea water sample. Redwood: 14.913523 173.779106.	-14.91356	-173.77910	2616.5	15.6	16	2017-12-09	1:51:28	S97	382
S97-fluid-15	S97-fluid-15. Major #1. Going for same orifice as gastight and temp at Redwood. Sampling at 2616 m near the top. Fired at 0155:30. Full at 0157:55.	-14.91356	-173.77910	2615.7	17.8	16	2017-12-09	1:55:33	S97	383
S97-fluid-16	S97-fluid-16. Duplicate fluid sample in same orifice as fluid-15. Major sampler #3. Fired at 0209:30. Redwood.	-14.91356	-173.77910	2615.7	16.8	16	2017-12-09	2:10:44	S97	386

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S97-sulfide-17	S97-sulfide-17. Sulfide from top of Redwood. Orifice where we were sampling. The area where the beehive grew back in less than 1 hour. Beautiful chalcopyrite in there. Small piece of active venting area. 5 cm max. Outer rind. Fell in the gastight box.	-14.91356	-173.77910	2615.9	16.5	355	2017-12-09	2:21:44	S97	392
S97-bio-18	S97-bio-18. Suction of biology from S side of Redwood. Z=2626 here on the chimney. Jar #3 ~15 Shrimp (Opaepele); 2 red and white scale worms; Barnacle.	-14.91356	-173.77910	2626.1	5.9	11	2017-12-09	2:41:42	S97	401
S97-bio-19	S97-bio-19. Suction of Holothurian (Chirodota) Long skinny rather transparent creature and barnacles. At active Eiffel Tower (~9m tall). From the south side of this chimney-about 5m off seafloor.	-14.91348	-173.77912	2626.0	5.0	335	2017-12-09	2:57:29	S97	409
S97-bio-20	S97-bio-20. Scoop #4 of snails. At Eiffel Tower.	-14.91348	-173.77912	2624.0	7.6	358	2017-12-09	3:04:36	S97	415
S97-fluid-21	S97-fluid-21. Water sample from 262C vent on K2 Chimney. Location 14.913382 173.7790881 depth 2631m.	-14.91339	-173.77910	2631.5	2.5	279	2017-12-09	3:44:07	S97	423
S97-sulfide-22	S97-sulfide-22. Part of the K2 chimney.	-14.91339	-173.77910	2612.5	20.0	330	2017-12-09	3:53:12	S97	424
S98-sed-01	S98-sed-01. Scoop of sediment in sandy area with some hydrothermal patches. Even the lighter sed are darker than normal. Dark black material. Glassy. Fresh black shiny volcanic fragments. Half a bag. Near waypoint 1.	-15.38171	-174.25877	2116.7	0.0	147	2017-12-09	18:52:14	S98	34
S98-sed-02	S98-sed-02. Pushcore of yellow flocculent sand overlaying black volcanoclastic sands. The yellow/orange floc is probably over a centimeter thick. Orange floc is fairly coherent. Extremely coarse volcanic sand. ~90m SE of waypoint 1.	-15.38223	-174.25812	2112.5	0.6	140	2017-12-09	19:16:24	S98	69
S98-rock-03	S98-rock-03. Piece of rock in area of fragmental lavas on steep slope. From bent pillow tube. Piece 1: Thick glassy rind-1cm. Large olivine crystals. Gray banded ground mass. From bent pillow tube. Piece 2: Extreme blackness on surface. Thick glass. 5 cm piece of same rock. Grayish ground mass is micro-crystalline fabric. ~90m NW of waypoint 2.	-15.38315	-174.25729	2049.8	2.1	141	2017-12-09	19:56:18	S98	141
S98-rock-04	S98-rock-04. Armored plate from large coherent pillow (hollow with yellow floc flowing from interior) from slope. 10 cm 1.5 cm glass rind on upper surface. Thinner glass rind on lower surface. White coating on part of interior. Band of relatively thick vesicles up the center of the rind. Seeing some crystals and yellow floc coating. Into partition 6. ~20m NW of waypoint 2.	-15.38368	-174.25690	2002.9	1.6	122	2017-12-09	20:16:41	S98	169

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S98-rock-05	S98-rock-05. Extruded pillow toe fragment from large (40m tall) pillow mound. Piece 1: Olivine crystals. Looks like all glass. Iron floc stuck to exteriors. Piece 2: Lost most of its glass. Large crystal in center. Rounded larger than first piece. At waypoint 2.	-15.38381	-174.25675	1961.9	20.3	151	2017-12-09	20:34:46	S98	190
S98-sed-06	S98-sed-06. Scoop #2 of volcanoclastic sediment between pillow lobes. Some lighter sed on surface but mostly black. Bag half full. Between waypoints 2 & 3.	-15.38438	-174.25576	1934.7	1.2	179	2017-12-09	20:56:50	S98	234
S98-rock-07	S98-rock-07. Piece of pillow tube/lobe near sed-06. Outer rind of hollow pillow with orange floc coming out interior. Lots of young microbial staining on surface. Crystals and vesicular upper surface and more dense core. Rough texture glassy surface. 20x7cm into partition 8.	-15.38435	-174.25573	1934.0	0.6	132	2017-12-09	21:04:47	S98	239
S98-rock-08	S98-rock-08. Fragment of drainage from large pillow. Long-wavelength fold on glassy surface. 10x20cm. Thick vesicular glassy rind with vertical Fe stains. ~30m W of waypoint 3.	-15.38502	-174.25451	1908.3	0.8	101	2017-12-09	21:31:25	S98	252
S98-rock-09	S98-rock-09. Outer shell of drained-out pillow at the flow boundary. Fragile outer rind; crumbly glass exterior. Mostly glass pillow lava frag. 3cm thick 7cm long. Wedge shaped. Iridescent look to glass. Very young. Very vesicular and some is frothy. 2nd smaller piece. 5cm long. In biobox 1. ~90m W of waypoint 4.	-15.38480	-174.25211	1904.2	0.0	48	2017-12-09	22:02:13	S98	274
S98-fluid-10	S98-fluid-10. In area of extensive microbial deposits on flows with some swimming polychaetes and squat lobsters. Forward Niskin successfully fired.	-15.38236	-174.25264	1873.7	3.5	338	2017-12-09	22:54:30	S98	303
S98-rock-11	S98-rock-11. Logalicious 30x20cm pillow segment. Phytic and vesicular with thick grey groundmass and black core. ~60m SE of waypoint 5.	-15.38147	-174.25321	1938.0	5.1	92	2017-12-09	23:21:36	S98	314
S98-rock-12	S98-rock-12. Collapsed pillow mound fragment from slope near ridge top. Size 5 x 8 cm. glass rim. ~150m NE of waypoint 6.	-15.38096	-174.24978	1808.1	0.9	18	2017-12-10	00:20:40	S98	380
S98-sed-13	S98-sed-13. Pushcore of black volcanoclastic sed where a big shrimp is sitting. ~75m SW of waypoint 7. (Nav beginning to go bad.)	-15.37950	-174.24906	1807.6	0.0	37	2017-12-10	00:44:52	S98	411

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
s98-rock-14	S98-rock-14. Fresh pillow piece (toe?) from facing a steep slope. Our water depth here is 1879. We're hanging over the cliff edge. Tube about 25cm long 10 cm diameter. Perfect glassy crust. Huge olivine crystals. Small vesicles. In partition 9. Between waypoints 7 & 8. (Nav bad)	-15.37797	-174.24876	1878.6	2.4	85	2017-12-10	01:26:39	s98	449
S98-rock-15	S98-rock-15. From top of steep pillow mound. Outer rind weird pillow with multiple layers. Z=1761. No nav. Angular piece of pillow rind. Pie shaped. 12 cm. Glassy exterior 1-2 mm glassy crust. Vesicular and angular. Some crystals. Into bin 10. Maybe 50m W of waypoint 9.	-15.37723	-174.24779	1761.3	1.3	105	2017-12-10	02:27:44	S98	502
S98-sed-16	S98-sed-16. Scoop 3 of black volcanoclastic seds with yellow bacterial floc on top. We have nav. ~20m S of waypoint 9.	-15.37748	-174.24731	1749.2	1.1	50	2017-12-10	02:36:29	S98	510
S98-rock-17	S98-rock-17. 10x5cm lava from jumbled flow with shrimp and squat lobsters. Some Fe and S staining. Vesicular and phyric with sharp point on bottom on one side. Waypoint 9.	-15.37741	-174.24716	1740.3	0.9	89	2017-12-10	02:51:34	S98	517
S98-rock-18	S98-rock-18. Grab of odd highstanding breccia feature (looked like chimney) with altered chunks of lava. Very top piece; ~7x10cm with fairly extensive white and orange staining on surfaces	-15.37739	-174.24751	1740.2	5.3	100	2017-12-10	02:59:47	S98	521
S98-bio-19	S98-bio-19. Slurp of two shrimp in breccia mound area. Same location as rock-18.	-15.37739	-174.24751	1741.8	1.5	75	2017-12-10	03:17:15	S98	527
S98-fluid-20	S98-fluid-20. Major sample to go with the shrimp. Slope is unstable so we are firing it near the talus pile and not in it.	-15.37739	-174.24751	1741.8	1.5	77	2017-12-10	03:27:18	S98	528
S98-rock-21	S98-rock-21. Very murky water area. Mostly glass frothy with orange coat from a highstanding feature. 5x15cm. Between waypoints 10 & 14.	-15.37588	-174.24597	1673.4	4.8	9	2017-12-10	03:59:29	S98	551
S98-rock-22	S98-rock-22. Very poor visibility Sample of jumbly/spatter texture lava possibly from older event. 15x25cm with extensive Fe-stains. Looks like near-vent. Using navigator's guess. ~55m NE of waypoint 14.	-15.37529	-174.24498	1658.9	9.3	46	2017-12-10	04:13:42	S98	556
S99-rock-01	S99-rock-01. Large pillow at landing site - grab of pillow rind. Larger piece with lots of interior. Staining on 1 side. 1-2 cm glassy rind. 20 cm chunk. Gray vesicular center. Into quad 8-very crumbly. No nav so using waypoint 1 as location.	-15.34295	-174.22479	1954.7	0.8	270	2017-12-10	18:40:34	S99	31

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S99-rock-02	S99-rock-02. Crumbly sheety lava. Piece of large fragmented near-vent spatter. Iridescent sheen. Folded. 20 cm irregular shape; mostly glass. Large vesicles. No obvious crystals. Between waypoints 1 & 2.	-15.34352	-174.22538	1953.4	2.8	181	2017-12-10	19:31:51	S99	65
S99-rock-03	S99-rock-03. From large mound of pillow with sediment at edge of flow on 2000m contour. Staining frothy 1cm glass on upper surface. No big crystals 15 cm. triangular wedge-shaped piece. Pillow surface and center. White specks on rock surface. Into bin #6. ~70m NE of waypoint 2.	-15.34467	-174.22586	1998.9	4.4	244	2017-12-10	19:59:31	S99	110
S99-rock-04	S99-rock-04. From broken up-swirly patterned sheety exterior of a pillow. Z=1975. Slab of more intact upper surface of pillow. 20cm with glass rind and some spongy gray interior. Near waypoint 2.	-15.34476	-174.22639	1973.8	1.6	272	2017-12-10	20:11:22	S99	130
S99-rock-05	S99-rock-05. Pillow crust from the base of a pillow. Lots of yellow alteration on gray-ish center with vesicles. Pie shaped with hole in top. 15-20 cm long. Some iron staining. Frothy interior. Into partition 7. Near waypoint 2.	-15.34482	-174.22664	1970.2	1.9	214	2017-12-10	20:22:52	S99	142
S99-rock-06	S99-rock-06. Pillow rind from lobate-looking pillow with white staining in its cracks. Chris fix: 15.346311 174.226760. Slab is pie shaped. Slabby top of pillow. 25+ cm length. Glassy rind. vesicular 2-toned grayish and lighter banded interior. Near waypoint 3.	-15.34635	-174.22672	1965.4	1.5	184	2017-12-10	20:45:12	S99	172
S99-rock-07	S99-rock-07. Orange flocculant material on this rumbly-looking rock in area of vent biota on slope (scoria). 15 cm angularly broken pillow fragment. Glass crust. Slightly vesicular. Between waypoints 3 & 4.	-15.34760	-174.22730	1932.2	1.3	186	2017-12-10	21:00:16	S99	211
S99-rock-08	S99-rock-08 Sample of top crust from a lobate pillow. 5x5cm vesicular. Half glass half groundmass and frothy. Aphyric or close to it. Piece 2 & 3also in Biobox 2 about same size. Looks like maybe rare small hydroids on outer surface. Location: 15.3480407 174.2273816 depth 1912m. Between waypoints 3 & 4.	-15.34791	-174.22751	1912.5	1.4	242	2017-12-10	21:17:49	S99	221
S99-sed-09	S99-sed-09. Scoop of sediment deposited on top of lobate pillows in flattened flow. 15.3488458 174.2278238 depth 1892m.	-15.34885	-174.22782	1892.7	0.9	141	2017-12-10	21:37:58	S99	227

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S99-rock-10	S99-rock-10. Crust from a hollowed out pillow. 3-4 cm on a side almost 10 cm on long axis. Lot of glass. First piece was small and fragile. Nav fix - 15.349475 -174.228162. Two more pieces gotten on a second grab. All went into biobox bin 3. Broke up a lot going into bin. From flatter ridge near waypoint 4.	-15.34949	-174.22814	1849.4	1.3	195	2017-12-10	22:01:47	S99	236
S99-rock-11	S99-rock-11. Suction of filaments of spun glass from interior of inflated and drained pillow off steep slope ridge face. ~200m SW of waypoint 4.	-15.35103	-174.22874	1830.2	6.0	270	2017-12-10	22:29:47	S99	252
S99-rock-12	S99-rock-12. From lava pillows/tubes on near vertical wall. Sample of pillow tube detachment end. Lava Britney Spear. Surface hydroids and lots of vesicular glass around groundmass core. Roughly 35x10cm before breaking. Three pieces. Between waypoints 4 & 5.	-15.35162	-174.22940	1808.7	1.0	204	2017-12-10	22:53:54	S99	259
S99-rock-13	S99-rock-13. Going for the tip of a pillow "toe". Big drainout pillow to the right and left. Vesicles Green olivine crystals. Nice glass rind on all surfaces but broken one. 15x15 circular bud. Some staining on the interior. ~150m SW of waypoint 5 .	-15.35504	-174.23091	1763.4	2.6	214	2017-12-10	23:39:52	S99	321
S99-rock-14	S99-rock-14. Rind of pillow tube. Olivine crystals visible. Vesicular; Glass exterior. Glat. 30 cm long 15 cm wide. Less than midway from waypoint 5 to 6.	-15.35669	-174.23176	1701.2	0.0	284	2017-12-11	00:14:31	S99	347
S99-sed-15	S99-sed-15. Sediment sample in this dark coarse volcanoclastic seds from flatter surface after moving up ridge. Black shiny - some very large grains. Z=1675. Nav fix: 15.357470 174.232244. Midway between waypoints 5 & 6.	-15.35744	-174.23245	1674.2	0.0	212	2017-12-11	00:42:54	S99	382
S99-fluid-16	S99-fluid-16. Major #3. Sample fluids above small patch of sulfur and filamentous (long hairy) mat. A few animals sparsely scattered about. Nav fix: 15.357548 174.232277 Z=1671. Fired at 0102:50. Done at 0104:50. From diffuse venting near vertical cliff at "Cliff Could Have Been a Contender" site.	-15.35755	-174.23228	1676.1	0.0	162	2017-12-11	01:03:13	S99	401
S99-bio-17	S99-bio-17. Suction 3 shrimp; 1 squat lobster; 1 small whelk; 1 scale worm; and Sulfur mat. Same location as fluid-16.	-15.35755	-174.23228	1675.8	3.4	177	2017-12-11	01:22:23	S99	407
S99-rock-18	S99-rock-18. Ropy sheet flow crust. Crumbly. Shiny surface. Skinny piece. 20 cm x 5 cm. Long skinny glassy shiny; aphyric. 15.358883 174.233083. From north of step-steep slope ~150m NE of waypoint 6.	-15.35888	-174.23308	1684.1	0.0	213	2017-12-11	01:39:34	S99	430

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S99-bio-19	S99-bio-19. Sample of Chrysogorgia with a squat lobster on old lava just after new lava contact. Broke the top off of it. Have the squat lobster too. Chris fix: 15.360397 174.2340815 Z=1642m	-15.36036	-174.23415	1641.9	1.3	102	2017-12-11	02:07:08	S99	472
S99-rock-20	S99-rock-20. Rind of pillow that is hollowed out. Fragile - oxidized. 15 cm crumbly narrow rind. Glassy? Older flow - don't know what year. Z=1625 Chris fix: 15.3604403 174.2336205	-15.36047	-174.23365	1620.5	2.9	215	2017-12-11	02:25:15	S99	484
S99-rock-21	S99-rock-21. Chunk of frothy glass from young-looking lava flow after traverse over older flow. Covered in hydroids. 15x15cm platy like Wisconsin. Location: 15.3636708 174.2365880 depth 1490m. Between waypoints 6 & 7.	-15.36366	-174.23652	1490.5	3.5	269	2017-12-11	03:05:27	S99	538
S99-fluid-22	S99-fluid-22. Fluid sample at very microbial outcrop along ridge with diffuse flow and Tmax=5C.	-15.36541	-174.23782	1423.2	1.7	231	2017-12-11	03:40:27	S99	565
S99-fluid-23	S99-fluid-23. Niskin sample over this hydrothermal active jumbly lava. Shimmering water along ridge. Altitude 3m over flows.	-15.36509	-174.23771	1419.2	2.3	237	2017-12-11	03:46:41	S99	569
S99-fluid-24	S99-fluid-24. Another Niskin in same place as first niskin.	-15.36509	-174.23771	1419.3	2.4	239	2017-12-11	03:47:18	S99	570
S99-sed-25	S99-sed-25. Scoop #2: volcanoclastic sediments - Black shiny sed. A bit more coherent upper crust lighter(?). Z=1379. Chris fix:15.36689237 174.2389108. Just before crest of summit at waypoint 8.	-15.36678	-174.23896	1378.7	0.9	162	2017-12-11	04:16:08	S99	596
S99-rock-26	S99-rock-26. Piece of pillow covered in yellow bacterial floc outer coating. The rock is fresh and black inside. Dome-shaped black and vesicular rock. 10cm. Piece 2: Looks fresh inside. 20 cm with iron cm. Grey frothy bubbly stuff near margins. Black inside. Same location as sed-25.	-15.36678	-174.23896	1378.4	0.9	129	2017-12-11	04:19:08	S99	597
S99-gas-27	This sample was tripped during stowage of Rock-12. Using that location information. This sample was accidental. It will be processed. Gastight 17 white.	-15.35162	-174.22940	1034.5	0.0	210	2017-12-11	04:43:01	S99	606
S100-rock-01	S100-sed-100. Stirred up yellow sed on slope. Exterior piece with interior included. Very Vesicular and crystal rich. Altered rind. Black glassy rind. Black interior. 25 cm x 20 cm. Brown/black staining on exterior. 15.012884 173.780081. Z=2387m.	-15.01288	-173.78008	2387.4	2.3	167	2017-12-11	19:04:22	S100	42

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S100-rock-02	S100-rock-02. Massive old pillow. Edge piece. Very vesicular. Large pillow rind. Vesicles are elongate and over 1cm. 7x5 cm wide. Into partition 6. Nice interior of pillow. Light brown/orange sediment. Very large crystals of green pyroxene. Navigator fix very uncertain: 15.0130130 173.7800763	-15.01301	-173.78008	2354.2	0.0	177	2017-12-11	19:25:23	S100	58
S100-rock-03	S100-rock-03. Pillow toe-like off cracked tube. Preserved interior. Orange staining on exterior.. Crystal rich with fresh interior. 30 cm long. Angular vesicular. Upslope ~15m from rock-02. Navigators best guess (no nav): 15.0131041 173.7800765.	-15.01310	-173.78008	2340.8	1.7	143	2017-12-11	19:36:54	S100	64
S100-rock-04	S100-rock-04. Piece of shelly-old-in place pillow. Glassy exterior. Smaller vesicles. Orange sed staining. 4cm across angular. Little glass rind. Crystals not visible. 2nd piece. Somewhat fresh interior. Preserved glassy exterior. Large wedge-shaped fragment of pillow. MnO coating on interior. 30x25cm. Upper surface of glass. Nav guesstimate: 15.0133684 173.7799255.	-15.01337	-173.77993	2327.9	4.5	135	2017-12-11	19:48:06	S100	76
S100-rock-05	S100-rock-05. Slabby pillow top (elongate pillow tube piece) on slope. All the exterior glass intact. 30 cm long. Smaller vesicles. Navigators best guess (no nav): 15.0136037 173.7798252.	-15.01360	-173.77983	2267.0	3.3	141	2017-12-11	20:12:01	S100	104
S100-rock-06	S100-rock-06. Piece of elongate pillow. Nice glassy rind. Less vesicular - small bubbles. Some crystals - less than others. 20 cm x 15 cm. Narrow wedge shape. ~18m upslope from previous sample and 12m apart in elevation. NAVIGATOR BEST GUESS: 15.0140592 173.7795558.	-15.01430	-173.77956	2252.3	7.2	144	2017-12-11	20:20:33	S100	111
S100-sed-07	S100-sed-07. From heavily sedimented plain. Light-sandy brown- sediments here. Scoop bag#2. Light brown/ orangish seds - coarser upper surface and buff colored underneath.	-15.01483	-173.77991	2254.9	0.0	126	2017-12-11	20:29:27	S100	121
S100-rock-08	S100-rock-08. From sharp boundary area of talus and in-place pillows. Piece of pillow with fresh glass rind and some orange surface staining. No hydroids made it. 5x7cm.	-15.01320	-173.78126	2380.2	1.4	308	2017-12-11	21:24:24	S100	171
S100-sulfide-09	From large chimney graveyard (after found active smokers nearby). Piece of chimney spire. Aiming for the top - hovering grab. 5x10cm orange with white filaments. From top of ~7m tall chimney. 15.0163547 173.7867155 depth 2348m "The Amphitheatre".	-15.01635	-173.78672	2346.7	7.2	135	2017-12-11	22:27:37	S100	213

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S100-bio-10	S100-bio-10. In area of tall black smokers. Right next to black smoker orifice: Suction chamber 5. 4 Shrimp (look like Opaepele) - some are really tiny; Snails (Ifremeria). Lau-FlatTop site at 5m off bottom.	-15.01668	-173.78693	2334.7	6.5	117	2017-12-11	23:22:29	S100	231
S100-bio-11	S100-bio-11. Mussels from the top of the flat chimney. Into biobox 2. Covered in little limpets probably. Same location.	-15.01668	-173.78693	2334.7	6.5	117	2017-12-11	23:24:44	S100	233
S100-gas-12	S100-gas-12. Gastight #16 orange. 327C black smoker gaping orifice. Looks like it's good and deep in the flow. Fired 2346:55. 15.0166822 173.786930 Z=2339 at base and 2335 at sampling site orifice. 327 C.	-15.01668	-173.78693	2334.8	4.3	119	2017-12-11	23:47:07	S100	243
S100-fluid-13	S100-fluid-13. Major sampler #3 in same huge orifice at Lau-FlatTop. Fired at ? It's filling now. 0001:05 finished.	-15.01668	-173.78693	2334.9	4.2	119	2017-12-12	00:01:16	S100	246
S100-bio-14	S100-bio-14. Grab of stalked barnacles. Got some sulfide as well - not exactly the sampling site; but to the left of it. Hdg=119	-15.01668	-173.78693	2334.9	3.4	119	2017-12-12	00:09:19	S100	255
S100-sulfide-15	S100-sulfide-15. Grab of sulfide when sampling stalked barnacles on chimney to the left of sampling orifice. Must be warm because lots of vent animals were living on it.	-15.01668	-173.78693	2334.9	6.0	111	2017-12-12	00:10:33	S100	257
S100-sulfide-16	S100-sulfide-16. Sulfide piece from very near the black smoker orifice. Beautiful piece. Outer piece of large sulfide probably chalcopyrite and anhydrite minerals. 15 - 20 cm across.	-15.01668	-173.78693	2335.0	4.4	119	2017-12-12	00:14:52	S100	259
S100-sulfide-17	S100-sulfide-17. Grabbed sulfide chimney spirt. It's white coating - pointed on top. 5 cm high - only half the piece is there. 2nd grab. The top piece of sulfide in the center. Nice flow zones. Chalcopyrite. Circular piece 2 cm. Nice little piece of sulfide with sparkly chalcopyrite interior. Into biobox 1. Voodoo Child little sulfide. 15.0167948 173.786947. Z=2340.	-15.01679	-173.78695	2340.0	0.0	108	2017-12-12	01:16:00	S100	338
S100-gas-18	S100-gas-18. Yellow gastight #6. Using both arms to right the sampler in the claw. Large black smoker flow at Voodoo Child. Temp measured at 322decC.	-15.01679	-173.78695	2340.0	1.6	108	2017-12-12	01:42:10	S100	348
S100-fluid-19	S100-fluid-19. Major sampler #2/ Fluid sample in same orifice as gas sample (and sulfide too) Voodoo Child little sulfide chimney. Z=322C. Fired 0203:32. End at 0204:25.	-15.01679	-173.78695	2340.0	1.9	101	2017-12-12	02:02:15	S100	359

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S100-bio-20	SS100-bio-20. Suction into canister #6. 3 Opaepele shrimp (including ones covered in black sulfide); Polynoid. Barnacles. At Voodoo Child.	-15.01679	-173.78695	2340.0	2.4	100	2017-12-12	02:12:18	S100	365
S100-sulfide-21	S100-sulfide-21. Large chunk of active sulfide taken from top of Big Smoke 35 cm. Chalcopyrite circular area. From Big Smoke. 15.0167531 S `73.7859689 Z=2330 at seafloor.	-15.01675	-173.78597	2318.0	0.0	343	2017-12-12	02:39:09	S100	382
S100-gas-22	S100-gas-22. GT#2 green fired at 0245:43. Looks like a good sample. Directly in the venting orifice at the top of Big Smoke.	-15.01675	-173.78597	2318.0	6.7	343	2017-12-12	02:46:29	S100	387
S100-fluid-23	S100-fluid-23. Major sampler #1. Fluid sample in the same black smoker hole as gastight; and Chris's sulfide sample. 0254:29	-15.01675	-173.78597	2318.0	7.3	342	2017-12-12	02:55:10	S100	393
S100-bio-24	S100-bio-24. Suction Shrimp (5). Probably mixed in with other bio sample to be figured out later	-15.01675	-173.78597	2317.9	7.2	343	2017-12-12	03:16:17	S100	398
S100-bio-25	S100-bio-25. Scale worms and some sulfur worms from same location/vent as sample 24. Got two snails - Alviniconcha.	-15.01675	-173.78597	2317.9	7.1	343	2017-12-12	03:23:15	S100	399
S100-sulfide-26	S100-sulfide-26. Large shiny piece of sulfide 10 - 15 cm part of second chimney vent at Big Smoke top. Massive chunk of pyrite. Went into the forward stbd part of gastight container.	-15.01675	-173.78597	2318.0	7.2	342	2017-12-12	03:26:23	S100	402
S100-fluid-27	S100-fluid-27. Aft Niskin in the smoke. We're at 2318 right now. Fired at 2315.6 m at Big Smoke.	-15.01675	-173.78597	2315.4	14.1	90	2017-12-12	03:32:41	S100	405
S100-fluid-28	S100-fluid-28. Forward Niskin fired at 2309 m. In the plume over Big Smoke.	-15.01675	-173.78597	2309.9	19.0	76	2017-12-12	03:33:36	S100	406
S101-rock-01	S101-rock-01. Grab 1: 2 pieces Drained out pillow - piece up upper crust. Black glass under upper sed layer. Lots of big crystals. 3 cm slightly vesicular. Glassy rind. 2nd piece: pillow rind. Very crystal rich. 10 cm x 6 cm across. 1 cm glass rind. Orange/brown staining on underside. Not too vesicular. Into partition 5. Near on bottom site with no biota.	-14.94620	-173.80036	2668.8	0.8	50	2017-12-12	22:20:13	S101	29
S101-rock-02	S101-rock-02. Ornamental toe of pillow just above small slope break where pillow morphology changed. Orange FeO stains on exterior with very fresh interior. Spongy and phytic. 10x15cm toe.	-14.94583	-173.79907	2639.4	1.4	27	2017-12-12	22:36:17	S101	41
S101-sed-03	S101-sed-03. Scoop of volcanoclastic sediment off the top of a pillow. Coarse black sed with some tan fines. Location 14.945588 173.799012 depth 2629m.	-14.94559	-173.79901	2629.1	1.0	59	2017-12-12	22:50:18	S101	46

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S101-rock-04	S101-rock-04. Grab of drained pillow crust from the same flow that has a tall coral attached to it. Rock is very frothy and phyr. Fe surface staining. 5x10x10cm with large light pyx. (Nav bad).	-14.94561	-173.79882	2626.0	0.0	38	2017-12-12	22:57:24	S101	49
S101-rock-05	S101-rock-05. Vesicular phyr. rock with some Fe and Mn surface staining. Frothy and irregular vesicle shape. Olivine and cpx including in rind. 14.944879 173.798626 depth 2601m.	-14.94501	-173.79875	2601.6	0.0	31	2017-12-12	23:14:43	S101	61
S101-rock-06	S101-rock-06. Sample of a bulbous striated pillow with hollow interior. Super bubbly with drips on the bottom. Fe stains all over and some sediment on top. 35x20cm.	-14.94390	-173.79837	2587.6	0.0	359	2017-12-12	23:41:00	S101	75
S101-sed-07	S101-sed-07. Scoop of sediment from talus slope. Signs of hydrothermal activity (orange patches) with coarser sediment.. Location: 14.943123 173.798675 depth 2550m.	-14.94295	-173.79869	2539.1	2.3	360	2017-12-13	0:09:55	S101	88
S101-rock-08	S101-rock-08. Pillow piece. Top of small pillow. Probably came off of piece directly above it. 1st piece is circular with small vesicles. Some crystals. Very little glass. 3-5 cm - roundish. Gray interior. Large white crystals angular. Green pyroxene(?) crystals. Large vesicles. 15 cm. Thick glassy rind. The white crystals are probably orthopyroxene.	-14.94012	-173.79537	2524.8	1.2	103	2017-12-13	1:19:50	S101	144
S101-sed-09	S101-sed-09. Scoop bag #2. Sed has orangish/yellow coating (hydrothermal). Mottled brown/blackish at surface. Black sparkly seds - volcanoclastic. Navigator fix (bad): Z=2513 m. 15.016742 173.787618.	-14.94049	-173.79395	2512.9	5.5	56	2017-12-13	1:42:06	S101	168
S101-rock-10	S101-rock-10. At the edge of satellite cone summit SE of summit. Long in place pillow lava - outer crust. Nice glass surface. White crystals. Small vesicles. Cow-shaped. 10 cm long 6 cm across. Into biobox 2. Glass rind on 2+ sides.	-14.93953	-173.79347	2464.7	0.8	32	2017-12-13	1:58:11	S101	201
	CORRECTION FOR SAMPLE-9 (Sed-9): 14.9393662 173.7947334.	-14.93958	-173.79307	2463.2	2.2	32	2017-12-13	2:01:23		204
S101-rock-11	S101-rock-11. From slope with in-place pillows. Pillow bud-like piece. - got half of it. Some white staining below the glass. Vesicles and some white crystal. Manganese coating. Grayish interior. 35 cm long. Filled up partition 9. Close to WP9 . Z=2485 m Nav fix: 14.9384109 173.7940416.	-14.93843	-173.79404	2485.7	0.9	353	2017-12-13	2:23:03	S101	235

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S101-rock-12	S101-rock-12. Half way between WP10 & 11. Rind of large pillow with cracked collapsed top. Z=2455 m. Wedge of crust. 25 cm long - 7 cm wide. 5 cm high. Black glassy crust. Very vesicular Some white crystals. 14.9382468 173.7965702.	-14.93831	-173.79585	2454.8	2.5	242	2017-12-13	2:40:25	S101	256
S101-rock-13	S101-rock-13. From east side of summit ridge. Drained out; worn out; seen its better days; piece of pillow crust! Gaseous big vesicles. Mostly outer edge or some interior as well. Don't see any glass. 2 pieces: 10x5cm and 8x5cm pieces. SW of waypoint 13.	-14.94015	-173.79818	2362.7	1.7	245	2017-12-13	3:06:20	S101	282
S101-rock-14	S101-rock-14. Grab from more tube-like lava behind the previous pillow sample (rock-13). 5x5 cm piece. glassy pillow rind. ~0.5 m behind rock-13. Z=2363 m. 14.9400886 173.7989411	-14.94020	-173.79833	2357.9	2.2	250	2017-12-13	3:13:49	S101	284
S101-gas-15	S101-gas-15. Sample from 299C smoker vent. Giant Beehive Chimney at summit. 14.9405783 173.7995584 depth 2360m. SW of waypoint 14.	-14.94058	-173.79956	2362.1	6.2	316	2017-12-13	4:01:10	S101	360
S101-fluid-16	S101-fluid-16. Water sample from 299C vent. Location: 14.9405783 173.7995584 depth 2360m.	-14.94058	-173.79956	2362.8	4.6	356	2017-12-13	4:17:01	S101	362
S101-sulfide-17	S101-sulfide-17. Sample of sulfide from the 299C vent. Location: 14.9405783 173.7995584 depth 2360m.	-14.94058	-173.79956	2362.8	4.9	359	2017-12-13	4:20:54	S101	364
S101-bio-18	S101-bio-18. Snail in front basket at same location on Giant Beehive Chimney. Crab and snails. Location: 14.9405783 173.7995584 depth 2360m.	-14.94058	-173.79956	2360.0	8.9	11	2017-12-13	4:31:03	S101	365
S101-sulfide-19	S101-sulfide-19. Scoop of sulfide fragments from 299C vent. Location: 14.9405783 173.7995584 depth 2360m.	-14.94058	-173.79956	2361.8	7.1	354	2017-12-13	4:39:00	S101	366
S101-fluid-20	S101-fluid-20. Niskin of smoky water at ~12m altitude at Giant Beehive.	-14.94058	-173.79956	2354.9	13.7	345	2017-12-13	4:42:19	S101	367
S101-fluid-21	S101-fluid-21. Fore Niskin fired at 2355m depth.	-14.94058	-173.79956	2352.8	19.5	343	2017-12-13	4:42:52	S101	368
S102-rock-01	S102-rock-01. Piece of pillow tube - nub at the end. Sedimented. Glass on a couple sides. Manganese/iron staining. Vesicular. Don't see white minerals. Fresh interior. 30x15cm. Into partition 9. ~70m W of waypoint 1.	-14.94401	-173.80920	2680.8	1.2	117	2017-12-13	19:12:32	S102	27
S102-sed-02	S102-sed-02. Scoop bag number 2. Scoop of volcanoclastic seds/sand from flat-ish seafloor. Very coarse black sand. Clumpy-ish gray seds as well. Z=2689m 14.9435140 173.8078919.	-14.94328	-173.80812	2689.2	0.0	32	2017-12-13	19:27:59	S102	45

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S102-rock-03	S102-rock-03. Outer crust of pillow tube near top of local high. Fragile/crumbly. Some vesicles. Small olivine crystals (?). Glass on lower corner? 10x10 cm piece. 1st piece is wedge-shaped and may be mostly interior. Z=2704m. 2nd piece: More exterior glass on this one. Ridges. 10ish cm fragment. Into partition 5.	-14.94314	-173.80792	2704.4	0.8	119	2017-12-13	19:47:57	S102	60
S102-rock-04	S102-rock-04. Intact pillow (not disgorged or collapsed) with a little barnacle and whip coral on top. Bubbly. 1 face glass - thick rind 1cm . Olivine and pyroxene crystals. 6cm longest dimension. Into quad 6. 2nd grab: Pyroxene megacryst - Some glass 5cm across. Vesicular. From pillow at edge of fissure. Z=2689m. 14.9432518 173.8070277	-14.94285	-173.80763	2688.9	0.7	158	2017-12-13	20:20:07	S102	111
S102-rock-05	S102-rock-05. Pillow toe from pillow tube. Huge. Broken face view - not seeing big white crystals. Rounded and elongate 25+ cm Glass all around; vesicular; very close to rock-04 but on different lava unit.	-14.94267	-173.80747	2675.6	5.3	64	2017-12-13	20:42:45	S102	122
S102-rock-06	S102-rock-06. Chunk of pillow lava from an intact flow somewhere on the approach to waypoint 2. Shaped like a slice of Chicago deep dish. 25x15cm; Fe and Mn coats; vesicular. Location 14.9412878 173.8051033 depth 2561m.	-14.94136	-173.80485	2563.6	10.9	56	2017-12-13	21:12:03	S102	160
S102-sed-07	S102-sed-07. Sed scoop. Came across relatively flat spot with a lot of sediment covering some volcanic spatter. Near-vent and in the area of what is interpreted as a small cone on the map. Fines are very sticky on the canvas; probably finer overall grain size distribution.	-14.94132	-173.80419	2577.8	0.4	69	2017-12-13	21:21:13	S102	165
S102-rock-08	S102-rock-08. Piece of jumbly lava; 3x7cm crusty bit with glass rind. Very cloudy water.	-14.94179	-173.80448	2583.5	3.5	130	2017-12-13	21:40:14	S102	177
S102-rock-09	S102-rock-09. Grab of top crust from an inflated pillow on a local high in the vicinity of waypoint 2-3. Glassy face. Pie shaped. Vesicular. Not too many crystals. Olivines and pyroxenes. 15 cm long.	-14.94167	-173.80394	2521.0	1.3	9	2017-12-13	22:00:29	S102	189
S102-rock-10	S102-rock-10. 5x7cm chunk of outer pillow lava crust. Pretty vesicular and some Fe and Mn coating. In place rock with flows having fair amount of sediment. Maybe near waypoint 7.	-14.94141	-173.80214	2464.6	0.0	299	2017-12-13	22:40:31	S102	234

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S102-rock-11	S102-rock-12. Piece of intact (at least sort of) pillow lobe. This is a big rock - not huge. Vesicular. Manganese on 1 side. Wedge shaped piece of a pillow. Good glass on a layer at least. Area with sheet-like on one side and lobate pillows to the other. Near waypoint 17. Z=2433m. 15x10 cm. 14.9392458 173.79900867 (bad pos).	-14.93892	-173.80030	2427.7	0.0	129	2017-12-13	23:52:17	S102	288
S102-fluid-12	S102-fluid-12. Major #3 in crack area of 12.3C water. Fired at 0109:12. Done 0110:25. Snanemone Garden: Z=2358 m 14.940412 173.799667. Snanemone Garden Site: large area of diffuse flow.	-14.94041	-173.79967	2357.5	0.9	148	2017-12-14	01:12:43	S102	378
S102-bio-13	S102-bio-13. Scoop bag #4 for biology: 4+ Ifremeria snails (big guys). Placed behind major box. Snanemone Garden.	-14.94041	-173.79967	2357.6	0.9	148	2017-12-14	01:17:41	S102	382
S102-bio-14	S102-bio-14. Suction jar#8. Pretty large pink anemones that were attached to a rock. Got 3 or 4 of them. Snanemone Garden	-14.94041	-173.79967	2357.7	0.8	148	2017-12-14	01:24:11	S102	384
S102-gas-15	S102-gas-15. Gastight #6 - yellow. Fired at 0201:12. Saw the poof when they depressed the ram. 238degC flow gray-smoker orifice. Rock Star is: 173.799375 W 14.940536 S. Z=-2361 at the seafloor. ~25m W of previous samples (?). Samples taken at ~7 m up the chimney at 2354 m. Tmax=238C.	-14.94054	-173.79938	2353.7	7.9	240	2017-12-14	02:01:35	S102	405
S102-fluid-16	S102-fluid-16. Major sampler #2. Same orifice position; etc. as gastight. Fired at 0217:17. Finished at 0218:30. Rock Star.	-14.94054	-173.79938	2353.7	7.8	240	2017-12-14	02:18:41	S102	411
S102-sulfide-17	S102-sulfide-17. Sulfide spire from active beehive. Flow hole in the center. Chalcopyrite? Narrow chimney spire. Taken right next to gas and fluid sampling site. The next spigot over. Placed in biobox 2.	-14.94054	-173.79938	2353.7	7.6	260	2017-12-14	02:24:45	S102	416
S102-bio-18	S102-bio-18. Suction into chamber 1: Huge Ifremeria snails (They are larger than the brachyuran crabs) brachyuran crabs; 1 snail - could be the hairy variety (going in biobox 2). Rock Star facing SW-different heading than previous samples.	-14.94054	-173.79938	2351.2	9.6	261	2017-12-14	02:34:48	S102	421
S102-fluid-19	S102-fluid-19. Major #3. Sampling while hovering over Bodacious Booming Beehive (B3-also from Dive S101 Giant Beehive). Fired. We think it's probably over 300C. (Location was just below Rock Star).	-14.94058	-173.79956	2357.5	11.8	335	2017-12-14	02:57:16	S102	435
S102-gas-20	S102-gas-20. Sample of smoker gases from top of B3.	-14.94058	-173.79956	2358.6	10.3	299	2017-12-14	03:08:54	S102	438

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S102-bio-21	S102-bio-21. Suction of 10 shrimp from Shrimp Township at the base of upper beehives at B3.	-14.94058	-173.79956	2360.2	9.0	339	2017-12-14	03:25:12	S102	440
S102-sulfide-22	S102-sulfide-22. Fragment of a rather large chimney sample from B3.	-14.94058	-173.79956	2360.9	5.6	316	2017-12-14	03:32:36	S102	442
S102-fluid-23	S102-fluid-23. Water sample from smoker vent about halfway up the B3 chimney structure. 2362.7m. (Major ????)	-14.94058	-173.79956	2362.2	6.6	323	2017-12-14	03:44:43	S102	443
S102-fluid-24	S102-fluid-24. Sample from the same hydrothermal vent as S102-fluid-23. (Major ??)	-14.94058	-173.79956	2362.3	6.2	325	2017-12-14	03:55:19	S102	444
S102-sulfide-25	S102-sulfide-25. Most of the rest of the whole chimlet we pulled off earlier as S102-sulfide-22 on B3.	-14.94058	-173.79956	2366.1	1.4	346	2017-12-14	04:05:17	S102	445
S103-rock-01	S103-rock-01. New pillow lava crust from landing site at WP1. Fresh shiny glass. Large phenocrysts. Very vesicular. 2016-2017 flow. Z=1596. 2 5x5cm pieces. Into biobox 1. Z=1596. 15.088296 173.737241.	-15.08830	-173.73724	1596.3	0.0	283	2017-12-14	18:31:10	S103	27
S103-sed-02	S103-sed-02. Push core 3. Coarse grained volcanoclastic sed. Nothing pelagic. Black shiny coarse. Tube is ~1/3 full. Same location.	-15.08830	-173.73724	1596.2	1.3	284	2017-12-14	18:35:37	S103	30
S103-bio-03	S103-bio-03. Suction of 2 small white scale worm; orange floc (some white floc too) ; black fresh volcanoclastic sand. The orange mat is really coherent. 15.088127 173.737943 Z=1589. T=4.69 C. (High temp was 4.98degC.) ~20m SE of waypoint 2.	-15.08813	-173.73794	1589.4	0.0	292	2017-12-14	18:59:33	S103	59
S103-rock-04	S103-rock-04. Frothy deposit - areas of glass - jumbled pattern. Grabbing pillow piece. Unstable. Black and glassy where the piece fell. Near-vent deposit from prior eruption. Older Rock. Piece has some orange coating. Nice black glass surface on 2 sides. Crystals some small 10 cm long. Not very vesicular. Z=1577. 15.087994 173.738276. Into partition 5. ~25m NW of waypoint 2.	-15.08794	-173.73830	1577.1	2.2	233	2017-12-14	19:19:51	S103	88
S103-rock-05	S103-rock-05. Piece of young frothy pillow "tongue" exgorged lava. Crystal-rich boninite. Fragile sheet that broke off the disgorged end. 1st piece. Glassy. Abundant crystals. 3 cm. Young fresh fragile frothy glass-sampled out of pillow tongue. 2nd piece: Ropey piece of lava just beneath piece 1. Glassy fresh phenocryst rich. 15.0884054 173.7380671	-15.08852	-173.73835	1578.2	4.4	234	2017-12-14	19:40:36	S103	122

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S103-sed-06	S103-sed-06. Extremely coarse volcanic sed. Black and shiny. At crest of sand dune. Produced during 2016-2017 eruption. Z=1570. 15.0884115 173.7382234.	-15.08843	-173.73833	1570.2	0.0	234	2017-12-14	20:00:07	S103	140
S103-rock-07	S103-rock-07. Bulbous pillow with disgorged end and twisty-looking toe on top. Grabbing piece near the toe. Fresh crystal-rich glassy. Large crystals. Vesicles. Thick glassy rind (cm's). Grayer material. Circular-ish shape. 20 cm long From next step up from sed-06 site. Placed in partition 8. 15.088600 173.738616. Z=1558m. ~20m E of waypoint 4.	-15.08861	-173.73862	1557.5	2.0	259	2017-12-14	20:10:34	S103	158
S103-sed-08	S103-sed-08. Scoop bag 3. Coarse spattery-like seds / small rock fragments / some yellow floc. More coherent rock as well. From gentle slope. Coarse. Fresh-glassy. Near vent deposit including spatter? 15.0891313 173.7388080. Between waypoint 4 & 5.	-15.08912	-173.73882	1530.5	0.9	209	2017-12-14	20:30:47	S103	182
S103-bio-09	S103-bio-09. Suction chamber 4: 3 Opaepele shrimp; 10+ polynoids. From 3m tall Spatter Mound in a crack-former eruptive vent site. 15.089261 173.738921 Z=1520. Tmax=4.69degC. ~30m N of waypoint 5.	-15.08923	-173.73887	1519.9	2.8	214	2017-12-14	20:59:38	S103	216
S103-fluid-10	S103-fluid-10. Aft Niskin taken from the side of this Spatter Mound (actually ~10m tall). Some location as sample 9.	-15.08923	-173.73887	1517.2	4.8	225	2017-12-14	21:02:28	S103	220
S103-rock-11	S103-rock-11. Crust of fairly large drained pillow tube we found at the sediment/slope contact at waypoint 6. 15x25cm irregular chunk with Some Mn/Fe/S alteration patches. 15.0892060 173.7399760 depth 1515m. Just E of waypoint 6.	-15.08921	-173.73981	1516.3	2.5	225	2017-12-14	21:20:47	S103	233
S103-rock-12	S103-rock-12. Narrow pillow tubes. 10x10cm pie slice of face-melting vesicular and very phyric with thick glass rind. Minimal secondary coating; looks extremely fresh. 15.0198835 173.7399095 depth 1518m. Near waypoint 7.	-15.08988	-173.73990	1518.8	1.0	125	2017-12-14	21:35:35	S103	241
S103-rock-13	S103-rock-13. Piece of jumbly spatter just short of waypoint 8. Phyric and very glassy. Vesicular and fragile. Location 15.0897957 173.7408626 depth 1474m. 15x25cm. (Not sure if new or old flow)	-15.08980	-173.74088	1474.2	1.0	289	2017-12-14	21:52:39	S103	253

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S103-sed-14	S103-sed-14. Scoop bag 1. Surficial sediments here near the axis of the east rift zone (just to the north of it). Lighter brown surficial sed with black patches. Z=1458m. Blacker sed under the lighter surface. 15.089246 173.741753. Sampling just the upper surface.(2/3 distance between waypoint 8 & 9)	-15.08919	-173.74172	1457.5	1.9	234	2017-12-14	22:13:49	S103	298
S103-rock-15	S103-rock-15. Pillow lava piece from steep slope - pillow pile. Nice glass surface. 30x15x10 cm. Some staining and large vesicles. Lots of crystals. Spongy pillow interior. ~45m from waypoint 11 to 12.	-15.08809	-173.74369	1502.9	3.2	150	2017-12-14	23:39:40	S103	345
S103-rock-16	S103-rock-16. Drained out pillow. Rind with thick glass rind on 3 sides ~1 cm. . Spongy grayish center. Crystals and vesicles. 15 cm on long axis 10 on short axis. From step/terrace level of this slope section. Just past waypoint 12.	-15.08891	-173.74399	1450.2	1.5	245	2017-12-15	00:00:52	S103	371
S103-rock-17	S103-rock-17. Piece of rind and come interior - pie wedge from large broken pillow. Yellow staining. Lots of crystals. gray interior. Glassy dark part 1 cm thick. 15x20 cm. Some large vesicles. Going into biobox 4. Z=1420 m. 15.0898648 173.7451580 near waypoint 14.	-15.08986	-173.74515	1419.4	0.5	174	2017-12-15	00:30:24	S103	413
S103-rock-18	S103-rock-18. Corner of the pillow rind from large broken pillow. Pie shaped. Thick class. Vesicles - 1cm thick crust. Gray center. 10 cm on narrower and 15 on longer side. Going into biobox 3. Z=1350. 15.0909443 173.7453364 Just before waypoint 15.	-15.09094	-173.74534	1349.4	0.8	165	2017-12-15	00:55:46	S103	439
S103-sed-19	S103-sed-19. Scoop bag 2. In area of lobate lavas with thick sed on the top. Sed color is lighter on top with black fresh volcanoclastic black sed underneath. The lighter sed on top also include hydrothermal mat on the top. Z=1350. 15.0910086 173.7453586. Storing it in the marker box. Near waypoint 15.	-15.09101	-173.74536	1349.2	0.9	162	2017-12-15	01:03:43	S103	446
	Sitting here at the base of a disgorged pillow. Going to grab a sample.	-15.09175	-173.74533	1320.9	1.1	175	2017-12-15	01:24:38		478
S103-rock-20	S103-rock-20. Delicate surface texture on this 2012-2016 lava. 20 long 5 to 10 cm wide. Large vesicles. Glassy rind. No visible crystals. Z=1321. 15.0917580 173.7453297 into partition 10.	-15.09175	-173.74533	1320.9	0.0	175	2017-12-15	01:28:00	S103	479

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S103-sed-21	S103-sed-21. New lava flow area (2012-2016) with thick sed that is light and black rippled with some yellow bacterial mat as well. At edge of contact in newer with microbial mats. NE of waypoint 16 (offset with Sentry map?)	-15.09211	-173.74505	1305.6	0.9	174	2017-12-15	01:40:59	S103	500
S103-rock-22	S103-rock-22. Good piece of bubbly vesicular rock Crystals in the rind and smaller crystals in the interior. Large void spaces. Z=1290. 15.0928442 173.7458779 35+ cm long 25 cm wide. Slipped on top of the scoop bags. Between waypoints 17 & 18.	-15.09286	-173.74586	1289.3	0.8	138	2017-12-15	02:14:00	S103	548
S103-bio-23	S103-bio-23. Suction jar 5. Alvinocaris ?(probably not); Opaepele; white scaleworm; pink scaleworm. Z=1289m 15.0931569 173.7457246. Newer lava. ~35m NNW of waypoint 18.	-15.09313	-173.74568	1289.1	1.6	171	2017-12-15	02:30:11	S103	558
S103-rock-24	S103-rock-24. Highest chunk of jumbly spatter from the top of Coneholio (waypoint 19) composed of narrow pillow tubes and spatter. 5x10cm glassy and phyrlic. Azimuthal vesicles. 15.0932943 173.7464016 depth 1276m.	-15.09332	-173.74634	1274.7	4.4	162	2017-12-15	02:58:07	S103	589
S103-fluid-25	S103-fluid-25. Major sampler #1 from 6C vent (ambient is 0.4degC warmer than previous 2 hours). Location: 15.093796 173.7462064 depth 1267.7m. From diffuse vent at the base of a pillow north of waypoint 20.	-15.09374	-173.74622	1267.7	1.2	37	2017-12-15	03:23:04	S103	602
S103-bio-26	S103-bio-26. Sample of Alvinocaris shrimp (1); Opele (5); and scale worm (1) from 6C vent. Location 15.093796 173.7462064 depth 1267.7m.	-15.09374	-173.74622	1267.7	1.1	33	2017-12-15	03:34:00	S103	603
S104-rock-01	S104-rock-01. Edge piece of flattish shelly pillow. Z=2352. orangish staining on exterior. Black interior - fine vesicles. Bubbly hole - glass on top. Small white crystals. 12 cm. Blocky. In quad 5. From older lavas upslope from landing site at waypoint 1 on satellite cone.	-15.03491	-173.77946	2351.4	0.0	221	2017-12-15	19:12:59	S104	40
S104-sed-02	S104-sed-02. Scoop bag #2. Area with 2-15cm thick sed. The volcanoclastics here are not dark black - quite a bit lighter in color (brown/gray ish). Light colored sand on surface. White circular granules (bio?) mixed with brown grains (very fine). Z=2352. Same location as sample 1. 15.0349054 173.7794550. Z=2355.	-15.03491	-173.77946	2351.9	0.0	226	2017-12-15	19:35:34	S104	49

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S104-rock-03	S104-rock-03. Jumbled sheet next to flat pillow lobe. Jumbled morphology. Taken from ropey jumbly spattery lump of lava. Cm-scale wavelength folds. Some glass. 10-15cm. Frothy magma. Into partition 6. 15.0354404 173.7796930. Between waypoint 1 & 2.	-15.03549	-173.77969	2388.7	0.8	3	2017-12-15	19:54:01	S104	70
S104-rock-04	S104-rock-04. Piece of jumbled from top of sheety lava (fluid-looking texture). 15.0361934 173.7812228. Crumbly. Frothy; small vesicles; some glass.~ 4 cmx1cm piece. 2nd grab: Fill flow interior White crystals some vesicles. Very altered. Irregular shape. 10cm in longest dimension. From base of northern slope heading to waypoint 3.	-15.03619	-173.78122	2381.6	1.7	193	2017-12-15	20:34:06	S104	109
S104-rock-05	S105-rock-05. Pillow (elongated) surrounded by thick sandy sediments. Z=2348m. Upper surface with come nice interior. Very vesicular with few crystals (aphyric?) . 10x7 cm. Orange staining on exterior. Location: 15.0365087 173.7829996 depth 2348m	-15.03587	-173.78290	2345.4	1.8	264	2017-12-15	21:10:07	S104	136
S104-rock-06	Slab of pillow crust. Heavily sedimented and drippy underside. Vesicular so that'll stay in it. 15x20cm Location 15.0364462 173.7838021 depth 2309m. Area of sediment and in-place pillows. ~40m NE of waypoint 4.	-15.03629	-173.78394	2309.3	1.1	264	2017-12-15	21:40:10	S104	149
S104-bio-07	Suction of Crangon shrimp. Same location.	-15.03629	-173.78394	2308.8	1.1	266	2017-12-15	21:43:49	S104	150
S104-rock-08	Jumbly frothy looking lava flow poking out of the sediment; crystal poor. vesicular. some glass ~half circular 10 cm. Location: z = 2260; 15.0378676; 173.7852540 Near waypoint 5.	-15.03765	-173.78526	2262.0	4.0	293	2017-12-15	22:11:12	S104	171
S104-sed-09	S104-sed-09. Coarse volcanic gravel sample. Z=2264. Scoop bag #1 Location: 15.0377795 173.7853838. (Same location as rock-08?)	-15.03765	-173.78526	2261.4	2.8	8	2017-12-15	22:22:20	S104	174
S104-rock-10	S104-rock-10. Piece of folded lava pillow. Very bubbly and full of fine sediment. 10x15cm.	-15.03734	-173.78625	2260.2	0.0	297	2017-12-15	22:37:31	S104	179
S104-rock-11	S105-rock-11. Pillow rind from weathered and sedimented pillow. 15 x 10 cm. From broken lava ridge while waiting for ship. 15.0388696. 173.7895640	-15.03811	-173.78889	2222.0	4.1	241	2017-12-15	23:24:08	S104	209
S104-rock-12	S104-rock-12. From large pillow with collapsed top (older in-place lavas). Highly oxidized - lots of secondary sediment filling the vesicles. Z=2238m. Lots of glass. 15x20cm. Manganese/iron coating. Angular. Into gastight box. 15.039232 173.789487	-15.03828	-173.78867	2238.3	0.0	216	2017-12-15	23:34:55	S104	217

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S104-sulfide-13	S104-sulfide-13. Sulfide spire top from old chimney. Orange stained interior. Brown exterior. Pointy top. Broke into at least 2 pieces. Into biobox 3. 15.038254 173.798012 (bad pos) Leaning Chimney of Taha (extinct chimney) ~6m tall.	-15.03914	-173.78965	2261.1	1.4	217	2017-12-16	00:06:02	S104	250
S104-bio-14	S104-bio-14. Biota from same old extinct chimney just sampled. Chrysogorgia (pink) with squat lobster. Into biobox 2. Many beautiful corals on this extinct chimney.	-15.03914	-173.78965	2260.3	3.6	281	2017-12-16	00:13:13	S104	251
S104-sulfide-15	S104-sulfide-15. Spire from extinct chimney at "Death Valley". Z=2258m . Leaning sulfide with horizontal banding. Weathered and covered in sediment about 9m tall. Area with a line of extinct chimneys. 15.038254 173.798012	-15.04021	-173.79055	2254.8	3.5	255	2017-12-16	00:28:56	S104	264
S104-rock-16	S104-rock-16. Outer cruse of old cracked pillow. Outer crust of pillow manganese staining. hydroid on top. vesicles. 6x4 cm angular. On slope of constructional mound on western summit crest. (??) 15.041176 173.790786 (bad pos). Z=2240m.	-15.04044	-173.79022	2239.8	2.8	147	2017-12-16	01:09:23	S104	286
S104-rock-17	S104-rock-17. Pillow with weird sediment pattern on top (holes in a geometric pattern). Z=2197. Piece of crust. 7x2 cm. Z=2197. Flat-ish All manganese coated. Thin brittle crust piece. Z=2197 m 15.042003 173.791493. Top of western mound near waypoint 7.	-15.04201	-173.79108	2196.8	0.0	202	2017-12-16	01:33:40	S104	307
S104-rock-18	S104-rock-18. Weathered large bulbous pillow with lots of cracking (in place within rubble) . Glass surface? Some vesicles; banding 15-29 cm long. From slabby crust. Grainy. Behind the major box. From the west base of the summit cone. Z=2247 15.041026 173.789131.	-15.04107	-173.78905	2247.6	0.0	116	2017-12-16	02:15:04	S104	357
S104-rock-19	S104-rock-19. Piece of bulbous cracked crumbly sedimented pillow - knob and plate. Z=2198 m. highly oxidized exposed surface. Large vesicles. Glassy crust. 25x20 cm. 15.040306 173.786507.	-15.04029	-173.78604	2197.6	0.9	23	2017-12-16	02:53:39	S104	394
S104-rock-20	S104-rock-20. 15x15 chunk of pillow rind. Prebroken. Mn-crust with large elongate vesicles on top. Drippy bottom. A couple of hydroids. After heavy sedimented area then into a ravine with busted up pillows and some in-place bubbly pillows. 15.041357 173.7855785 depth 2160m.	-15.04170	-173.78536	2161.4	1.0	211	2017-12-16	03:16:41	S104	407
S104-rock-21	S104-rock-21. Part of the crust of a half-drained pillow tube near waypoint 11. ~7x15cm; breaking into two.	-15.04179	-173.78600	2167.0	2.2	203	2017-12-16	03:32:27	S104	418

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S105-rock-01	S105-rock-01. From thick dense dacite flow on the bottom (layered) and small glassy outer crust - flatish surface. Glassy exterior with oxidized coating on interior. Stretched texture on the glass. Interior has a gray look. 7cm long. From a lava flow that's 1.5 m thick. No vesicles or crystals that can be seen. 14.887193 173.946451	-14.88719	-173.94645	2790.7	4.3	130	2017-12-16	18:21:48	S105	36
S105-rock-02	S105-rock-02. Pillow-like structure with buffalo-hair outer striated rind - very glassy underneath (shiny); obsidian-like. Long angular piece of black glass with a small bit of gray interior. 25cm long - pointy end. From top of small ridge (30-40m high). 14.8879879 173.9444424.	-14.88799	-173.94444	2794.0	0.8	159	2017-12-16	18:37:18	S105	61
S105-rock-03	S105-rock-03. Piece from pillow with exposed fresh glassy interior and some banding. Different texture glass on interior than exterior for these lavas. Nice 10cm piece of outer layer with buffalo hair. 14.8891448 173.9437913	-14.88914	-173.94379	2793.4	1.0	49	2017-12-16	18:57:44	S105	86
S105-rock-04	S105-rock-04. Same pillow-different piece. Z=2793m. Piece from interior. Some orange staining on 1 side. Massive with conchoidal-like fracture.	-14.88914	-173.94379	2793.1	1.5	47	2017-12-16	19:01:42	S105	87
S105-sed-05	S105-sed-05. Bag #4: Scoop of orangish surface with a bit of crusty layering. Pasty orange coating on the bag. Orange crusty layer; mustard yellowish green layer; Thicker layer of darker material; also some gray coarse volcanic sand. Z=2805. 14.8892748 173.9431381	-14.88927	-173.94314	2805.3	0.7	66	2017-12-16	19:11:00	S105	97
S105-rock-06	S105-rock-06. Piece from the blocky pillow interior. Massive interior. Elongate angular piece. 25cm long. Pillow interior. Z=2797. 14.8896350 173.9433376.	-14.88964	-173.94334	2795.0	0.0	142	2017-12-16	19:29:54	S105	112
S105-sed-07	S105-sed-07. Core #2. Buff-colored sed surface. Harder layers in there. Darker sediments in the bottom are coarser (volcaniclastic ash?) and buff colored seds (pelagic) on top. Sedimented layer at base of slope measured at 20-40cm. Z=2815. 14.8903206 173.9433119.	-14.89032	-173.94331	2814.5	0.0	102	2017-12-16	19:50:28	S105	126
S105-sed-08	S105-sed-08. Scoop #3 of thick layer of coarse pebbles that overlay buff-colored seds. Pebble layer is ~10 cm thick and various sizes. From coarse pebbles on top of the buff layer (at the distal edge of fragmented slope) Z=2815. The buff-colored layer is sticky is somewhat coherent. 14.8913405 173.9436663.	-14.89134	-173.94367	2814.9	0.0	204	2017-12-16	20:01:00	S105	136

sample	Description	latitude	longitude	depth	altitude	heading	date	time	dive	record
S105-sed-09	S105-sed-09. Area with <10cm thick sed. Scoop of sediment lens next to talus contact. Shallow lens with coarse fragments and some pumice clasts. Trying to get a good representation of the size fractions present. Location: 14.8919000 173.9437271 depth 2792m.	-14.89190	-173.94373	2791.7	0.0	176	2017-12-16	20:35:13	S105	155
S105-rock-10	S105-rock-10. From area with lots of dikes. Chunk of dike rock from wall of rock near waypoint 4. Columnar joints and some curved fracture planes. Faceted. 25x20cm. Mn coat and evidence of prior Fe stains. Location: 14.8932083 173.9452427 depth 2707.5m.	-14.89321	-173.94524	2707.5	0.0	184	2017-12-16	21:25:57	S105	182
S105-rock-11	S105-rock-11. Chunk of glassy pillow overlying the dike complex. 10x10cm. Piece has "buffalo head hair" texture where glass rind is intact. Location 14.8961433 173.9452471 depth 2688m.	-14.89614	-173.94525	2687.1	1.8	338	2017-12-16	21:49:21	S105	192
S105-rock-12	S105-rock-12. Swirly outer crust on pillow. Massive flow interior of jumbly sheet-like flow. Black shiny whole coherent fold. 20x15 cm. Into biobox 3. Z=2680. 14.8961066 173.9448542.	-14.89611	-173.94485	2682.3	1.2	207	2017-12-16	22:01:45	S105	200
S105-rock-13	S105-rock-13. Pillow crust from flat region along approach to waypoint 5. Fresh glassy with some Fe stains and radial banding. Pillows here are slightly squat with buffalo head hair glass texture. Location 14.8963248 173.9444023 depth 2678m.	-14.89632	-173.94440	2677.7	0.6	80	2017-12-16	22:43:10	S105	216
S105-bio-14	S105-bio-14. Chrysogorgia (tentative ID; looks odd; "Puff Daddy") sample with a squat lobster in the center. Location 14.8983133 173.9422745 depth 2682m.	-14.89831	-173.94227	2678.8	4.2	139	2017-12-16	23:12:46	S105	228
S105-rock-15	S105-rock-15. Chunk of pillow crust with perfect buffalo head hair glass rind. Area with higher sediment load in water and on pillows. Location 14.8993756 173.9415846 depth 2676m.	-14.89938	-173.94158	2676.3	1.0	135	2017-12-16	23:30:03	S105	235
S105-sed-16	S105-sed-16. Scoop of very fine sediment sitting atop pillows at rock-15 location.	-14.89938	-173.94158	2675.6	2.1	146	2017-12-16	23:37:04	S105	236
S105-rock-17	S105-rock-17. Chunk of rock with thicker ropy texture on flat top - somewhere west of waypoint 6. Location 14.9006223 173.9393462 depth 2706m.	-14.90062	-173.93935	2705.7	0.6	64	2017-12-16	23:59:10	S105	245
S105-rock-18	S105-rock-18. Christmas gift from the ROV pilots. "Dirtbag" 10x15cm with orange sediment coating on bottom. 14.9006223 173.9393462 depth 2706m.	-14.90062	-173.93935	2702.5	3.5	7	2017-12-17	00:08:16	S105	246

6.6 SuBastian Dive Logs

This version of the cruise report does include the dive logs (**an additional 435 pages**). The complete version which includes logs is available online at the Marine Geoscience Data System (MGDS):

www.marine-geo.org.

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

<https://www.pmel.noaa.gov/eoi/laubasin.html>.