HAWAI'I UNDERSEA RESEARCH LABORATORY
QUICK LOOK REPORT
DIVE: PV-638

MISSION STATUS

Location: Volcano 19, South Tonga (Tofua) Arc

Latitude: ***Begin*** 24° 48.073'S **Longitude:** ***Begin*** 177° 00.688'W

Mission Date: June 16, 2005 **Duration:** 7 hours 02 min (Bottom Time)

Maximum Depth (m): 980 m

Project Title: SITKAP
(Submersible Investigations of the Tonga-Kermadec arc using PISCES)

Principal Investigator: Prof. Peter Stoffers, Kiel University
Guest Scientist from New Zealand, Gary J. Massoth

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Observer 1: Gary J. Massoth **Observer 2:** None
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Pilot 1: Terry Kerby **Pilot 2:** Steve Price

Scientific Data Acquired: Video, hand-held still photos, CTD, fluid, biological, and rock/mineral samples

Objectives:
The goals of this dive were to (1) Explore east wall of explosion pit to locate source of 880 ± 35 m plume, (2) explore the main pit crater atop Volcano 19, pit ~ 50 m deep, floor depth 550 m, (3) explore rock outcrops on east wall of explosion pit, and (4) sample hydrothermal fluids, minerals, and biota.

Observations, findings, etc: (Also see Appended Dive Log)

Summary: The dive commenced moving upslope from below base of lower north escarpment. Climbed to 890 contour and proceded north until encountered altered rock from above. Also noted dense 'smoke' in same region as saw during dive 635 so went downslope to 969 m in search of proximal vent, which was not observed. Climbed back normal to slope heading NW to 890 m then S to base of wall and columnar jointed rock face, which was asceded for 70+ m. from this point worked way to base of main upper

escarpment at 647 m. Climbed directly up obvserving little rock but primarily compacted breccia until about 504 m when an FeOOH vent patch venting at 79ºC was found and sampled for fluids. Rose to summit crossing rock and FeOOH crust to pinacle at 384 m when 14-m-tall barite chimney was observed and sampled. Tmax was 245ºC and phase separated flow was evident as bubbles. Transited to S summit and sampled crust, but barely explored before leaving seafloor.

Species List:

Samples Collected:
PV-638-A1 Bythograeidae (4) 13:51, 399m, Lat/Lon 24 48.269, 177 00.108
PV-638-A2 Galatheidae (3) found on coral
PV-638-A3 Caryophiliidae (Lophelia?) 13:22, 418m, Lat/Lon 24 48.265, 177 00.208

Observed in video

Midwater:
Pyrosoma
Cylothone
Appendicularia
Munnopsidae
Mysida
Bathylagidae?
Pasiphaeidae
Chaetognatha
Tomopteris
Euphasiid?

Benthic
green headed eels - numerous
Synaptibranchidae
Holothuroidea
Asteroidea
Serpulidae - on columnar jointing
Caryophiliidae (cup corals)
Gorgonacea (small white)
Squiliformes (cat shark)
Lepidisis
Trachymedusae (on rock)
Brisingidae
Ophiuroidea
Bathypathes
Crinoidea (white stalked, frilly)
Keratoisis?
Palanuridae
Galatheidae (red, long arms)

MISSION EVALUATION:

A. Limitations, failures, or operational problems noted:

The snorkels on both the Major and Gas-Tight samplers were positioned with the intake sloped downward, rather than upward, during sampling, which may hinder flushing of the snorkel and increase the effective dead volumes of these samplers.

B. Recommendations for corrective action or improvement:

Valuable time on the seafloor could be saved when working in confined areas by communicating only the decimal minutes when sending and confirming position information.

C. In your opinion, did the mission essentially achieve its purpose?

Yes.

D. Compare actual work accomplished with the work that was expected to be accomplished.

The primary objectives of observing the west wall escarpments for Vol. 19 and locating sites of hydrothermal discharge in the summit are were fully accomplished. Ancillary rock sampling in the summit area was deferred to a subsequent dive due to time limitations.

E. List specimens or samples collected on the mission. (See Sample List Below):

Sample Number	Time (L)	Latitude	Longitude	Depth(m)	Comments
		Min/decM 24degS	Min/decM 177degW		Volcano 19: East wall and summit reconn.
PV-638-R1	09:46	48.017	0.626	890	Altered rock from talus at base of lower wall
PV-638-MS-White	11:52	48.262	0.262	504	Major Sample (79.2ºC) in FeOOH chimney
PV-638-GT-Green	11:52	48.262	0.262	504	Gas Tight sample (79.2ºC) in FeOOH chimney
PV-638-A2	13:22	48.265	0.208	418	Galatheidae (collected on coral)
PV-638-A3	13:22	48.265	0.208	418	Caryophyliidae (looks like Lopehelia - Yellow)
PV-638-R2	13:35			425	FeOOH-Mn crust from summit plateau
PV-638-MS-Yellow	14:08	48.269	0.108	385	Major Sample (245ºC) top 14 m chimney, MKR
PV-638-MS-Blue	14:08	48.269	0.108	385	Major Sample (245ºC) on top of 14 m chimney
PV-638-GT-Red	14:08	48.269	0.108	385	Gas-Tight (245ºC) on top of 14 m chimney
PV-638-Scoop #5	14:08	48.269	0.108	385	Barite Chimney Top (14 m tall)

PV-638-R3	14:08	48.269	0.108	399	Top of small barite chimney at base above
PV-638-A1	14:08	48.269	0.108	399	Bythograeidae (4 - 2 juveniles)
PV-638-R4	15:27	48.269	0.108	397	"Leafy" flange-like material near crab habitat
PV-638-R5	16:00	48.400	0.160	414	Dark, pyrite impregnated FeOOH-Mn crust

Time (L)	**Z (m)**	**Lat. S**	**Long. W**	**Observations**
		24º	177º	
	950	48.100	00.650	Landing Target (WP1)
08:05				Dive, Dive, Dive (on deck go-ahead, depth 900 m)
08:10				PISCES in water
09:08	980	48.073	00.688	On bottom, ~70 m NW of drop target (WP1). T=5.5ºC. Heavily sedimented talus slop, angular large basalt pieces, not columnar at this lower depth.
09:16				Underway East, upslope to interset 890 m contour. PISCES sl. Heavy, pump water and pick some balast rocks up.
09:26	957			heading upslope, mostly exposed talus, holothurians in view.
09:31	900			Steepness increases passing this depth
09:32	888	48.058	00.605	Noticable increase in turbidity as cross 890 contour. 90 m bearing 330 degrees to WP2 at base of escarpment to climbed.
09:38	886			Good video of end-on exposure of columnar joints, i.e., the 'toe'.
09:43	890			Again, noticibly murky, discussion of 'missed vent' this area.
09:46	890	48.017	00.626	**PV-638-R1** Altered rock sample collected as base of wall. Decide to head downhill to look for a 'smoking' vent between this depth and the lower transect contour (970 m) that Mark came by on. In talus gully following altered rock trail.
10:03	934			2.5 m dike end exposed to port; good video.
10:07	942			Back into an 8-m-tall vertical wall facing to the NW and protruding out of lower slope.
10:13	970	48.026	00.684	At lower end of down-transect to look for local vent site, over talus rubble pile.
10:20	969			Transect NW back up slope to 890 contour, normal to slope and oblique to downpath. Over many mass-wasted hexagonal-shapped pillars. Full talus pile, very lightly sedimented. Massive flow face, consolidated brerccia, comes to a sharp-tipped pinicle tip.
10:30	922			At base of outcrop, columnar joining. As rise can distinguish bedding in consolidated breccia flow. Also see a dike outcrop at about 900 m.
10:35	890	48.966	00.657	At base of wall, west of desired start for ascent.
10:40	890			Start up wall at columnar joints site. Columns to up to 884 m. then solid rock exposure with broken basalts.

10:46	823			Rise vertically to this depth, passing flow after flow, no visible signs of alteration anywhere, arrive at sediment 'cap' feature. 67 m wall.
10:49	815			Heading toward WP4, base of upper vertical wall. Everything here is much more heavily sedimented, see occasional signs of alteration, FeOOH and altered rock. See bluenose fish.
10.51	815			Stopped at site of altered rock, 670 m and 130º to WP4
10:58	790			Driving on 790 m contour. Sedimented talus breaking to occasional rock outcrops and talus flows, many canyons.
11:02	776			Stop for photo of bedding. Some flakes of FeOOH.
11:07	755			Large, long, white salp.
11:10	748			End of tape 1, moving NE turning to SE.
11:11	739			Start tape 2.
11:15	722			At base of wall, to up it. Exposed rock, flow layers, broken basalt faces.
11:16	714			300 m/130º to WP4
11:21	702			Observed clay-like chunks, ash, among talus rubble flows on gentle slope.
11:24	686			Old, rounded FeOOH on smooth, sorted slope. Mostly covered with ash.
11:26	666			Shark, barraks fish
11:27	658			Large (10s of cm in length) chimney chunk debris, sl. Discolored dark. Stil photo. Friable to sampling. Crabs living in the FeOOH. Surface reports 20 m from WP4. Shrimp.
11:35	647			Base of wall, start ascent up vertical wall that looks like consolidated ash-conglomerate face (pyroclastic flow? Not welded at all, so probably not) with multiple erosion gullies. Entire face is this type of material.
11:47	522			Note much more particulate matter in water.
11:48	516			See aged, localized, bacteria patch on rock face. As move up see add'l patches with dead filimentous bacteria.
11:51	504	48.262	00.262	Come up over ridge and see chimneys, schleiren. At a ledge/pocket hosting multiple small FeOOH chimneys, all of which appear to be venting fluids with Tmax =79.2ºC. Very difficult to position so can see basal region of vents, complete and lengty 'brown outs' when attempt to scrape away the FeOOH covering. Also difficult to assure the sample snorkels are in the flow stream when sampling. Much time taken sampling. Ambient T = 9.4ºC. Chimney area is maybe 8 m wide with some structures on upper ridge in view. The extent of the flow seems impressive, even though sampling is dificult.

12:53	504	48.262	00.262	**PV-638 MS-White and PV-638 GT-Green** taken. Note that snorkel angles at intake level are actually tilted down rather than up to enhance flushing.
13:10	488			As ascend wall see Fe crust that appears to have flowed. Comment that the crust looks more like Mn upon examination. End Tape 2.
13:12	472			Tape 3 start. See irridescent green small ell-like creatures (3) like we saw at Macauley, back end was more brown, but also shimmering. Good video at 13:16:45 for only a few seconds.
13:20	426			Orange roughy, heading east and up.
13:22	418	48.265	00.208	Dendrifillia hydro-coral, a yellow coral sampled **PV-638-A1.**
13:27	425			**PV-638-R2** FeOOH crust that looks flow-like. Good video of blue and yellow fish with head in rocks.
13:38	421			White corals abundant, start to see some signs of altered lava, see schleiren along ridge covered in FeOOH: T = 43.4ºC.
13:44	415			Enter hazy layer as ascend ridge, come to basalt wall which is ascended, then a second.
13:49	385			Note altered rock interspersed with FeOOH and also an abundance of white macro particulate matter in water.
13:51	384	48.269	00.108	As rise to top pinacle and see some schleiren and even more white macro-particulates, top feature and behold a very tall, white, 'bee-hive'-topped, and built outward toward the top, chimney. Also view other, smaller chimneys in forground and below. Place MKR #37 on the overlooking perch.
13:53:05	384			See school of small fish in vent area. Great Video.
14:00				Video survey as approach tall chimney, see small crabs, then bubbling of fluids.
14:05	385			T in bee-hive = 245ºC. No macro-biology visible directly in HiT flowstream.
14:10	385			Top of tall chimney, perched against bee-hive where temp. was measured. Begin sampling with **PV-638 - Sediment Scoop #5** on top level base and also on side of bee-hive (unsuspectedly hard). Take **PV-638-MS Yellow, PV-638-GT-Red, and PV-638-MS-Blue** all in same orifice where temp. was measured. Again note that angle of snorkel was down and not up wrt flushing flow. Snorkel tip was well-positioned in flowstream when triggered.
14:55				Finish sampling above and move back to Mkr #37 before descending to bottom of chimney (see orange roughy in crack in rock by mkr) 14 m below!
14:57	391			Terry comments on abundance of starfish (not in view).

14:59	399	At base of 14 m-tall barite chimney, numerous small chimneys on m-scale around base, cream-colored at base grading to white enlongated upper sections.
15:02	399	**PV-638-R3** Chimney top from lower region of giant structure.
15:06		**PV-638-A2** designed to collect two crabs, note abundant flatfish and another green eel. Note bubbles coming from below us. Clam shells observed, but too difficult to grab.
15:12	398	End tape 3.
15:13	397	Start tape 4
15:18	386	At narrow 'waist' of tall chimney for photography of abundance crabs living on this structure.
15:21	390	heading N to structure on sonar 20 m distant.
15:27	397	In 'hole' lined by breccia, heading back to chimney. Come back up same approach as before. Decide to sample 'leafy' stuff from side of tall chimney. **PV-638-R4** pieces from mid-chimney, near where crabs were observed, put into biobox.
15:38	385	Beginning to head to WP7 where Tim wants rock sample. Decide too far and change target to WP8, 160m/203º.
15:56	425	On ridge of s. summit, see schleiren T = 46º
16:03	415	Sample piece of dark crust on top with bright yellow underside. **PV-638-R5.**
16:11	415	Leave bottom