HAWAI'I UNDERSEA RESEARCH LABORATORY
QUICK LOOK REPORT
DIVE: PV-625

MISSION STATUS

Location: Healy Volcano Caldera, Kermadec Arc

Latitude: ***Begin*** 34° 59.544'S **Longitude:** ***Begin*** 179° 00.898'E

Mission Date: May 1, 2005 **Duration:** 6 hours 28 min (Bottom Time)

Maximum Depth (m): 1483 m

Project Title: New Zealand American Submarine Ring of Fire Leg II

Principal Investigator: 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, Fornari Still Camera, CTD, Temperature probe

Objectives:
The goals of this dive were to (1) Explore 4 cones trending SW 1430 m from landing point to locate source of 1405 ±50 m depth plume, and (2) sample hydrothermal fluids, macro- and micro-fauna, and deposits.

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

Summary: Started dive at 1389 m in saddle between E and W summit pits of NW (#1) cone. Observed ubiquitous covering of FeOOH-Si deposits overlying black 'basaltic-looking' sand/ash. No lava outcrops or talus was in view. Proceeded to E pit (<50 m diam., 13 m deep) where a thicker (half-meter or greater) blanket of FeOOH-type seds was punctuated by up to m-high chimneys of same material. Also, many intricate smaller chimneys of varying morphologies were observed many with intact flow orifices. Although the temperature probe registered up to 15.9ºC compared to 4ºC ambient temp., no schleiren was observed here, or at the larger W pit (30 m by 60 m oval, 19 m deep), which was relatively devoid of the chimney structures. The full extent of the outer slope of this cone was coated in FeOOH with occasional outbreaks of coarse-grained black

sands and even rarer basalt outcrops. Hundreds of 'flocaberries' up to several cm in diameter were observed cascading down this slope with accumulations in low pockets. The slope of the adjacent pit (#2) was bare black sand to within a few m of the summit where the FeOOH seds again became thick. Schleiren marked a 20-m band of diffuse discharge on the NW rim (Mkr 19). A circumnavigation of this rim located a second, small region of discharge on the WNW rim sector. No venting was observed within the 4-m deep, 40-m diam. pit, other than on the inner upper NW wall adjacent to Mkr 19, which was too diffuse to sample, with overlying FeOOH deposits approaching 1 m in depth. Where vent fluids were collected from the outer rim region at Mkr19, the fluid temperature was 33.9ºC. The next cone (#3) was similar, although smaller in dimension. Here, venting through FeOOH seds was again observed, at temperatures up to 28.4ºC . The fourth cone in this sequence was not explored due to time constraints. The FeOOH seds in most areas were dark orange overlain by a lighter yellow filimentous-looking covering. A large squid was observed enroute to pit #3 but no sessile macro fauna. Fish were observed but rare. The consistent venting depths (1373±10 m) plus the persistent plume visible near the cone summits provide strong evidence that these sites are the source of the plume mapped by CTD tows during previous expeditions.

Species List:

Unknown shrimp
Aristoma shrimp
Unknown small black fish (rat tail?)
Unknown small white shells (gastropods?)
Large (giant?) squid (> 1 m in length)

MISSION EVALUATION:

A. Limitations, failures, or operational problems noted:

None

B. Recommendations for corrective action or improvement:

Some time might be saved when working in confined areas by just communicating 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 full survey area was not explored due to findings of major objectives early in dive.

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

Sample Number	Time (L)	Latitude	Longitude	Depth(m)	Comments
		34º 59.'	179º 00.'		
PV-625-1-Sc#5	09:42	0.544	0.742	1389	<1 cm thick FeOOH-Si crust and black sand (as
PV-625-2-SS#1	10:19	0.563	0.831	1391	Suction sample of 25-30 cm thick FeOOH-Si cru
PV-625-3-SS#2	12:10	0.692	0.509	1483	Suction sample of FeOOH-Si seds mid-way betv
PV-625-4-Sc#4	12:31	0.784	0.435	1373	FeOOH-Si that hot water was flowing thru (MAR
PV-625-5-MS (yellow)	12:31	0.784	0.435	1373	MS Yellow (T=33.9ºC in seds), on NE rim of Co
PV-625-6-Sc#1	13:19	0.816	0.408	1373	Scoop #1 of fiberous FeOOH-Si chimney matter
PV-625-7-SS#3	13:19	0.816	0.408	1373	Suction sample of fiberous FeOOH-Si matter
PV-625-8-R	13:41	0.816	0.408	1372	Rock (basaltic, visicular) from w/i black seds ber
PV-625-9-MS (blue)	14:24	0.784	0.435	1373	MS Blue (T=28.3ºC in seds) @ MARKER#19
PV-625-10-GT (red)	14:24	0.784	0.435	1373	GT Red (T=28.3ºC in seds) @ MARKER#19
PV-625-11-GT (yellow)	14:24	0.784	0.435	1373	GT Yellow (T=28.3ºC in seds) @ MARKER#19
PV-625-12-SS#4	15:26	0.952	0.313	1384	Suction sample of orange seds under white fluff
PV-625-13-SS#5	15:26	0.952	0.313	1384	Suction sample of white mat atop orange FeOO
PV-625-14-MS (white)	15:26	0.952	0.313	1385	MS White (T=28.4ºC in seds)

Time (L)	Z (m)	Lat.	Long.	Observations
		34º 59.'	179º 00.'	
		0.345	.898	Landing Target at 1460 m depth
08:14				Dive, Dive, Dive (on deck go-ahead, depth 1382 m)
08:20				PISCES in water
08:24				"Clear to Dive"
08:25				"Tower Awash"
09:23	1389	0.544	.742	On bottom, ~500 m SW of drop target on Fe00H-Si ppt. almost completely covering coarse black basalt sand. Natural collapse of old and weathered thin (< 1 cm thick) Fe crust exposes black sands in spotty pattern. Sonar and position info indicate we are in between two peaks on a saddle atop the first cone (#1) target. We plan to look at eastern peak first, then western, larger peak. Ambient T is 3.9ºC.
09:42	1389	0.544	.742	**PV-625-1-Sc#5**. Scoop sample of black sand with overlying cm-thick FeOOH-Si old and weathered crust.
09:46	1389			start ~180 m treck to east up 45º slope of eastern cone, note soon that we are getting deeper rather than shallower, going into a pit, not up a peak. Also note that visibility is clearly decreased and within a definite hydrothermal plume as pass 1406 m. Same large pieces of orange-colored floc in water column.
09:52	1413			4 MAB, peak 30 m ahead

09:57	1430			First sighting of 'flocaberries' FeOOH floc rounded, rolling and collecting in depressions.
10:03	1440	0.642	.837	In line with ripples running E-W (064º); very thin FeOOH covering black sands; some talus debris; decide to head WNW back to main peak (330 m/310º); no sessile biology, see one small black fish and large aristoma shrimp. As start going up hill FeOOH becomes dominant.
10:11	1391			º322 heading over 95% black sand; as rise move into sharp gradient of thick FeOOH cover, much thicker, create scooge storm when land.
10:19	1391	0.563	.831	**PV-625-2-SS#1.** Suction sample of 25-30 cm-thick FeOOH-Si old and weathered crust at first exposure as climb cone. Temp. at base of seds is 15.9ºC.
10:26				Base of steep, rocky slope with some talus in view but mostly a full covering of thick FeOOH seds, starting to see some small nontronite chimneys. Old crust, cracked in view. Good view of chimneys and seds. Note that the small chimneys have flow holes at top.
10:29				single shrimp on top of FeOOH seds
10:32	1374			200 m/280º to cone summit. On ridge of pit crater with sharp dropoff to pit (13 m deep, 50 m diameter).
10:37	1389			At Iron City. Fine sculptured chimneys, all different morphologies, finger-diameter on large basal structure.
10:45	1394	0.524	.778	At bottom of pit 50 m diameter, 20 m deep; many lattice-like nontronite chimneys. Realize still on eastern edge of w cone, need to continue to the west to explore this cone more fully.
10:50				1 m tall nontronite chimney, decide to drive thru to see if solid or all fluff. Landed in deep fluff. Chimney all fluff.
10:54				Chimney Village within the first and smaller of two joined pits on west cone summit. Work around the pit in video survey, temp is 4.9ºC at bottom, 5.5ºC at rim. GOOD VIDEO HIGHLIGHT
11:03				At base of pit, wave forms (E-W) on black sand, much different than adjacent pit, here pretty much devoid of FeOOH seds.
11:09	1356			transition from black sand to light coating of FeOOH seds; 230º/50 m to WP2 and see we are entering yet another pit 60 m by 30 m oval 19 m deep, rimmed by FeOOH seds.
11:16	1375			At base of pit covered by Fe floc.
11:23				On ridge rim of pit and climbing NW to summit, totally covered in FeOOH, small back flow holes punctuate the flat sediment cover. END TAPE 1

11:28	1345	0.508	.639	At summit of W cone(#1), totally devoid of macrofauna (Terry comments he saw a hydrolagus). In visible plume at summit. FeOOH covered (some lighter FeOOH floc) along full rim. 650 m/210º to WP3 (Cone #2)
11:42				Underway for WP3 after brief stop for lunch
11:51				On down slope of Cone#1, steep with hundreds of flocaberries running downhill - an impressive Fe flux. Full outer slope is Fe sed covered. GOOD VIDEO HIGHLIGHT (see closeup of rolloing berries!)
11:57				At base of cone see still a THICK blanket of FeOOH suggesting a huge flux here of Fe.
11:59				Attmpt to settle onto bottom but sink in Fe seds up to bumper bar without bottoming out. The entire basal area of the cone is fluxing and collecting Fe. GOOD VIDEO
12:04	1461			300 m/210º to WP3. observe turbidity flow from our trail roiling downhill to our port.
12:08	1483	0.692	.509	GOOD VIDEO of basket driving thru the Fe Seds at base between the cones, this could be the souce of the deeper plume.
12:10	1483	0.692	.509	**PV-625-3-SS#2** of floc seds at base between cones, Temperature = 8.7ºC.
12:22				As start climbing the second cone transition from Fe seds to winnowed black sands with wave crests running up/down slope. See white shells, small gastropods? Shrimp seen, sand is barren of all live or floc. Many small rat tail fish seen congregating. Slope is ash covered and smooth wrt any lava rock.
12:30				As approach the very summit enter more turbid water and also transition into FeOOH seds with som rock outcrops. Almost immediately enter a large chimney field of nontronite spires, some on the m-scale, others smaller and thin. Most of this area has clear shimmering water coming thru the Fe-Si chimneys.
12:31	1373	0.784	.435	On summit pit crater rim with chimneys and shimmering water. Tmax = 33.9ºC emerging thru thick blanket of FeOOH seds. Position is 60 m from WP3, as we are on the NE rim of the summit pit. MARKER 19 deployed. **PV-625-4**-**MS Yellow** taken in max flow stream, just above black seds. **PV-625-5-Sc#4** of FeOOH seds through which hot water was flowing.
13:03	1373			Starting to move clockwise around rim.
13:06	1366			Single shrimp in water over pit ridge. Large sections of crust collapsed in on itself. See many chimneys in pit. No venting locally. Rim is narrow and steep sided, especially on inside. Sheer wall in places. Heading 283º.
13:10				Some schleirin from small chimneys

13:13	1373	0.816	.408	Stop at FeOOH chimneys with fluted, holed, and dark fibrous material. GREAT video. Temp = 21.3ºC coming thru the fibrous mat. **PV-625-6-Sc#1** fibrous, dark colored mat material. **PV-625-7-SS#3** same fibrous, stringy, tamale paper-like material as scooped. END TAPE #2.
13:27				Tape #3 started at same site as above. Close to being back to MKR 19, now on NW part of rim, MKR 19 on N rim.
13:30				Entire rim floc structure collapses on basket and reveals bare black sand base with rock embeded.
13:34				GOOD VIDEO of exposed sand/rock section. Fluid flow is thru the entire sand pile, diffuse and sand reacted?
13:41				rock falls out from exposed wall and is sampled: **PV-625-8-R.** Temp in sand pile where rock came from is 22.5ºC.
13:47				Depart sampling site to continue around ridge to MKR 19. Pit is 40 m in diameter and 14 m in depth.
13:51				Start to see small chimneys, then see MKR 19. Therefore, two areas of active discharge, both on the northern quadrant of the pit rim. See into pit, quite murkey.
13:54	1373			Inside of Pit opposite MKR 19. Thickly sedimented with FeOOH and active diffuse fluid flow, exciting landing in deep seds, above bumper bar.
13:56	1372			5 MAB and moving into pit.
13:59	1387			At base of pit. Many small finger chimney FeOOH spires, most with intact flow holes, but no apparent venting at base of pit.
14:02				See small rock outcrops as ascend north inside wall.
14:10	1373			Temp in FeOOH seds: 35.8ºC. Near MKR 19, but inside part of wall.
14:24	1373	0.784	.435	**PV-625-9-MS Blue, PV-625-10-GT Red, PV-625-11-GT Yellow** all at MKR 19 outside rim, T = 28.3ºC; seds MUCH thinner (a veneer) compared to inside pit at same sector. All sampled in discrete flow site coming out of bared, coarse black sand.
14:47				Underway for WP4 (Cone#3) 360 m/209º
14:41	1389			land on many splendard small chimneys of steep s. slope of Cone #2 - chimneys as far as can see, contrary to upslope approach from N side.
15:00	1441			192 m/230º to WP4. Still see FeOOH seds.
15:04				climbing up black sand slope of 3rd cone, even more barren than comin up previous cone.

15:05				Giant Squid (~> 1 m in length) sighted directly in front on slope of cone, feeding tenacle exposed, long and white. Shrimp. Ripples in seds running 256º directly uphill. Wavelengths appear greater than on previous cone. Highly weathered outcrops occasionally seen.
15:15	1386			On NE rim of cone #3. Seds with schlerin on top of ridge, thin layer starts right at top, about 1385 m. See fibrous deposit as on previous cone.
15:26	1384	0.952	.313	Tmax = 28.4ºC. **PV-625-12-SS#4 and -13- SS#5** (orange FeOOH and white floc on top, respectively). **PV-625-14-MS White.**
15:32				END OF TAPE #3, while MS sampling
15:51				Leave bottom.