HAWAI'I UNDERSEA RESEARCH LABORATORY
QUICK LOOK REPORT
DIVE: PV-616

MISSION STATUS

Location: Macauley Caldera Cone, Kermadec Arc

Latitude: ***Begin*** 30° 12.516'S **Longitude:** ***Begin*** 178° 27.057'W

Mission Date: April 12, 2005 **Duration:** 6 hours 59 min (Bottom Time)

Maximum Depth (m): 521 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:** Colin Wollerman

Scientific Data Acquired: Video, Fornari Still Camera, CTD, Temperature probe

Objectives:
The goals of this dive were to (1) Explore upper slope and summit pit crater for fault structures, light rock, fluid discharge, and biota, (2) Sample hydrothermal fluids and macro- and micro-fauna, and (3) Conduct a video survey of the summit pit and mark future fluid sampling sites.pth plume, and (2) sample hydrothermal fluids, macro- and micro-fauna, and deposits.

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

Summary: Started dive at 521 m on N slope of Macauley caldera cone. Proceded upslope observing sparce biology to about 325 m when see crust coating basalt pillow outcrops and then broken 'plates' throughout the area. Between this depth and 300 m become totally underlain by dense biology (mussels on and in ash seds, starfish) and still a metallic crust. Ascend to cone crater rim at about 280 m and proced counter clockwise to pinicle peak of cone at 248 m. Descend then 89 m to base of explosion pit being 80 m in diameter at top and 30 m dia. a base, which is a flat, ash and S covered floor. Sample 129ºC fluids but measure max T of 155ºC nearby on base floor, north all. Video survey

all on ascent, shows huge mass accumulation of elemental S as diked (ash conglomerate?) wall and sulfur chimneys. Very little biology inside pit rim, mostly confined to outer cone slope within 290º-350º degree sector as demonstrated by circum navigation of cone at 290 m, depth of densest biology on north slope.

Species List:

Trilobite crustacean
Shark
Carallium hard corals
Starfish
Tunicates
Whip coral
Macurid fish
Decorator crab
Iridescent green-headed eel
Anenomae
Scorpenid fish
Spined scallop
Hermit crab
Large shrimp
Mussels (two types at least)
Butiaguchi fish
Large gastropods (two species)
Kahala fish
Grouper fish
Small 'ash-like' spotted flat fish
Spiney crabs

MISSION EVALUATION:

A. Limitations, failures, or operational problems noted:

1 hour of video lost due to missed tape change. White major sampler failed to fire on demand.

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.

100% achieved

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

Sample Number	Time (L)	Latitude Min/decM 30degS	Longitude Min/decM 178degW	Depth(m)	Comments
PV-616-1-MIN	09:45	12.679	26.991	345	Iron oxide 'plate' crust
PV-616-2-MIN/R	10:00	12.715	26.998	325	Iron oxide/silica 'flow coating'
PV-616-3-BIO/MIN	10:24	12.735	26.980	292	Starfish + mussels + rocks
PV-616-4-SS1	10:32	12.763	26.998	284	White filimentous bacteria on clams and rock
PV-616-5-MIN/R	11:07	12.847	27.042	345	Crust on loose boulder
PV-616-6-BIO	11:32	12.853	26.930	248	Large gastropod on peak pinicle
PV-616-7-MIN/BIO	12:27	12.778	26.953	337	Elemental S, Fe/Si crust, crab in Scoop #1
PV-616-8-MS/GT	12:43	12.773	26.968	336	Blue MS, White GT(failed) at Mkr #9, T=128
PV-616-9-MIN	13:56				Elemental S 'worm casting' shape at base of
PV-616-10-BIO	14:22	12.808	26.924	270	Mussels from clump near pit rim, pos. approx
PV-616-11-BIO	15:14	12.769	27.037	292	Single mussel with filimentous bacteria outer

Time (L)	Z (m)	Lat.	Long.	Observations
		-30	-178	
		12.6	27.46	Landing Target at 500 m depth
08:12				Board PISCES V
08:20				PISCES in water, depth 497m (3 "Maytags")
08:23				"Clear to Dive"
08:25				"Tower Awash"
08:45	521	12.516	27.056	On bottom, ~190 m northeast of drop target on basalt talus and grey ash-like sediment with yellow seds beneath in places. Small shark swims by. Ambient T is 8.7C.
08:48				Sharks swims by again, same positon
08:52				Start southward transit up north face of cone. Stop to pump water, heavy.
08:55				Restart transit S.
08:56				See many small fry. Terry comments on carallium hard coral.
08:58				Some outcrops in view, pillow fragments, slope is very smooth. Quite heavily dusted with pumisy ash on even small talus, about 70% cover.

09:01				Mostly finely sorted small talus. Terry sees small trilobite crustacean (Craig Young has seen in Atlantic but not here).
09:04	520			Heading 053 upslope at classic angle of repose. Gargonian coral (branched, white)
09:06				Basalt looks fairly fresh, larger than below, clean pillow fragments, less dust.
09:07				See first starfish, otherwise barren of biology.
09:09				Fine, sorted drain channel being travelled.
09:10	472			Tunnicate seen by Terry, Whip corals
09:11				Macurid fish seen by Terry, Cool fish, different from anything Terry has seen. High fin (anagonia-like with a weird hump plus spine)
09:13				In place pillows; decorator crab (small)
09:14				See first FeOx staining, plus white deposit
09:15				Big-eyed, almost transparent-basalt camoflaged fish
09:17	446			See more scallop-like white shells; see irridescent-green snake-like eel. Shimmering pulses of green color, ripples back over body. The 'glowing eel'.
09:21				Good close-up of green thing; stay tuned, more good stuff
09:25				Terry sees an anenome; bottom much or yellow-ish
09:26	428			Slope still very smooth, large % sand with finely sorted basaltic fragments and light shells, mostly broken
09:27				Galateid crab, small
09:28				221 heading, see another small green thing
09:29	406			Scorpenid fish (scorpian fish); urchin; open mussel
09:31				Spined scallop with hermit crab; scour in seds, ripples normal to slope
09:33				large in place pillows, worked over on outer edges
09:38				Unknown fish with spines, verigated coloring
09:40	356			Terry sees a large shirmp; water clarity is high
09:45	345	12.679	26.991	Fe crust, plate-like, pervasive, broken, like old, thick mat. Scoop sample #1 taken of this crust at base of basalt pillow, looks like crust 'flowed' around the pillow.
09:55				Renew uphill trek; crust pervasive, looks like Fe-rich fluid leaked out and solidified.
09:56				Terry sees another irredescent green snake thing
09:58				Coming into thick dead bio-deposits, still with think Fe crust everywhere.
10:00	325	12.715	26.998	Taking MIN sample #2 of crust coating basalt rock. (in marker, rear, box)
10:06				Underway again; lots of wasted 'razor clams' (Mussels); then live beds, buried in slope in part. Great shots of bio. T = 13.2 ambient, T = 13.4 in seds by clams.
10:15				Resume uphill climb. Milky water. Still in think biology

10:16				Butaguchi fish
10:17	300			Starfish on clams on crust on seds, huge bundle of startfish then seen on a bacteria-marked vent, no schlerein.
10:24	292	12.735	26.980	BIO sample of startfish with mussels; outcrop at this site heavily encrusted in FeOx. T = 13.8C.
10:28:51				On rim of pit crater, top of transect up from S side of cone. Bio drops off in density. See venting and filimented bacteria on mussels. Whole area looks like it exuded Fe at one time.
10:30				Heading 330 to 284…..Peak of cone is to SW, looks like ash covering. Ambient T is 13.5C. Probe in seds = 21C.
10:34	284	12.763	26.998	BIO sample into Slurp sampler bucket #1 of filementous stuff on clams. Good close-up at end. See for first time that the bottom is covered with flat fish that dart around, seem to be feeding ubiquitous surface coating of white waving bacteria. Still on rim. Good shots of flat fish. No visible schlerien yet.
10:47				Moving to SE on rim. End of Tape 1.
10:48				Terry sees a Morrey Eel; looking into a pit w/little biology, altimeter reads 20 MAB
10:50				Terry thinks we are outside the pit on outer slope: little biology on seafloor but metal coating on angular basalt still prevalent.
10:52	280			Still looking for pit
10:53	293			Milky, poor visibility; small white clam shells (abandoned)
10:55				Conclude on western outer slope of cone.
10:57	317	12.824	27.060	Stopped for position: on WNW outer rim; on dead white clam shells imbedded and on heavy ash cover. Decide to head due E to Cone summit.
11:03				Large piece of pillow basalt with Mn or Fe-Si crust on top surface, all sitting out of place on ash and small talus slope.
11:07	313	12.847	27.042	MIN/R sample of above basalt-crust
11:24				Moving to peak; some areas 90% ash covered, no biology like on N slope, see a grouper following us; rocks appear to have a different, more Mn-like, coating compared to the Fe-Si cruist first observed on N slope
11:26	300			060/110 range and bearing to summit peak Target
11:28				Smokey and see more Fe-staining.
11:29				020/80 range and bearing: ash-covered slope with occasional large basalt pillow erratics.
11:30	257			Emerging into a milky layer; heading NW
11:31				Climbing more steep section, very milky, see dead mussel shells again.
11:32	248	12.853	26.93	At basalt pinicle peak of cone: Only large gastropods on pinacle basalt; strong bio-zonation. Current out of N. BIO sample of large gastropod on

				pinicle
11:42				Over pit heading 347, alt 9 m. Very milky as we drove INTO the plume from the pinicle, now 20 m away and we are dropping down a cliff with 8 m alt now. Wall here is covered with mussels, a 'clam bake'. Sheer wall of explosion pit is the impressing as we descend, see S chimneys go by port (Alt = 20) as we spin around to check out dimensions of hole. Terry continues to move out from all.
11:48	279			Alt = 35 m (a hole) and getting even more milky. See Kahala fish darting about PISCES V, very aggressive. Comments on wall (smooth with coating and very sheer) as descend but video is black. No biology in sight.
11:51				Stopped on ledge to get rid of some water, PV is still too heavy for this descent. Grouper in view. White deposits on rock and oxide coating adjacent to that. See many flatfish on the ledge surface. Looks like a large blast hole.
11:55	310			Still descending into a hole (sonar images captured): 80 m across at this point.
11:59				Kahalas darting about. Scorpenid at base of rock coated with anenome and starfish, good video. Drapped coating on rocks, desire a sample at some point.
12:01	320			60 m diam. Hole now, still 20 m alt. starting down again. Sulfur crust/coating on all of wall. Terry notes a strong current going up out of hole.
12:07				.7 m long salp: shrimp; 40 m across now, Terry again comments on flow coming up out of hold impeding our descent. See lots of S as approach the bottom. Ash floor.
12:10	335			Pit floor is **89 m** below pinicle: T = 12.8, lower than at top.
12:12	337	12.778	26.953	See rare venting, coming from behind a loose rock on the pit floor. Outcrops of S on walls, sitting over darker (Fe-rich?) cruist layer several inches thick. T-probe in flow that can't get at to sample is 154.5C.
12:24				Can see that S was molten and dripping down the cliff face. Great video of sulfur extrusion plus layer beneath of darker stuff.
12:27	337	12.778	26.953	Scoop Sample #2 of elemental S plus crab plus brown-red layer of lower plate or sheet crust (confirmed by video and Terry's comments). Looks like crabs are living in the S crusts. After sampling scoop, Terry tries to slurp a flat fish on bio-box lid.

				Moving from sampling site, see schlerien all over base of pit, which has wave furrows about 6-8 cm wave-length (estimated, not measured). Outcrops of S dot the bottom. Flatfish swarm when start to move. Move to crack at base of rock outcrop with elemental S coating, best flow we have seen to date. Crab and flat fish right at vent.
12:43	336	12.773	26.968	Marker #9 deployed on N. wall base of pit. T = 128.6Cmax buried in seds within crack where water samples will be taken. MKR #9 on ledge above vent. MS White failed to withdraw, but did within the hour still in the pit = pit bkgd water. MS Blue fired as did GS Green and GT White. When taking T the water flow changed from clear to milky for some time.
12:51				While still taking T the video runs out and miss about one hour of dive (mostly taking water samples and rearranging the basket, but also the first rise part way up the wall).
13:51	337			Video 3 begins. Marker 9 in sight at base of pit after re-descending to redo video survey of wall.
13:56	337			MIN sample (#9) of extruded (worm-like) blob of elemental S placed in biobox. Taken from pit floor with flat fish all about; elongated pieces plus a more round blob.
13:57				Excellent video of the sulfur for PR
14:00				Moving to get another short of MKR #9, see more blobs of S now on the floor, wonder if just came out!
14:02				Area of most intense diffuse discharge (Tmax about 90C) just 4 m E of Mkr #9, also at base of wall. White altered rock, also source of milky plume. Red (Fe) and White staining on pillows at base.
14:05				Heading to south end of pit then coming back to north to come up the N wall face.
14:06	327			10 m up wall as position to rise.
14:09				Conglomerate stack; talus slope and large chunks of S block adjacent.
14:10				Sheer wall with dike features cross-cutting, some dikes (look like ash) cross-cut older dikes. About 4" or more in thickness. 14:10:53 excellent video of dikes on S wall. Terry sees very yellow, fresh splotches of s coming thru the wall in several places. Wall overhangs in several places.
14:16	296			See draping Fe-Si crusts for first time as we ascend (now 40 m up from pit floor). Terry sees S chimney structures,
14:18				Stopped at S chimney, brakes off at basket, light in wt, ash-color underneath.

14:20	276			Nearing top of pit, see live mussels, become thick all of a sudden at 272 m, 44 m above pit floor
14:22	270			Sample large batch of live mussels from clump, just knock off into biobox so many! Lots of bacterial mat on the clams.
14:28	260			Still climbing and heading E. Near rim. Pit about 80 m deep on this wall.
1431	257	12.808	26.924	80 m above pit floor! 80 m across. On rim. Clams at this site have worm-cast like coatings on them. Bacteria?
14:40	274	12.762	26.904	on N. rim, starting clockwise circumnavigation of cone on 290 contour.
14:45				On the circum trail, see mostly ash and fine talus mixed with white clam waste debris.
14:52	291	12.8	26.851	Near fissure or ridge structure on E slope. As we go around we see very sparce biology, which is nothing like we saw that was maxed at this depth on north face of cone, opposite the inside wall where the venting occurred and where the S abundance was great (est?).
15:12				Lots of bio-debris comes into view again.
15:13				Bio-debris, pillows have Fe-Si crust coating again.
15:14	292	12.769	27.037	Begin of live mussels, have heavy coating of filementous bacteria. Tmax at 17.4C in mussels. BIO sample (#11)
15:15				Huge grouper swims in front of camera.
15:18				Good shot of t-probe in mussels, down to rock, Terry sees schlerein. A
15:25				As leave mussel sample site, see it was isolated, but then get back into dense biology within the minute. Crust is again abundant, as saw when first came into this band from below.
15:28	287			Crossing dense bio-debris and life that we first saw on approach to cone.
15:31	289	12.739	26.95	Passed out of high biology zone, back to ash and small basalt talus as turn NE. Sitting in small 'razor clam'-like shells on ash as wait for position.
15:39	289			Cleared to leave bottom; where basket has dredged bottom, can see structure vertically within as, like bioturbation/discard.
15:44	290	12.745	26.93	Leave bottom
15:45				Video off as leave bottom
15:57	0			PISCES V on surface (13 min. ascent)
16:07				PISCES V secure on deck.