

## Okeanos Explorer ROV Dive Summary

Dive Information			
Dive Map			
Site Name	"Moki" seamount, ROV on bottom at ~2200 m		
ROV Lead(s)	Karl McLetchie		
Expedition Coordinator(s)/ Mapping Lead	Kelley Elliott / Meme Lobecker		
Science Team Lead(s)	Santiago Herrera (Biology) and Matt Jackson (Geology)		
General Area Descriptor	North Samoan region, Near southern margin of Manihiki Plateau		
ROV Dive Name			
Cruise	EX1702		
Leg			
Dive Number	07		
Equipment Deployed			
ROV	Deep Discoverer (D2)		
Camera Platform	Seirios		
ROV Measurements	<input checked="" type="checkbox"/> CTD	<input checked="" type="checkbox"/> Depth	<input checked="" type="checkbox"/> Altitude
	<input checked="" type="checkbox"/> Scanning Sonar	<input checked="" type="checkbox"/> USBL Position	<input checked="" type="checkbox"/> Heading
	<input checked="" type="checkbox"/> Pitch	<input checked="" type="checkbox"/> Roll	<input checked="" type="checkbox"/> HD Camera 1
	<input checked="" type="checkbox"/> HD Camera 2	<input checked="" type="checkbox"/> Low Res Cam 1	<input checked="" type="checkbox"/> Low Res Cam 2

	<input checked="" type="checkbox"/> Low Res Cam 3	<input checked="" type="checkbox"/> Low Res Cam 4	<input checked="" type="checkbox"/> Low Res Cam 5
	<input checked="" type="checkbox"/> LSS	<input checked="" type="checkbox"/> ORP	
Equipment Malfunctions	Midway through the dive, the video started flickering. The fiber optic power levels began to drop, and this led to concern that the controls might also be influenced. A decision was made to abort the dive and bring the ROV to the surface.		
ROV Dive Summary (from processed ROV data)	In Water:	2017-02-22T20:07:28.025000 11°, 10.235' S ; 169°, 53.627' W	
	Out Water:	2017-02-23T03:41:01.071000 11°, 10.502' S ; 169°, 54.139' W	
	Off Bottom:	2017-02-23T01:21:32.308000 11°, 10.007' S ; 169°, 53.533' W	
	On Bottom:	2017-02-22T21:46:54.550000 11°, 10.143' S ; 169°, 53.530' W	
	Dive duration:	7:33:33	
	Bottom Time:	3:34:37	
	Max. depth:	2116.3 m	
Special Notes			
Scientists Involved (please provide name, location, affiliation, email)	Asako Matsumoto, PERC, Chiba Institute of Technology, Japan Bruce Mundy, NOAA PIFSC Chris Mah, NMNH Smithsonian Institution Christopher Kelley, University of Hawaii at Manoa Deborah Glickson, NASEM Diva Amon, University of Hawaii at manoa Matthew Jackson, UC Santa Barbara Natalie Summers, University of Hawaii at Manoa Santiago Herrera, Lehigh University Tara Harmer Luke, Stockton University Timothy Shank, Woods Hole Oceanographic Institution		
Purpose of the Dive	<p>The goal of this dive was to generate baseline information on geology and geochemistry of this unexplored (and largely unmapped) seamount. There is also significant interest in understanding the deep sea habitats and biological communities on the seamount to better understand their diversity and distribution.</p> <p>Maps of the seamount were generated the night before, complementing existing data. From a geological standpoint, this seamount may be an older seamount linked to the Society hotspot, not Samoa. Samples from this seamount are key in defining the Society hotspot tracks back in time, and as such an age on a volcanic rock is needed from this seamount. Without an age, it is not possible to truly define plate motion for the time frame represented by this volcano.</p> <p>From the biological perspective this dive has the potential to provide new depth</p>		



	<p>records for several species as well the discovery of new species. Very little work has been done in the Central Pacific at these depths on seamounts. We aimed to collect information that will inform the biogeographic identity of the communities at abyssal depths in this region.</p>
<p>Description of the Dive</p>	<p>The seamount explored in this dive, tentatively called “Moki” seamount, lies on the northern region of the American Samoa EEZ. The seamount had been partially mapped before, but required additional mapping at higher resolution for dive site selection. Thus, the night before diving, much of the volcano was mapped. The seamount has a simple conical structure. There are a small number of scattered, smaller cones on the deep flanks of the seamount that may relate to a later stage of volcanism, but no such conical structures are visible on the shallower portions of the seamount (including the dive track of the ROV). The dive track targeted the largest continuous steep region visible in the bathymetry of the volcano. The dive track was designed to start at ~2200 m water depth, which is several hundred meters beneath the summit of the seamount. In the dive plan, the ROV will move upslope along a ridge toward to the summit. The ROV will traverse across the summit and finish at a depth of ~1900 m.</p> <p><b>The following geological description provides a chronological summary of the major geological features, or changes in the geology of the ocean floor, over the course of the dive:</b></p> <p><i>21:25:00.</i> The first view of the ocean floor revealed rough terrain, likely to be a ferromanganese encrusted (FE) rock outcrop. The outcrop appears to be constructed of pillow basalts, and &lt;1% of the surface is covered with a light-colored sediment. Panning out reveals that the outcrop is the edge of a steep wall that drops at least 10 meters below the ROV.</p> <p><i>21:35:05.</i> A small scree/talus flow is observed in a gully, and the rocks appear to be partially welded together. A small number of cobbles appear to be loose, including the first geologic sample. The first geologic sample was collected from this scree/talus slope; the rock is approximately 15 to 20 cm in diameter (the samples is wide and flat), and was placed in the starboard rock box. The ROV is &lt;300 m from the summit on this dive, so the rock could not have rolled very far:</p> <p><b>02_DIVE07_SPEC01GEO</b></p> <p><i>21:50:22.</i> A narrow (0.5 to 1 m) razor back ridge came into view as we summated the steep wall. The ridge is constructed of basalt and falls off precipitously (slope &gt;60 degrees) on both sides. Light-colored sediment cover increased to ~30%, and sediment shows evidence of spilling off the steeper rock faces. The ROV traversed along the 10 to 20 meter-long razorback ridge.</p> <p><i>21:52:18.</i> A sheer wall enters the view as the ROV leaves the razorback ridge to the left, and pillow lavas appear to be the primary rock type in the wall. At the top of a wall is a ridge. A camera zoom reveals well-developed FE deposits on the rock surfaces.</p> <p><i>22:02:35.</i> Another steep face is observed in the field of view. Again, the face is constructed of pillow basalts that have well-developed FM deposits on the surface.</p> <p><i>22:07:46.</i> The ROV continues to move upslope, and moves along another razor back ridge that is above the face that we observed. Fe encrusted pillow basalts dominate the field of view, and sediment constitutes &lt;20 to 30% of the surface</p>



cover.

22:22:00. The ROV reached the end of the razorback ridge and some small deposits of rock rubble are found on a shallow slope. The razorback ridge intersects with a steep face, and the ROV moved up the face. The face is composed of FE encrusted pillow basalts.

22:30:14. The ROV summited the face and continued to moved forward along another razorback ridge. Again, the ridge is composed of FE encrusted pillows. Light-colored sediment covers <10% of the rock surface.

22:46:00. The ROV moved onto a talus slope with scattered FE cobbles (<30 cm in diameter). None of the boulders were suitable for sampling. Sediment cover is ~50%. The ROV moved another 5 or 10 meters upslope and identified a promising rock sample. A FE cobble (angular, perhaps 20 cm in diameter) was taken as the second geological sample, which was laced in the port forward rockbox. The ROV is <300 m from the summit on this dive, so the rock could not have rolled very far:

**02\_DIVE07\_SPEC02GEO**

23:00:35. The talus deposits transition to a steeper face constructed of FE pillow basalts. Sediment cover is <5% on the steep face. At the top of the steep face is a ridge with a shallower-sloping face on the far side; the sediment cover is up to 60% on this far-facing side. Ripples are present in the sediment.

23:11:40. The ROV entered a talus field with RE cobbles and boulders. An angular block (30 cm by 20 cm) was chosen for sampling. The rock was placed in starboard side rock box, and is the larger of the two rocks in the box. The ROV is <300 m from the summit on this dive, so the rock could not have rolled very far:

**02\_DIVE07\_SPEC03GEO**

23:42:41. The ROV has left the talus field and has moved up on a steeply-sloping face composed of FE-encrusted pillow basalts. Light-colored sediment covers <5% of the surface.

00:05:25. The ROV crested the steep face and arrived on a flatter, more level surface. The surface is composed of basalt flows and is lightly (<10%) sediment covered.

00:09:27. The surface brakes up into basalt rubble including cobble and boulder-sized basalt (~30% of the surface), with ~50% of the surface composed of solid flows and 10 to 20% composed of light-colored sediment.

00:11:55. The field of view is comprised completely of boulders and cobbles (70%) and light-colored sediment (30%).

00:12:35. The ROV approached a relatively steep (perhaps 40 degrees, rough estimate) slope composed of FE pillow basalts.

00:33:28. The steeper surface has very nice pillow structures with perhaps 2% sediment cover, confined to crevasses in the pillows.

00:38:18. Reaching the surface of the steep face the ROV arrived on a FE basaltic ridge. The ridge is 2 or 3 meters wide, and slopes steeply (perhaps 45 degree slope) to the left and to the right. Sediment cover approached 25% on the left-hand ridge, and <5% on the right hand ridge. This might suggest stronger currents on the left hand side of the ridge.

01:04:02. Moving upslope along the ridge, FE basalt flows fill the field of view, and ~10% of the surface is covered with sediment.

01:12:16. The ROV moved into a talus field composed of FE cobbles. 30 to 40% of the field of view shows sediment cover. Some FE outcrops, composed of pillow basalts, are also clear.

01:21:57. The ROV emerged from the talus field and moved up a steeply sloping face composed of FE pillow basalts. Sediment cover is <2%. However, at some locations along the face, there are less steeply sloping areas where larger



quantities of sediment have accumulated and sediment cover increases to perhaps 30%; on these less steeply sloping areas it appears that cobbles have accumulated and are welded (via FE) to the face of the slope.

01:47:36. The ROV is continuing along above the surface of the same steep wall from the prior observation.

01:48:23. The slope of the wall has diminished a bit, permitting additional sediment accumulation (perhaps 40% sediment cover); additionally, loose cobbles are present in abundance in this region of diminished slope.

01:51:31. The ROV summits the face and has arrived on a 2 to 3 meter wide ridge that has a rather shallow slope. To the left and right of the ridge the slope is relatively steep (30 to 40 degrees).

**The biological perspective is as follows:**

Landed on very steep terrain, exposed boulder MANY chrysogorgiid octocorals *Pleurogorgia*, very similar to the ones observed yesterday in Utu seamount. Also observed 3 occurrences of ophiacanthid brittle star ophiuroid possibly genus *Ophioplinthaca* 2215 m Moki Seamount. As yesterday's dive on Utu, this kind of ophiuroid was associated with bare skeleton of the octocoral (possibly feeding on it), novel observation. Also two morphospecies of zoanthids growing on the *Pleurogorgia* corals, as well as small anemones and hydroids. Intermixed with the live *Pleurogorgia* colonies also saw many dead colonies exposed skeletons colonized by zoanthids and worms. Also observed a feather black coral (*Bathypathes?*), a whip black coral, as well as a very large (taller than 2m) bamboo whip with no needle sclerites in polyps. A small mostly dead bamboo whip with only 3 polyps near the base; no colonization of the bare skeleton indicating a recent loss of tissue (predation?).

Continued climbing along steep terrain of exposed rock. 2107 m 22:21. Imaged a sea star *Chiraster?* Observed a couple of whip black corals. Observed a *Iridogorgia* coral with a squat lobster and anemone associate at 22:34 ~2091 m. Also observed a *Chrysogorgia* with two squat lobsters associated. Also observed a living whip slender bamboo whip (similar to the dead one observed earlier; this one had needle sclerites in/and sticking out of polyps. Observed a drifting sea cucumber at 2085m 22:51.

Abundant exposed rock but not too many corals or sponges attached to 2060m 23:12. Observed small juveniles of chrysogorgiid octocorals and black corals. Encountered a large vertical wall at 2037 m with large 22:45 bamboo whips, *Iriogorgia* golden corals (including one larger, a large *Chrysogorgia* with 2 squat lobsters, many *Pleurogorgia*.

Encountered another flat-wall step at 2021 m 00:14. Observing many swimming tomopterid? polychaetes throughout the dive. Seen a water layer with a lot of suspended particles here. Attempted to collect cookie star but failed ☹️ 00:24.

Found large abundances of dead coral holdfasts (branching corals) indicative of old coral communities living on this seamount in the past (sometimes thousands to hundreds of thousands of years given that some are covered with iron manganese crust). Most of them belonged to branching corals which are not currently present here.

Troubleshooting vehicle issues 00:42 at 2005 m. 00:48 continuing with the dive

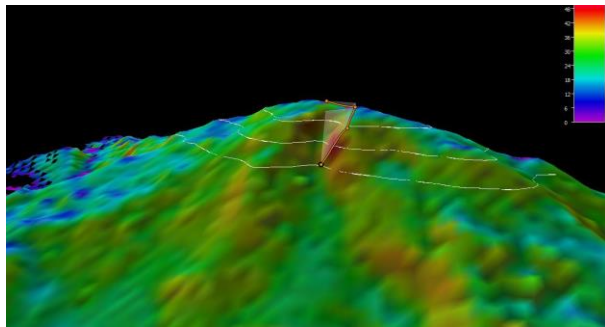


(slight power problems with some video and data systems of the ROV). Observed first (and only) fish of the dive at 2000m (halosaur). Collected *Chrysogorgia* with a squat lobster and hydroid associates (D2\_DIVE07\_SPEC04BIO 01:11, 1993 m)

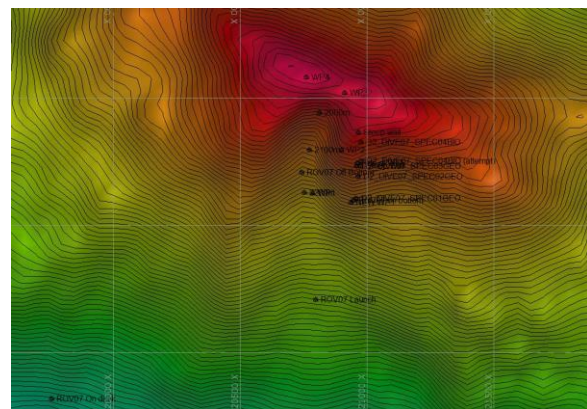
Observed corallimorpharian at 01:15 ~1985 m. As we ascend near the top the terrain has a gentler slope with broken talus and pockets of sediment. Encountered another steep vertical wall at 1960 m 01:25. Observed very large abundance of octocorals, primarily *Pleurogorgia* corals with yellow small comatulid associates, anemones, brisingid sea stars, as well as *Ophioplinthaca* ophiuroids. The later were also observed moving on the seafloor. Also observed several large branched isidid colonies, likely from the genus *Jasonisis* with a sponge and hydroids attached on bare skeleton parts. Also on this wall observed one hexactinellid glass sponge (first and only of the dive) as well as large *Iridogorgia* colonies and whip bamboo corals.

Problems with vehicles at ~1920 meters 01:50. Came off bottom near the top of the wall (almost at the top of the seamount) and after assessment of situation the dive was ended. Could not reach highest point of seamount.

Overall Map of the ROV Dive Area



Close-up Map of Main Dive Site



Representative Photos of the Dive





EX1702\_IMG\_20170222T233907Z\_PTMAN\_COR\_CLIFF....



EX1702\_IMG\_20170223T000237Z\_ROVHD.jpg

**Steep terrain with light sedimentation. Chrysogorgiid and bamboo whip corals attached to surface.**

**Large *Iridogorgia* coral colony and *Pleurogorgia* on a near-vertical wall.**

### Samples Collected


#### Sample

Sample ID	02_DIVE07_SPEC01GEO	
Date (UTC)	20170222	
Time (UTC)	21:38:29	
Depth (m)	2115.9718	
Temperature (°C)	2.0344	
Field ID(s)	Rock	EX1702_IMG_20170222T213800Z_D2_DIVE07_SPEC01...

Comments

#### Sample




Sample ID	02_DIVE07_SPEC02GEO	
Date (UTC)	20170222	
Time (UTC)	22:58:24	
Depth (m)	2075.9465	
Temperature ( ° C)	2.1006	
Field ID(s)	rock	EX1702_IMG_20170222T225740Z_D2_DIVE07_SPEC02...
Comments		

### Sample

Sample ID	02_DIVE07_SPEC03GEO	
Date (UTC)	20170222	
Time (UTC)	23:20:42	
Depth (m)	2054.8783	
Temperature ( ° C)	2.1014	
Field ID(s)	Rock	EX1702_IMG_20170222T231832Z_ROVHD.jpg
Comments		

### Sample

Sample ID	D2_DIVE07_SPEC04BIO	
Date (UTC)	20170223	
Time (UTC)	01:10:44	
Depth (m)	1993 m	
Temperature ( ° C)	Sensors not transmitting data	
Field ID(s)	Chrysogorgia with squat lobster	EX1702_IMG_20170223T010916Z_D2_DIVE07_SPEC04...



Comments	Likely associate hydroid as well
<b>Sample</b>	
Sample ID	
Date (UTC)	
Time (UTC)	
Depth (m)	
Temperature ( ° C)	
Field ID(s)	
Comments	
<b>Sample</b>	
Sample ID	
Date (UTC)	
Time (UTC)	
Depth (m)	
Temperature ( ° C)	
Field ID(s)	
Comments	

**Please direct inquiries to:**

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