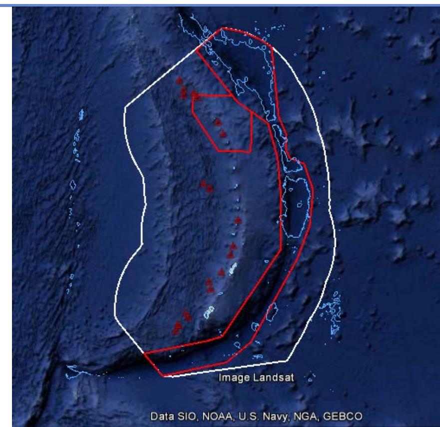
OKEANOS EXPLORER ROV DIVE SUMMARY

Site Name	Northern Forearc Ridge		
ROV Lead/Expedition Coordinators	Jim Newman/ Kasey Cantwell		
Science Team Leads	Shirley Pomponi (HBOI-FAU, CIOERT) Patty Fryer (UH)		
General Area Descriptor	Areas in and around the Marianas Trench Marine National Monument		
ROV Dive Name	Cruise	Leg	Dive Number
	EX1605	3	DIVE11
Equipment Deployed	ROV:	Deep Discoverer	
	Camera Platform:	Seirios	
ROV Measurements	☒ CTD	☒ Depth	☒ Altitude
	☒ Scanning Sonar	☒ USBL Position	☒ Heading
	☒ Pitch	☒ Roll	☒ HD Camera 1
	☒ HD Camera 2	☒ Low Res Cam 1	☒ Low Res Cam 2
	☒ Low Res Cam 3	☒ Low Res Cam 4	☒ Low Res Cam 2
Equipment Malfunctions			
ROV Dive Summary (From processed ROV data)	Dive Summary: EX1605L3_DIVE11 ^^ In Water: 2016-06-27T20:29:21.215000 22°, 23.802' N ; 145°, 12.665' E Out Water: 2016-06-28T06:35:32.726000 22°, 23.671' N ; 145°, 13.443' E Off Bottom: 2016-06-28T04:19:29.289000 22°, 24.178' N ; 145°, 12.826' E On Bottom: 2016-06-27T23:04:01.415000 22°, 24.118' N ; 145°, 13.012' E Dive duration: 10:6:11 Bottom Time: 5:15:27 Max. depth: 4428.0 m		
Special Notes			
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(please provide name / location / affiliation / email)			
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Purpose of the Dive

Investigation of an unknown feature with the morphology and position (relative to the trench axis) to be a serpentinite mud volcano. This dive investigated the scarp to the east of the edifice to search for exposures of flank mudflow sequences dissected by submarine erosion.

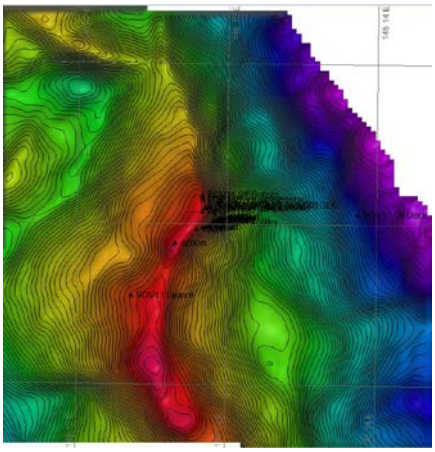
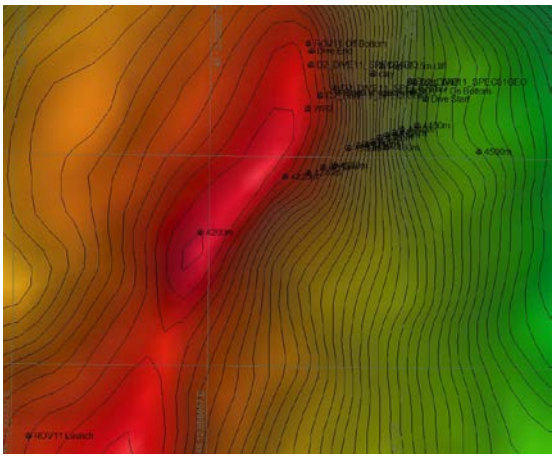
Description of the Dive:

ROV *Deep Discoverer* (D2) approached the sea floor at ~4422 m depth on a steep wall of highly fractured (in at least 3 intersecting directions) pale-brown to pale-gray rock. The slope had a series of ridges 10 to 20 m wide with and narrower channels (or chutes) between them, down which talus had fallen. The face of the wall was cut by numerous thin white veins snaking across the exposed surface at a variety of angles. Looking north along the wall, its face is dipping eastward at about 50° (at 23:09:14 UTC). SPEC01GEO, a mafic medium-grained rock, was collected from an area of the wall with a few exposed rocks (at 21:13:30 UTC). It did appear to be in situ within the layer of the wall from which it was recovered. The video from *Seirios* of D2 (at 23:36:56 UTC) showed the width of the ridge as ~20 to 30 m wide, although the width was quite variable as we rose along it, narrowing to "knife-edged" in some places. There were some very small patches of red staining on the wall at about 4,390 m. At about 4325 m there was a distinct white layer, roughly 20 to 30 cm thick, containing pebbles and cobbles that covered the top of the ridge the ROVs were transiting up. It made an angle to D2 (heading of 245°) of ~20° (at 00:44:45 UTC) and on zoom it was clearly draping the underlying surface. The ROV rose to the top of the ridge and the top of the white layer was covered with sediment and topped by cobbles and a few boulders. Just above this point, at 4314 m, D2 encountered a patch of pale-gray rock, draped with talus, and the ROV nudged the bottom, discovering that the gray material was clay-like. Above this depth there were more outcropping sequences of finely- to coarsely-layered dark-brown material (sediment?). There were also layers of variable thicknesses of blue-gray and yellow-tan sequences. The latter sometimes contained rocks of varying sizes. It should be noted that the entire eastern-facing wall of the ridge was intermittently covered with talus and/or finer unconsolidated sediment during the entire dive. At the top of the ridge, its surface was thinly sedimented, with occasional small, to cobble-, to boulder-sized rocks. As we drove the ROV along the crest of the ridge, we also flew the ROV down the side of the ridge wall a few times to examine its steep face, and saw layers of varying thicknesses of these same clay-like sequences interlayered with the darker, brown sediments(?).

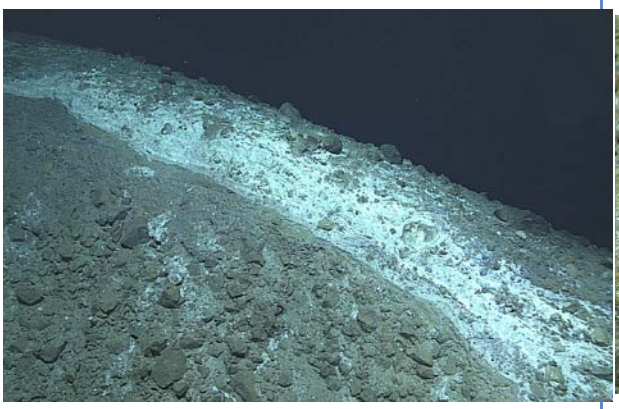
Although the biology was “sparse”, it was also exciting. There were very few benthic (or even midwater) organisms observed—a few squat lobsters, a tiny stalked crinoid and a comatulid (unstalked) crinoid with long cirri (both likely new species, according to Allison Miller, U Guam), and only 2 species of sponges—one hexactinellid and one demosponge (both new species). This prompted a discussion about the scarcity of food in the deep sea and taking advantage of food that’s there. All of our shore-based biology team members had some interesting facts to share about this and other adaptations to life in the deep sea:

- Tara Harmer Luke (Stockton University) explained: Food is scarce and so is the biology; organisms are adapted for not feeding very often or for eating food of different sizes. It takes a long time for particles to drop from the photic zone to this depth, and on the way, there are many other organisms that feed on these particles.
- We saw a few beautiful pelagic polychaetes, and summer intern Nolan Barrett (participating from the HBOI-FAU ECC) reminded us that the delicate setae on these worms are adapted for swimming, so it’s unlikely that they can creep along the bottom and scavenge.
- Bruce Mundy (NOAA Fisheries, participating from the Inouye Regional Center ECC) explained that the cusk eels we observed feed on bottom-living polychaetes and crustaceans. One of the species we saw has large eyes, but with no lenses; it can see bioluminescence but cannot form images. The eyes look prehistoric; the absence of a lens makes them look like dark pools, giving the fish a deathlike stare.
- Scott France (U Louisiana at Lafayette) explained that the anemone living on the pagurid crab we saw actually secretes a chitinous carapace for the crab it’s living on—so the crab doesn’t outgrow its carapace and the anemone doesn’t lose its home.

- There was also a shrimp with really long antennae, on which leeches were attached!

Overall Map of ROV Dive Area	Close-up Map of Main Dive Site
	

Representative Photos of the Dive

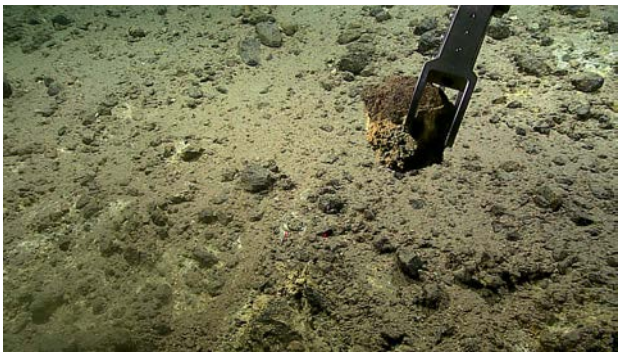
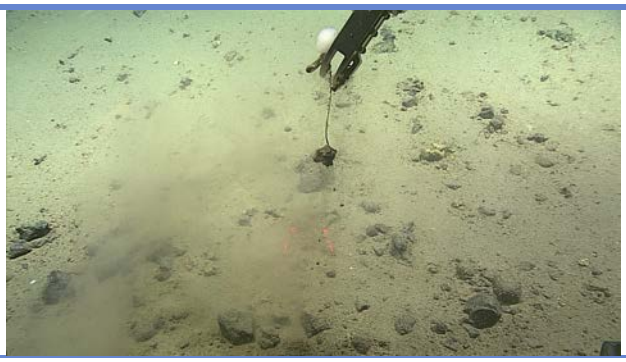
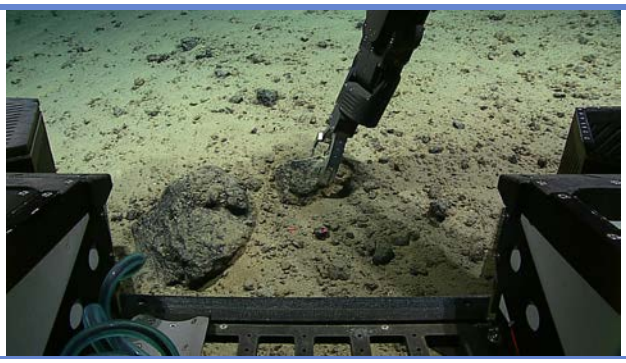


This image shows a sharp contact between the typical dark layer (below) of unsorted talus, which made up most of the slope, and a pale layer containing many cobble- to boulder-sized rocks in a fine-grained matrix.

The anemone on this pagurid crab secretes a chitinous carapace for the crab, so that the crab doesn't outgrow its carapace and the anemone doesn't lose its home.

Samples Collected

Sample ID	SPEC01GEO
Date (UTC)	20160627
Time (UTC)	232044
Depth (m)	4413.55
Temperature (°C)	1.49

Field ID(s)	ROCK	
Comments	26x22x15, rock split open during recovery. Mafic igneous rock.	
Sample ID	SPEC02GEO	
Date (UTC)	20160628	
Time (UTC)	022619	
Depth (m)	4238.21	
Temperature (°C)	1.48	
Field ID(s)	ROCK W/ SEDIMENT; POSSIBLY MANGANESE COATED	
Comments	15x13x13, rock with serpentenized peridotite mud clinging to surface.	
Sample ID	SPEC03BIO	
Date (UTC)	20160628	
Time (UTC)	025258	
Depth (m)	4224.48	
Temperature (°C)	1.47	
Field ID(s)	HEXACTINELLIDA	
Comments	Long spicules anchoring it into sediment	
Sample ID	SPEC04BIO	
Date (UTC)	20160628	
Time (UTC)	034520	
Depth (m)	4207.1	
Temperature (°C)	1.47	
Field ID(s)	COMATULID CRINOID WITH LONG CIRRI	
Comments	Anchored on rock. Has gonadal tissue.	

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