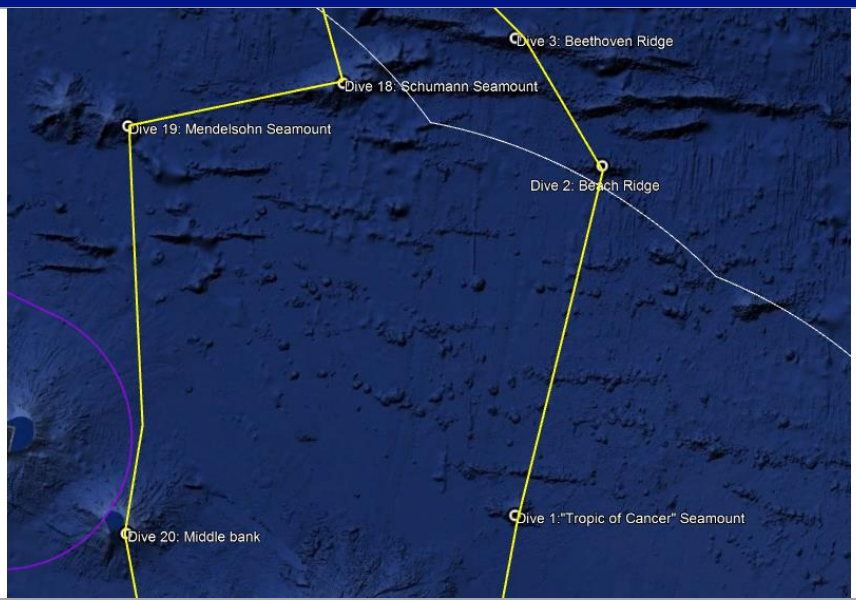
Ocean Exploration and Research

Okeanos Explorer ROV Dive Summary

Dive Information			
General Location			
General Area Descriptor	Just outside of PMNM, US EEZ Hawaii		
Site Name	Middle Bank		
Science Team Leads	John R. Smith/Meagan Putts		
Expedition Coordinator	Kasey Cantwell		
ROV Dive Supervisor	Karl McLetchie		
Mapping Lead	Mike White		
ROV Dive Name			
Cruise	EX1708		
Leg	-		
Dive Number	DIVE20		
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 5
Equipment Malfunctions			

ROV Dive Summary (from processed ROV data)

Dive Summary: EX1708_DIVE20

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In Water:	2017-09-26T18:26:12.198000 22°, 45.217' N ; 160°, 55.808' W
Out Water:	2017-09-27T02:23:51.628000 22°, 45.330' N ; 160°, 55.848' W
Off Bottom:	2017-09-27T02:00:25.761000 22°, 45.281' N ; 160°, 55.957' W
On Bottom:	2017-09-26T18:57:15.580000 22°, 45.249' N ; 160°, 55.692' W
Dive duration:	7:57:39
Bottom Time:	7:3:10
Max. depth:	477.7 m

Special Notes

Scientists Involved (please provide name, location, affiliation, email)

Name	Email	Affiliation
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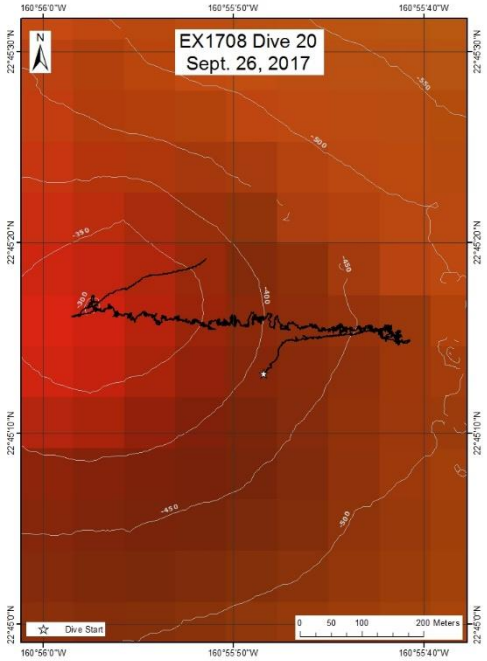
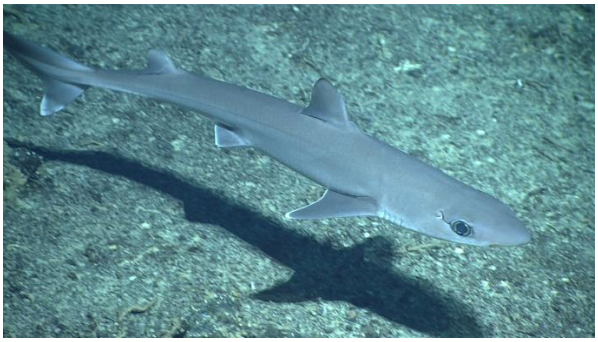
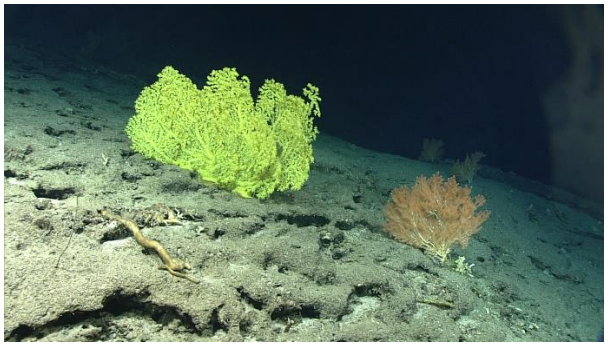
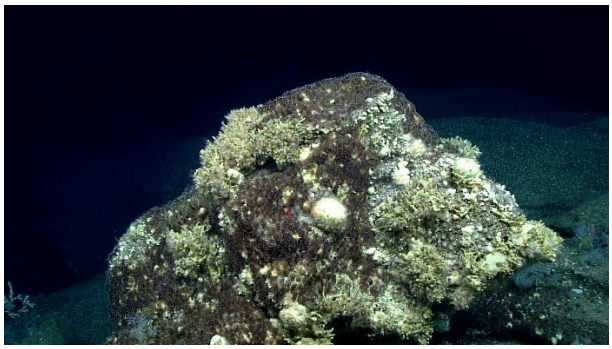
Purpose of the Dive	This dive, located just outside the boundary of PMNM, was carried out at the request of the Monument staff and NOAA NOS NCCOS. The objectives were 1) to explore fish and invertebrate boundary communities and 2) ground truth coral habitat suitability and taxonomic richness models based on multibeam sonar bathymetry and slope data. Management unit species within the precious coral and bottomfish fisheries were of particular interest. The selection of this dive site on Middle Bank was based on high-resolution multibeam bathymetry, slope, and backscatter data revealing the presence of a pinnacle feature that likely had populations of bottomfish and precious corals. In addition, regional coral habitat suitability models indicated it was close to an area that had high potential habitat suitability for the occurrence of seven or more genera of coral species. Draft models were produced as a collaborative effort by NOAA NOS NCCOS as part of a BOEM-funded Biogeographic Assessment of the Main Hawaiian Islands. More information about the project can be found at: http://coastalscience.noaa.gov/projects/detail?key=163.
Description of the Dive	Geological setting: Dive #20 investigated a conical feature primarily of volcanic origin that is located on top of the carbonate platform of Middle Bank. The field interpretation is that it formed as a result of secondary volcanism, long removed from the primary shield building stage of volcanism that formed the bulk of the edifice. The above or near sea level portion of Middle Bank has long since eroded away and the bank has undergone subsidence, or sinking, as it moved off the Hawaiian hot spot plume, thanks to the northwestward motion of the Pacific tectonic plate. While the cone that ROV Deep Discoverer (D2) dove on is mainly a result of constructional volcanism, it does report a somewhat complex geological history. It appears to have undergone episodes of volcanism of various types (volcaniclastics and lava) alternating with periods of reef growth, suggesting that either the cone remained at least mostly submerged or that it emerged and resubmerged with varying stands of sea level. Repeated episodes of volcanism and/or emergence/resubmergence may explain the massive amounts of dead deep-sea coral trees collecting at the base of the cone and upper slope. Dive log: ROV *Deep Discoverer* (D2) arrived on bottom at time 16:57 at 475 m water depth near the base of the cone. The seafloor was a flat and featureless brown hard surface, only interrupted by thin carbonate-like layers. Two Dogfish sharks (*Squalus mitsukurii*) and corals (Primnoidae, *Ennalopsammia* sp. “purple’) were observed in close proximity. A gentle slope collecting a large amount of dead coral trees was seen at 476 m. D2 began imaging “dissolution holes” in the pavement surface suggesting it is composed of carbonate. The first documented precious coral on Middle Bank, a *Hemicorallium* sp. pink coral, was observed at time 19:14 (475 m) underneath a large *Acanthogorgia* sp. coral, followed by an Asterophiura sp. brittle star perched on top of an long dead gold coral branch at time 19:18 (475 m). Darker outcrops and ledges came into view, suggesting a volcaniclastic composition at 471 m. The dark matter also

	surrounded (flowed around?) some rugose and lighter colored (tan) outcrops likely to be fossil coral reef. The slope increased from flat to 20-30°, which remained generally consistent for most of the dive until D2 rose closer to the summit. More inclined outcropping slabs with dissolution beneath came into view at 470 m. The depth of 470-471 meters may mark the transition between all carbonate and mixed mode substrate, at least on this one dive track. A suspended ledge "tongue" with many corals on the tip was observed at time 19:47 and Codling, *Laemonema rhodochir* at time 19:54. Close-ups of the dark material forming a ledge showed a tan colored matrix speckled with shiny black bits –all highly confusing. To add to that, a thin vein of tan material persisting between layers of dark material on an incline were observed at time 20:12. To help alleviate the confusion, a wide view of a carbonate tongue (tan) surrounded by tuff (volcaniclastic, dark) was captured at time 20:20 (455 m). A close-up a monkfish, *Lophiodes micanthus*, was obtained at time 20:20 (455 m). More contacts with tongues of dark material flowing through and around tan substrate, with numerous gold, *Kulamanamana haumeaae*, and bamboo corals, *Acanella* sp. and *Orstomisis* sp., at 449 m. A *Plinthaster* sp. cookie star was imaged at time 20:31 (448 m). No available rocks had been seen until a collection of a lone angular talus piece from the open and featureless slope was collected at time 20:44 (447 m). Later examination aboard confirmed it was of volcanic origin, likely basalt, although highly altered and brown in color outside. It was split open along an existing crack and the matrix and numerous clasts were found to be reddish-orange with no vesicles. Gold corals abound in this location with the present current flow from the north at ~0.5 knot. An example of the "Midas" growth stage of a bamboo coral being recolonized by a gold coral was imaged at time 20:52 (443 m). An orange-red *Leiopathes* sp. coral with two nearby squat lobsters were seen at time 20:57 (439 m) and two specimens of black coral were collected at 405 m. A large school of Amberjacks, *Seriola durmerili*, were first seen at 397 m and likely the same school persisted throughout the remainder of the dive. The slope increased to ~45° at 378 m with the same alternating tan and dark substrate. A pencil urchin, *Stereocidaris hawaiiensis*; scleractinian coral, *Eguchipsammia* sp.; and a colorful squat lobster, *Eummunida* sp., were observed between times 23:18 to 23:39 and a wiry white plexaurid coral was collected at 23:33 (374 m). A close-up of a gold coral base showed on-lapping of the dark (volcaniclastic?) material, indicating that the eruption events were coeval with at least the older corals. This may explain the large number of dead gold coral bases found on the slope and at the base of this cone. A *Chaunax umbrinus* angler fish with bright orange and yellow camouflage pattern along with a number of small sponges were imaged at time 00:00 (359 m). A Bandfish, *Owstonia hawaiiensis*, was imaged at time 00:06 (356 m), apparently somewhat unusual in these environs. A nice wide view of the tan material over dark was had at time 00:07 (352 m). Some shimmering water had been observed and the temperature varied by ~1° during these episodes, this time at 00:18 (332 m). It may be explained by water mass mixing at these relatively shallow depths as no geologic, hydrologic, or hydrothermal activity is thought to presently be active on Middle Bank. Interestingly, the pilots reported that the ambient temperature dropped when the shimmering was observed. Possible cooling fractures in the volcanic (dark) material were observed running up and downslope at time 00:25 (335 m). Possibly a new fish, orange with big black eyes, that stumped the experts was imaged at time 00:30 (330 m). The assemblage of black coral trees was noted to be getting denser and larger as the summit was approached. At time 00:45, D2 came upon vertical walls of massive outcrop with densely packed black corals lining all edges of the rocks composed of the tan material. Another raised vertical ledge of tan material covered with many black corals was traversed, along with a derelict piece of fishing line, at time 00:52 (312 m). Another local high, a false summit ridge, was ascended at time 01:04 (307 m). The substrate

	soon after became confusing again, looking like volcanic tuff but not as dark as before, now in between the dark and tan material – perhaps brown. An *Antipathella* sp.? coral was collected at time 01:24 (304 m) since it is by far the dominate species on the upper portion of this cone feature. A "conger-gation" of nine large eels, *Conger oligoporus*, peering out of a gap in a large outcrop was seen at time 01:33 (301 m). D2 descended into a gully between massive outcroppings of brown material at time 01:42, and after rising to the top a "living rock" of anemones, demosponges, corallimorpharians, etc. covering its entire observable surface was documented at time 01:47 (295 m). The anemones were also seen to carpet the tops of nearby outcrops into the distance carpeting the rock face, mimicking the look of Mn-crust, even resembling basalt with vesicles at a distance! Undulating surfaces of massive outcrops with fractures, gulleys, and isolated blocks were observed on the last run along the summit at time 01:53. D2 left bottom at time 02:00 from a water depth of 296 m as a large school of small fish quickly swam underneath the ROV.

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

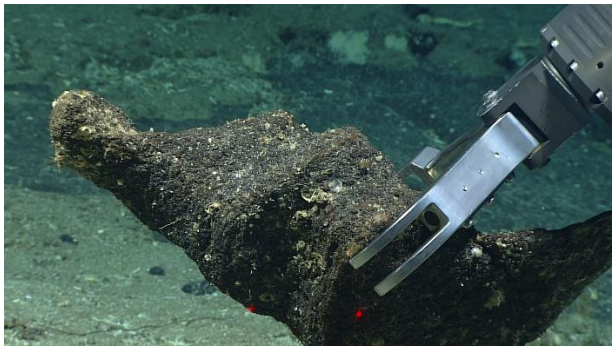
Representative Photos of the Dive	
	

Curious green-eyed dogfish, *Squalus mitsukurii*, swiftly swimming by D2	A before and after shot of colonization by gold coral (left), Kulamanamana haumeaae, and likely host colony species, bamboo coral (right), *Acanella* sp.
	
Large school of Amberjacks, Seriola durmerili, boldly circling D2	Large boulder 100% covered with demosponges, anemones, corallimorpharians and more!

Samples Collected

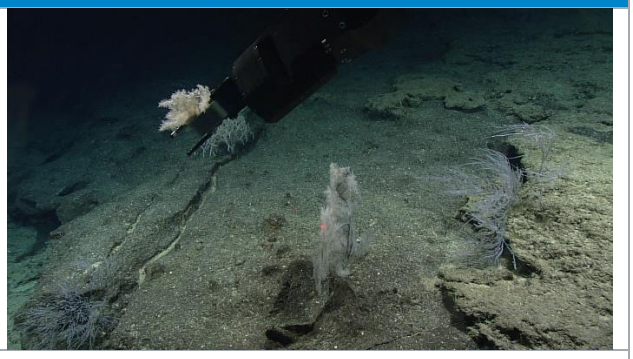
Sample

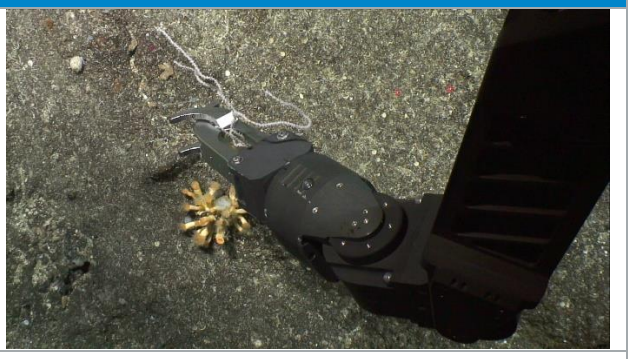
Sample ID	EX1708_D2_DIVE20_SPEC01GEO
Date (UTC)	9/26/2017
Time (UTC)	20:45
Depth (m)	447.7
Temperature (°C)	8.8
Field ID(s)	Angular basalt talus from open slope. Brown in color. Split open along existing crack to reveal that the matrix and numerous clasts are reddish-orange in color with no vesicles.



Commensal ID and Field Identification	EX1708_D2_DIVE20_SPEC01GEO_A01 Demosponge Encrusting EX1708_D2_DIVE20_SPEC01GEO_A02 Poriferan EX1708_D2_DIVE20_SPEC01GEO_A03 *Hemicorallium* sp. EX1708_D2_DIVE20_SPEC01GEO_A04 Scleractinia Single Polyp 1 EX1708_D2_DIVE20_SPEC01GEO_A05 Scleractinia Colonial Polyps 2 EX1708_D2_DIVE20_SPEC01GEO_A06 Scleractinia Colonial Polyps 3 Dead EX1708_D2_DIVE20_SPEC01GEO_A07 Hydrozoan EX1708_D2_DIVE20_SPEC01GEO_A08 Bryozoan
Comments	

Sample		
Sample ID	EX1708_D2_DIVE20_SPEC02BIO	
Date (UTC)	9/26/2017	
Time (UTC)	22:27	
Depth (m)	405.1	
Temperature (°C)	9.9	
Field ID(s)	*Myriopathes* sp.	
Commensal ID and Field Identification	EX1708_D2_DIVE20_SPEC02BIO_A01 Scalpellidae	
Comments		

Sample		
Sample ID	EX1708_D2_DIVE20_SPEC03BIO	
Date (UTC)	9/26/2017	
Time (UTC)	22:33	
Depth (m)	404.2	
Temperature (°C)	10.1	
Field ID(s)	*Myriopathes ulex*?	
Commensal ID and Field Identification		
Comments		

Sample		
Sample ID	EX1708_D2_DIVE20_SPEC04BIO	
Date (UTC)	9/26/2017	
Time (UTC)	23:33	
Depth (m)	374.4	
Temperature (°C)	10.5	
Field ID(s)	Plexauridae	
Commensal ID and Field Identification	EX1708_D2_DIVE20_SPEC04BIO_A01 Actinarian	
Comments		

Sample		
Sample ID	EX1708_D2_DIVE20_SPEC05BIO	
Date (UTC)	9/27/2017	
Time (UTC)	01:24	
Depth (m)	305.0	
Temperature (°C)	12.3	
Field ID(s)	*Antipathella* sp.?	
Commensal ID and Field Identification	EX1708_D2_DIVE20_SPEC05BIO_A01 Actinarian	
Comments		

Please direct inquiries to:

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