


OKEANOS EXPLORER ROV DIVE SUMMARY

Site Name	Exocet Seamount			
ROV Lead/Expedition Coordinator	Brian Bingham/ Brian Kennedy			
Science Team Leads	Andrea Quattrini and Mike Cheadle			
General Area Descriptor	Puerto Rico and US Virgin Islands			
ROV Dive Name	Cruise Season	Leg	Dive Number	
	EX1502	3	DIVE11	
Equipment Deployed	ROV:	Deep Discoverer		
	Camera Platform:	Seirios		
ROV Measurements	<input checked="" type="checkbox"/> D2 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"/> ROV HD 2	<input checked="" type="checkbox"/> Seirios CTD	
	<input checked="" type="checkbox"/> Temperature Probe	<input checked="" type="checkbox"/> D2 DO Sensor	<input type="checkbox"/> Seirios DO sensor	
Equipment Malfunctions	Operating with a secondary DO sensor that was last calibrated in 2013			
ROV Dive Summary (From processed ROV data)	Dive Summary: EX1502L3_DIVE11			
	^.....^			
	In Water at:	2015-04-28T10:48:19.250000 18°, 01.891' N ; 064°, 19.440' W		
	Out Water at:	2015-04-28T20:15:14.671000 N/A ; N/A		
	Off Bottom at:	2015-04-28T19:04:40.515000 18°, 01.738' N ; 064°, 20.196' W		
	On Bottom at:	2015-04-28T13:28:57.046000 18°, 01.809' N ; 064°, 19.650' W		
	Dive duration:	9:26:55		
	Bottom Time:	5:35:43		
Max. depth:	2900.7 m			
Special Notes				

Scientists Involved <i>(please provide name / location / affiliation / email)</i>	Amy Baco-Taylor	Florida State University	abacotaylor@fsu.edu
	Bernard Ball	Duke University Marine Lab	bernie.ball@duke.edu
	Jason Chaytor	USGS	jchaytor@usgs.gov
	Mike Cheadle	University of Wyoming	cheadle@uwyo.edu
	Amanda Demopoulos	USGS	ademopoulos@usgs.gov
	Mike Ford	NOAA Fisheries	michael.ford@noaa.gov
	Scott France	University of Louisiana at Lafayette	france@louisiana.edu
	Graciela Garcia-Moliner	Caribbean Fishery Management Council	graciela.garcia-moliner@noaa.gov
	Christopher German	WHOI	cgerman@whoi.edu
	Christopher (Chris) Mah	National Museum of Natural History (Smithsonian)	brisinga@gmail.com
	Cheryl Morrison	USGS	cmorrison@usgs.gov
	Andrea Quanttrini	USGS	aquattrini@usgs.gov
	Taylor Heyl	WHOI	theyl@whoi.edu
	Thomas Ritter	Montana State University Woods Hole Oceanographic Institution	thomas.ritter@msu.montana.edu
	Santiago Herrera	Woods Hole Oceanographic Institution	tiagohe@gmail.com
	Timothy Shank	Delaware Museum of Natural History	tshank@whoi.edu
Liz Shea	NMFS National Systematics Lab	eshea@delmnh.org	
Michael Vecchione	University of Hawaii	vecchioni@si.edu	
Christopher Kelley		ckelley@hawaii.edu	

Purpose of the Dive

- i) To carry out five 10 minute horizontal traverse mid water transects every 100m from 800-1200m to observe mid-water biology.
- ii) To document benthic communities living on and around the eastern margin of Exocet Seamount
- iii) To determine the lithology and geological structure of the eastern margin of Exocet Seamount
- iv) To compare the fauna found on Exocet with that found on seamounts to the north-east (Dog, Conrad & Noroit) and west (Grappler and Whiting)

Description of the Dive:

This dive was the first ROV dive on Exocet Seamount, which is a poorly understood seamount that is bathymetrically complicated and has not been the subject of seismic surveying. The dive began at 10:40 UTC. D2 descended to 800m at 11:25 UTC and began to carry out the mid water transects. The transects were complete at 12:58 UTC and D2 headed down towards 2900m. The ROV landed on a soft sediment, pteropod shell hash covered seafloor at 2898m (13:30 UTC). A sea-poke test showed the sediment to be >75 cm deep (2897m, 13:39 UTC). The dive then proceeded due west reaching the bottom of the slope at 2881m (14:07 UTC) and then headed in a direction of 260, up a relatively continuous slope (mean dip 32°) until the dive ended at 2385m water depth (19:05 UTC). There was a negligible surface current at the start of the dive and little current on the seafloor.

Geology:

This dive was the most difficult dive to interpret in terms of the geology, because the lack of previous exploration on Exocet Seamount, and its likely structural complexity means there is no background framework to help constrain the geological observations. Additionally, all but one exposure was Fe-Mn coated, making rock identification difficult. Consequently, the interpretation of the outcrops is very tentative in the lower part of the dive.

The dive started with D2 landing on a planar, very gently sloping, sediment covered surface at 2898m (13:30 UTC). The sediment was very fine grained (muddy), and contained copious amounts of shell debris, notably pteropod shells (2890m, 13:57 UTC). D2 proceeded due east over the gently sloping muddy surface and the narrow talus apron to the main seamount slope was reached at 2881m (14:07 UTC). The presence of scour marks around the base of the talus boulders indicated current activity. Near the base of the hill slope, the ROV changed heading to 260 and followed this heading

until the end of dive at 2385m. A steep slope of boulder covered outcrop was reached at 2879m (14:08 UTC), and this style of exposure continued for approximately 100 vertical metres to 2778m (14:43 UTC). The exposure consisted of metre sized rounded, sometimes knobbly weathering, massive blocks with sparse, rounded, talus, draped by mud. Possible, weak layering or bedding was observed in many of the exposures e.g. at 2854m (14:14 UTC) and 2805m (14:26 UTC). The lithology of this series of outcrops is unknown, however the massive nature of the exposures, the lack of simple and clear bedding and the absence of pitted, honey-comb textured surfaces suggests that these could be exposures of the Cretaceous to Eocene volcanic/plutonic basement, in which case the weak layering/bedding might have been stratification within the volcanic sequences. Alternatively, the outcrops could be exposures of Oligocene to Late Miocene sedimentary rocks. In which case, given the proximity of Exocet Seamount to St Croix these rocks would correspond to part of the Kingsmill and Jealousy Formations and their sub-surface continuation.

At 2778m (14:44m), the slope became more gentle and outcrop became more sparse, with more extensive sediment. At 2775m (14:49 UTC) the outcrops began to have a conspicuous E-W orientation, and parallel outcrops with infilling mud seemed to almost define a muddy "road" up the slope (e.g. see Seirios view at 14:51 UTC (2773m) and at 14:58 UTC (2765m)). Additionally, further up the slope, the outcrop became vertically jointed with the joints having the same E-W trend (e.g. 2688m; 15:40 UTC and 2681m; 15:44 UTC). At 2684m (15:43 UTC), D2 observed an outcrop where the Fe-Mn crust had been broken off to reveal fractured, vertically jointed carbonate. This vertical E-W trend could be traced to at least 2552m (17:04 UTC) upslope. The simplest interpretation of this feature is that it is a small offset, E-W fault zone, which perhaps formed early within the Oligocene to Miocene sedimentary sequence. Other, second order, E-W trends are seen elsewhere in the bathymetry of Exocet Seamount suggesting that these might be part of an early, within Miocene basin, E-W trending, steeply dipping fault set that was subsequently truncated by the later, NE-SW trending faulting that formed the Anegada Passage.

At 2718m (15:21 UTC), an outcrop of moderately SE dipping, 10 cm thick beds were observed emerging above the mud. These are most likely from the Miocene platform sequence (Kingsmill Formation) and are therefore from this point upwards, the transect was most likely within the platform sequence. Additional evidence that the remaining part of the transect was within platform carbonates is provided by: i) As discussed above, a broken rock face exposed likely carbonate at 2684m (15:43 UTC), ii) A rock "break" test using the manipulator arm at 2681m (15:45 UTC) revealed that outcrop was made of carbonate, and iii) beds (starting at 2525m, 17:44 UTC) dipping 30° to the east-south-east with "limestone pavement" were seen at the end of the dive (e.g. 2369m, 18:54 UTC).

A very spectacular, but enigmatic, outcrop was found at 2688m (15:40 UTC). Here vertically layered (jointed or bedded) rocks are apparently truncated by shallowly dipping rocks suggesting an unconformity. However more vertically layered rocks are found upslope of this outcrop (e.g. 2684m (14:43 UTC)), and so it is unlikely that it's a simple unconformity between vertically layered rocks below and gently dipping rocks above, unless the traversed section is quite extensively tectonically disrupted. Crosscutting joints (e.g. 2651m, 16:03 UTC) in some outcrops and cleavage in others (e.g. 2709m, 15:27 UTC) perhaps hints that structural complexity is present.

In summary, it is clear that carbonate rocks, likely of the Miocene Kingsmill Formation, are present in the top of the dive transect. It also seems likely that a fault cuts the sequence near the dive transect. The presence of more complicated tectonic disruption is speculative, but, if present could explain the possible structural complexity. The nature/lithology of the lowermost section is not very well constrained.

Biology

Dive 11 began with five midwater transects conducted for 10 min every 100 m in depth, from 800-1200 m. During these transects the D2 observed several empty larvacean houses, a few ctenophores, arrow worms, hydromedusae (jellyfish), midwater fishes (e.g., Gonostomatidae) and a potential foraminiferan (aka, "sunburst creature"). Several of these observations were new for this expedition, and new observations for the shore- and ship-board scientists. Most of the sightings in midwater were in 800-1100 m depth. These findings combined with the previous midwater findings repeatedly illustrate the utility of exploration in the pelagic zone.

The D2 reached bottom at 13:30 UTC, at a depth of 2898 m. Several pieces of *Sargassum* detritus were observed, as well as

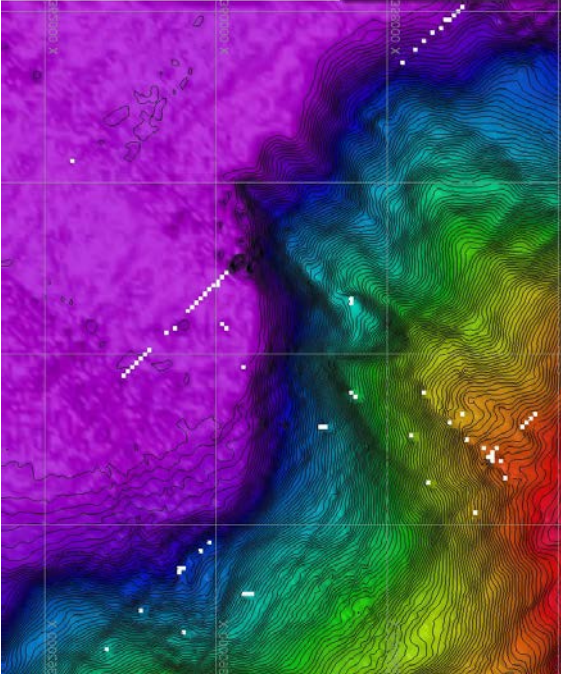
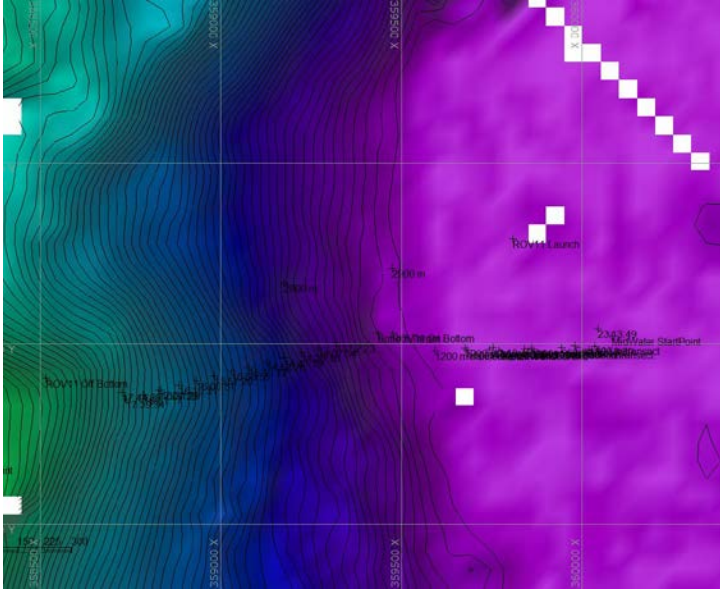
piles of pteropod shells. A few rusted steel cans were observed in the area. One shrimp (*A. edwardsiana?*), a large, ophidiid cusk eel, and at least one dark purple, asteroid “slime-star” were observed; however, the area surrounding the seamount was generally devoid of megafauna.

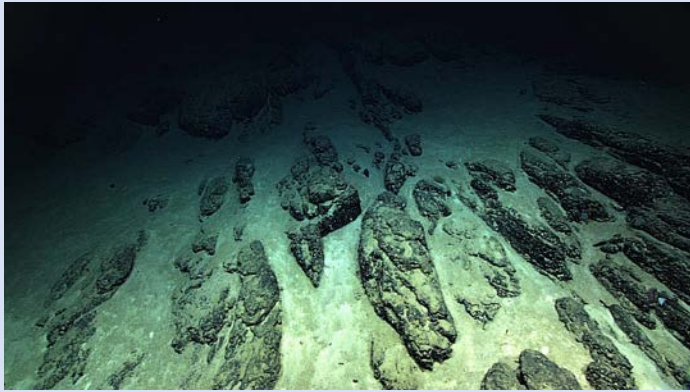
The D2 approached the base of the seamount at ~14:15 UTC and continued up slope to a depth of 2384 m. Overall, colonization by sessile fauna was low. Several species of hexactinellid sponges were observed, a few of which were not easily identified. However, throughout the dive, the abundance of sponges remained low. In addition, only six corals were seen. These included: a *Desmophyllum* cup coral at 14:54 UTC (2766 m), an unknown black coral at 16:55 UTC (2565 m), a stoloniferan overgrowing a sponge, a primnoid whip coral, and a bamboo coral all at ~18:20 UTC (2448 m), and another bamboo (same species) at 18:34 (2436 m). Interestingly, considerable hard substrates were observed throughout the dive, and although there was some sediment overlying some surfaces, many of the rock surfaces were bare.

Overall, at least eight fish species were seen throughout the dive, including: *Bathysaurus mollis*, *Bathypterois phenax*, *Ipnapops murraya*, *Xyelacyba myersi*, three additional unknown ophidiids, and gonostomatids (*Cylcothone sp.*). A few white, squat lobsters (*Munidopsis spp.*) were observed. Additionally, at least one brisingid and three additional species of seastars were observed, including: *Hymenaster sp.*, *Circeaster americanus*, and *Ceramaster grenadensis* (identifications confirmed by C. Mah, NMNH). A few shrimps were observed, including nematocrinids.

Notable Observations:

Of note, several pieces of trash were observed throughout the dive, including rusted steel cans and plastic bags. At least five species of holothurians were observed, including one translucent form (17:49 UTC, 2521 m) that had not been observed before on this expedition. Also, a blind lobster (Polychelidae) was observed (17:35 UTC, 2544 m) buried in the sediment, and although difficult to tell, was likely just a molted exoskeleton.

Overall Map of ROV Dive Area	Close-up Map of Main Dive Site
	
<p>Representative Photos of the Dive</p>	



Please direct inquiries to:

NOAA Office of Ocean Exploration & Research
1315 East-West Highway (SSMC3 10th Floor)
Silver Spring, MD 20910
(301) 734-1014