Okeanos Explorer ROV Dive Summary

Site Name	Whiting 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	DIVE12
Equipment Deployed	ROV:	Deep Discoverer	
	Camera Platform:	Seirios	
ROV Measurements	☒ D2 CTD	☒ Depth	☒ Altitude
	☒ Scanning Sonar	☒ USBL Position	☒ Heading
	☒ Pitch	☒ Roll	☒ HD Camera 1
	☒ HD Camera 2	☒ ROV HD 2	☒ Seirios CTD
	☒ Temperature Probe	☒ D2 DO Sensor	☐ 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_DIVE12

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In Water at:	2015-04-29T10:45:45.406000 17°, 50.940' N ; 065°, 42.257' W
Out Water at:	2015-04-29T20:37:44.953000 17°, 49.973' N ; 065°, 41.494' W
Off Bottom at:	2015-04-29T20:11:46.640000 17°, 50.064' N ; 065°, 41.487' W
On Bottom at:	2015-04-29T11:31:02.984000 17°, 50.773' N ; 065°, 42.056' W
Dive duration:	9:51:59
Bottom Time:	8:40:43
Max. depth:	1303.3 m

Special Notes			
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Purpose of the Dive

i) To document benthic communities living on and around the north-western margin of Whiting Seamount/Bank.

ii) To determine the lithology and geological structure of the north-western margin of Whiting Seamount/Bank.

iii) To compare the fauna found on Whiting Seamount with that found on seamounts to the north-east (Dog, Conrad, Noroit & Exocet)

Description of the Dive:

This dive was the first ever ROV dive on Whiting Seamount/Bank The dive began at 10:43 UTC and D2 descended to 1301m (11:28 UTC) and observed the north-western slope of the seamount. This slope is a partially eroded fault scarp, the uppermost 1900m of which is exposed. The dive began on this slope, approximately 600m from the bottom of the scarp. The dive then proceeded south east, climbing the slope until 507m (19:53 UTC), when D2 left the seafloor. This dive traversed from the Cretaceous-Eocene basement across the unconformity with the overlying Late Oligocene to Early Pliocene Platform sequence (the Juana Diaz and Ponce Formations). There was a surface current of 0.5 knot from the northeast and a negligible seafloor current at the start of the dive, but the seafloor current increased as D2 ascended. At ~ 938m (15:45 UTC), the current came from the west.

Geology

The dive started with D2 landing on the northwestern slope of Whiting Seamount at 1279m (11:30 UTC). Most of the rocks during the entire dive were Fe-Mn encrusted making rock identification difficult. The first outcrop at 1278m (11:31 UTC) was extensively cracked and jointed, generating tabular, but angular clasts. This outcrop had a different character to subsequent outcrops. At 1275m (11:39 UTC), the outcrop character became more massive, but still with planar, non-weathered faces. At 1273m (11:42 UTC), the ROV was set down and the manipulator arm used to remove the Fe-Mn coating from a clast. This operation was very successful, and revealed that the rock was an igneous rock, likely a granodiorite (12:17 UTC) from the Cretaceous/Eocene basement. This massive, often angular outcrop continued intermittently with more talus and/or mud rich sections up to 1039m (14:41 UTC). Dipping joints defining a weak layering were seen in several of these outcrops (e.g. 1197m, 12:56 UTC and 1119m, 13:40 UTC).

At 1123m (14:38 UTC), D2 entered a small (20m across) box canyon and whist rising up the vertical, north-west trending, west wall of the canyon, it imaged a spectacular, clear, sub-horizontal contact between massive outcrop below and northerly dipping beds/joints (1039m, 14:40 UTC). Both sets of rocks on either side of this contact are most likely Cretaceous to Eocene basement rocks. It is tempting to interpret the rocks below the contact as the continuation of the granodiorite intrusive body surveyed at 1273m (11:42 UTC) and the rocks above as the meta-volcanic rocks of the basement. Above this outcrop, the fraction of true outcrop decreased, but intermittent (with mud) angular outcrop and/or talus continued until 842m (16:37 UTC). The angular and massive nature of these outcrops and sub-vertical jointing (e.g. 950m, 15:28 UTC; 935m, 15:40 UTC) suggests that these rocks are still part of the Cretaceous/Eocene

basement. Above 842m (16:37 UTC), the slope shallows and mud becomes much more prevalent. At 806m (16:51 UTC), the talus appeared to contain clasts of sedimentary origin and possible cross bedding was observed in a clast from 801m (16:54 UTC).

At 792m (16:57 UTC), definite sedimentary bedding was observed in a boulder. Thus, although the unconformity between the basement & the overlying platform sequence was not seen, it is interpreted to lie between 842 and 802 metres water depth, and therefore the rocks directly above 842/802 metres are clastic rocks from the clastic Juana Diaz Formation.

At 694m (17:33 UTC), weathered, honeycombed outcrop suggests that the rocks were carbonates, and if so, these rocks are either from the uppermost Early Miocene Carbonate Juana Diaz Formation or from the carbonate Miocene Ponce Formation. This would mean the thickness of the clastic Juana Diaz Formation is 108-148m in this location. From 694m to 571m (18:44 UTC), outcrop was sporadic between poorly developed talus piles and mud, but all the rocks had honey-comb weathering suggestive of weathered carbonates. At 595m (18:14 UTC), D2 was maneuvered to measure the dip of the carbonates as ~50^{o} to the south east; this relatively steep dip is consistent with Whiting Seamount being a rotated fault block and is consistent with the dip if the carbonates seen in seismic data (Mann et al., 2005). From 571m until 522m, 19:33 UTC), outcrop and talus decreased, but clear, often broken, gently dipping, 5-5cm thick carbonate crusts appeared. These were sub-parallel to the slope and therefore discordant to the bedding measures earlier. Consequently these mud covered carbonate crusts seem to be a diagenetic feature possibly caused by cementation of the carbonate mud. From 522m until the end of the dive at 507m (19:57 UTC), sparse talus piles with weathered/honeycombed clasts were present. If the identification of carbonate rocks is correct, it would mean that we traversed 111m of the Early Miocene carbonate facies of the Juana Diaz Formation and the carbonate Miocene, Ponce Formation. Given that the top of Whiting Seamount is 75m below the sea surface, the preserved thickness of the Miocene carbonate (Juana Diaz and Ponce Formation) sequence would be ~ 530m.

It should be noted that this was the only dive in the whole series that convincingly traversed from the Eocene/Cretaceous basement, crossing the unconformity, into the Oligocene to Pliocene Platform sequence. Dive 5 was solely within the Cretaceous/Eocene basement, Dive 11 was unclear and all the rest were within the carbonate platform sequence.

Biology

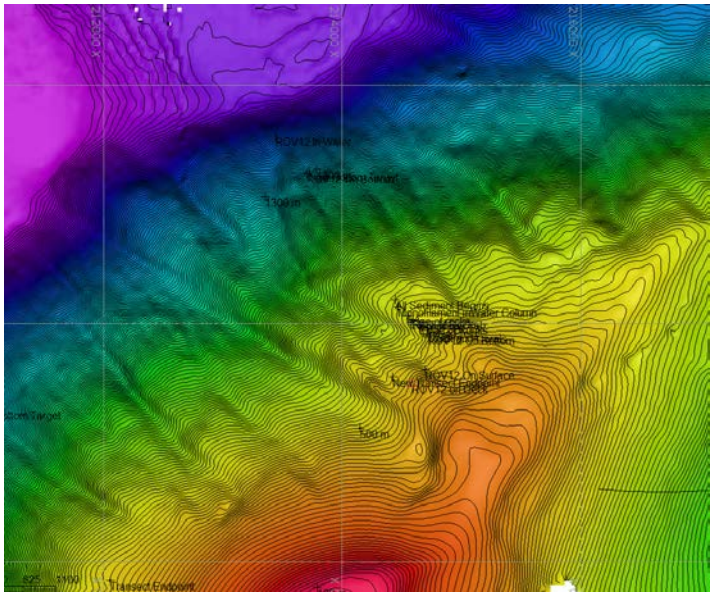
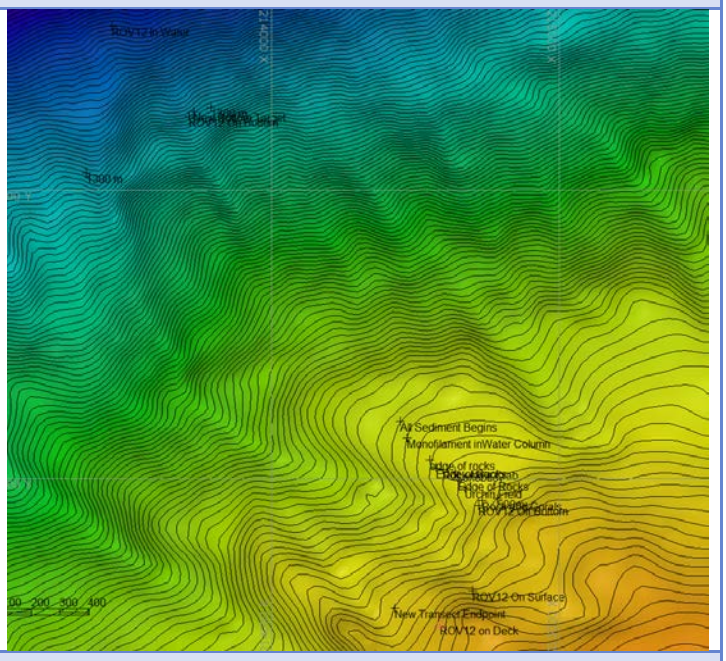
Immediately upon D2's arrival on the seafloor (~11:30 UTC, 1275 m depth), many piles of dead scleractinian corals were observed. These dead coral patches were not composed mostly of broken coral rubble, rather they contained fairly large, intact branches. Live scleractinian, colonial corals (just a few branches) were observed twice in this area, at 12:44 UTC (1262 m) and 13:03 UTC (1183 m). Throughout this area of the slope, several dislodged, dead octocorals(?) were also observed. Additionally, many dead octocoral(?) skeletons were observed still attached to hard substrates. (The tentative id on the octocorals is due to the fact the most abundant, live sessile species observed a bit shallower appeared to be branching sponges with large "holdfasts", overgrown by zoanthids). Epifauna, including hydroids and serpulid tubeworms were noted overgrowing several of the dead skeletons. Very few live sponges colonizing hard substrates were observed in this area, as well as a few live, whip, black corals (?*Stichopathes* sp.).

At ~1150 m, the abundance of dead corals seemed to decline. The D2 began observing more, live octocorals and large, branching sponges(?) colonized by zoanthids. Numerous species of corals and sponges (demosponges and hexactinellids), many new for this expedition, were observed throughout this dive. Octocorals observed during this dive included: bamboo corals (?*Eknomisis* sp., ?*Lepidisis* sp., *?Acanella* sp.), *Victogorgia* sp., white stoloniferous corals, *Chrysogorgia* sp., an unknown purple Plexauridae, and *Paramuricea* sp. As for other scleractinians (observed at depths <1100 m), *Enallopsammia rostrata* colonies (some live and dead) and cup corals (e.g., *?Javania* sp. and ?*Flabellum* sp.)

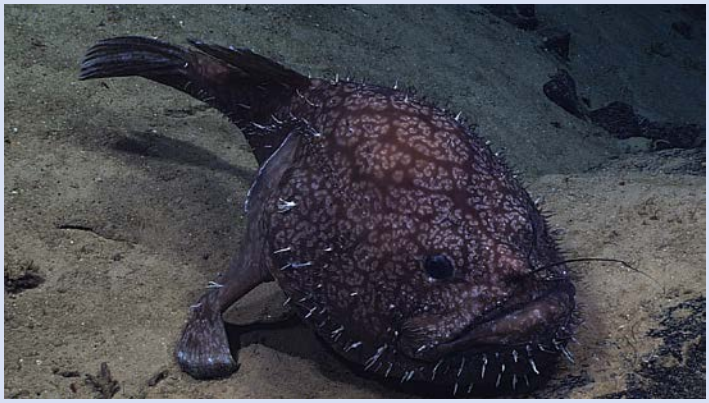
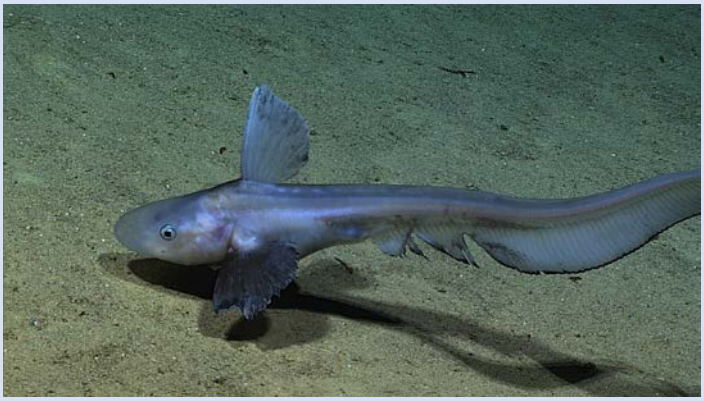
were common. Although not as common, a few black corals were observed (?*Stichopathes* sp, *Bathypathes* sp., three unidentified species) during the dive.

At least 15 fish species were observed during this dive, including *Neoscopelus* sp., tinselfish (Grammicolepidae), a few species of rattails (*Nezumia* sp., *Goadomus* sp.), several cusk eels (*?Benthocometes robustus,* unknown ophidiids), Darwin's Slimehead (*Gephyroberyx darwinii)*, and scyliorhinid catsharks. At least two range extensions are noted, as they were not previously known to occur off Puerto Rico: a Shaefer's anglerfish (*Sladenia shaefersi)* was observed at 14:03 UTC (1099 m) and a jellynose (Ateleopodidae) at 19:07 UTC (545 m). Numerous species of deacapod crustaceans were seen throughout the dive, including galatheiod squat lobsters and "decorator" crabs. Seastars, brisignids, crinoids, and ophiuroid brittle stars were common.

Trash was encountered throughout the dive, and included a likely "target missile" with a parachute attached. Numerous benthic fauna colonized this piece of trash, including a *Gephyroberyx darwinii*, sponges, and anemones. At least two large black coral colonies were observed (at 18:26 UTC, 587 m and 18:48 UTC, 570 m); each hosting several ophiuroid brittle stars and squat lobsters. At the end of the dive, a large (~.5 m wide) purple, plexaurid octocoral was observed with numerous brittle stars (*Asteroschema* sp) and squat lobsters, including what appeared to be the first *Eumunida* sp. of the expedition.

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

Representative Photos of the Dive

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