


OKEANOS EXPLORER ROV DIVE SUMMARY

Site Name	Septentrional Fault			
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	DIVE02	
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_DIVE02			
	In Water at:	2015-04-11T13:44:29.078000 19°, 00.373' N ; 067°, 43.862' W		
	Out Water at:	2015-04-11T22:09:41.546000 18°, 59.841' N ; 067°, 42.722' W		
	Off Bottom at:	2015-04-11T20:15:30.593000 18°, 59.644' N ; 067°, 43.562' W		
	On Bottom at:	2015-04-11T16:12:02.421000 19°, 00.433' N ; 067°, 43.661' W		
	Dive duration:	8:25:12		
	Bottom Time:	4:3:28		
Max. depth:	3675.8 m			
Special Notes				

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Purpose of the Dive

- i) To investigate the lithology of the exposed rocks along the southern slope of the valley formed above the eastern termination of the Septentrional Fault.
- ii) To identify any deformation related to the Septentrional Fault, with a view to understanding why the fault apparently terminates at the eastern end of this valley.
- iii) To identify features that could be related to slope failure.
- iv) To look for evidence of sediment flows both within the valley and down the valley wall.
- v) To document the biology living on and around the slope from 2600-3650m.

Description of the Dive:

This dive was sited within a narrow east-west trending valley formed above the Septentrional Fault. This fault is a major left lateral strike slip fault which separates the Mona Block/Seamount in the south from the carbonate platform to the north. The dive began at 13:35 UTC and D2 descended to 3675m and landed on a horizontal valley floor, 500m to the north of the southern valley wall. The dive traversed up the southern side of the valley and ended on significant outcrop at 3177m (20:16 UTC). It might be worth noting that Gastel et al., 1998 use seismic reflection data to argue the carbonate platform sequence is here 1200-1800m thick. Therefore, given our dive started at only 3675m and the top of the slope is only ~1km above, at ~4700m, it seems likely that the entire dive was spent within the Carbonate platform sequence.

Geology:

The dive started with D2 landing on a horizontal, coarse sediment covered valley floor at 3675m; 500m away from the southern wall of the valley. The sandy/pebbly sediment exhibited from irregular to moderately regular (see photo below), to spectacularly parallel, ripples (wavelength = 12-20 cm) which had a strike of 140, rotating to 130 as the valley wall was approached (17:14 UTC). White shell debris was observed on the lee slope of the ripples tentatively suggesting that the sea bottom current flow direction was 050. This observation can be verified by careful checking of the videos. Interestingly, D2 recorded a bottom current of 0.13 m/s due east, consistent with the flow direction interpreted using the ripples. Approximately ten ~20 cm high, straight, E-W trending, sand ridges were observed during the traverse to the valley wall (see Seirios photo below). The spacing of the ridges was initially at 10-15m (16:46 UTC), but decreased to 5m (16:59 UTC) and then increased again to ~10m, before no more were seen (17:14 UTC). The origin of the ridges was unclear, but the preferred interpretation was that they were current related, perhaps related to currents flowing from south to north down the carbonate platform.

As the valley wall was approached, the slope began to increase (17:17 UTC) and Fe-Mn encrusted rock debris began to appear and increase (17:29 UTC). The rock debris was commonly rounded, often poorly sorted, and varied in diameter from cm to m scale and was likely of variable composition. Some rocks showed bedding or foliation and some were

definitely made of carbonate (e.g. 3620m; 17:57 UTC). Nice current “shadows” in the mud were visible (17:31 UTC). The slope began to steepen to 40° at 17:49 UTC (3631 m) and remained very consistent for ~ 400 vertical metres until outcrop was reached at 3224 m (19:56 UTC). It was a dominantly sandy slope, with irregularly spaced patches of rounded cm-m scale Fe-Mn coated rock debris. The slope is likely a sediment covered talus slope created by multiple depositional events (18:13 UTC, 3582m) Downslope gravel chutes, streaks and rills were present at various locations on the slope (3577 m, 18:17 UTC; 3940m, 18:42 UTC, 3366m, 19:18 UTC; 3250m, 19:49 UTC). Some of these slope deposits were only lightly sediment covered and therefore relatively recent (e.g. 3598m, 18:12 UTC). The lithology of the rock debris was likely very variable, and difficult to discern just using video. However, possible carbonate fault breccia or volcanoclastic breccia was recognized at 3582 m (18:14 UTC), and at 3409m (19:00 UTC). Definite carbonate boulders with burrows, and with Fe-Mn coating removed were observed at 3721 m (19:40 UTC); the amount of carbonate boulders seemed to increase towards the top of the slope.

At 3224m (19:56 UTC), outcrop was reached and approximately 40 m of bedded conglomerate was traversed, which contained well rounded, very coarse clasts (up to 1m in diameter). Another 20 metres of more sediment covered, finer clast size (20-40cm), conglomerate (see photo below) with light coloured recent sediment chutes was traversed before D2 left for the surface at 3170m (20:15UTC). Debate ensued about the origin of the conglomerate. Tentative consensus was reached that it might be fluvial in origin, produced by erosion of the pre-Eocene island arc and thus older than the carbonate platform deposits. At 3175m (20:11 UTC), a broken open, possibly carbonate clast was visible in the outcrop. If so, the conglomerate might be part/base(?) of the platform carbonate sequence. In any case, weathering/breaking down this set of outcrops likely supplied the rock debris that was traversed during the early part of the dive.

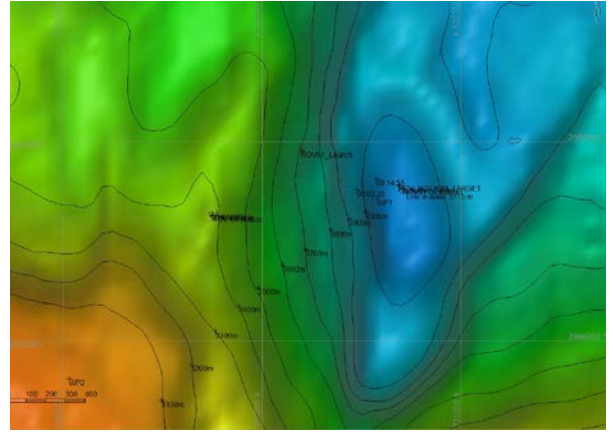
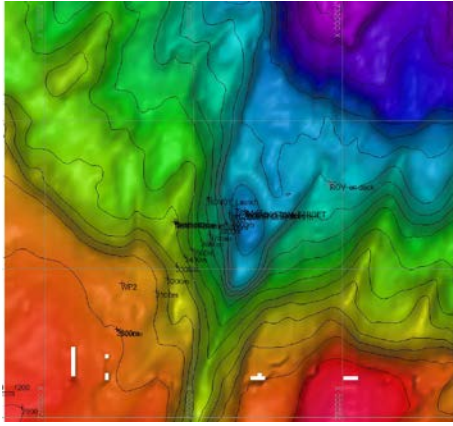
Biology:

As the D2 traversed over sand ripples in the beginning of the dive, *Sargassum* detritus and pteropod shells were noted to accumulate in pockets between the ripples. This area was fairly barren in terms of fauna, with only a few shrimps (*Aristaeopsis edwardsiana*) observed over a distance of 500 m. One squid, likely *Vampiroteuthis* sp., was observed at 16:42 UTC (3765 m) in the Seirios camera. In the rock debris field, a few sponges and at least one anemone (or corallimorph) were observed attached to the rocky substrate. One galatheoid squat lobster associated with a sponge was noted. Of note, a *Hymenaster* deep-sea slime star was reported at a depth of 3640 m (17:44 UTC). At 18:38 (3511 m), a hermit crab (*Parapagrus* sp.) with an anemone on its back was observed on soft substrate. The D2 then approached the steep, vertical rock outcrop at 19:56 UTC (3224 m), yet it was noted that the rock faces appeared mostly barren. Relatively few sponges and sessile fauna, in general, colonized the rocks. In this area a few swimming holothurians were noted as well as the sea cucumber *Benthoodytes* sp. At the end of the dive, an unidentified organism (bryozoan or branching sponge) was found under an overhang as well as one whip-like, bamboo coral (*Isididae*).

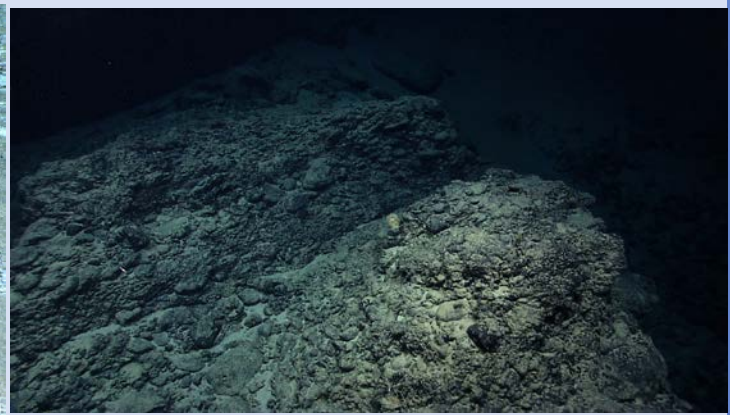
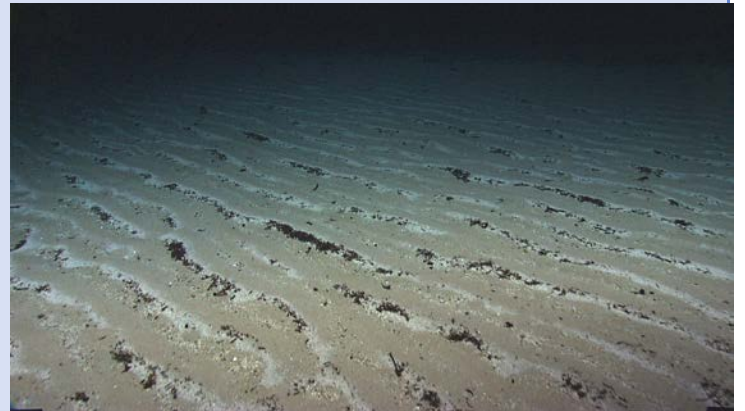
A few pieces of bamboo (plant) debris were found throughout the dive. Most of these were colonized by limpets and serpulid tubeworms; however, at 18:06 UTC (3608 m depth) a brisngid sea star (*Feyastera* sp.) was noted on the bamboo. In addition, only two fishes were observed throughout the dive: the deep-sea lizardfish *Bathysaurus mollis* and the grenadier *Coryphaenoides armatus*. There was also a noticeable lack of midwater fauna during the descent and throughout the course of the dive.

Overall Map of ROV Dive Area

Close-up Map of Main Dive Site



Representative Photos of the Dive



Please direct inquiries to:

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