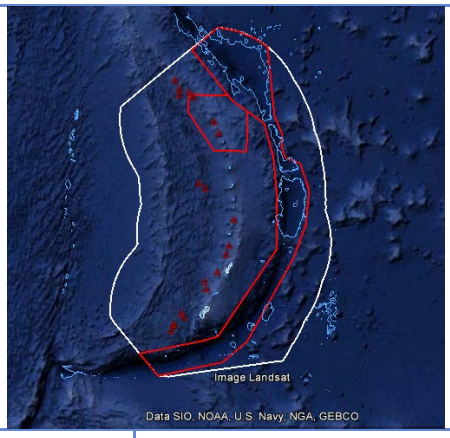
OKEANOS EXPLORER ROV DIVE SUMMARY

Site Name	Subducting Guyot 1	
ROV Lead/Expedition Coordinator	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	DIVE16
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_DIVE16

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In Water:	2016-07-02T20:23:47.300000 20°, 27.374' N ; 147°, 04.248' E
Out Water:	2016-07-03T06:32:40.603000 20°, 27.089' N ; 147°, 04.290' E
Off Bottom:	2016-07-03T02:28:10.694000 20°, 27.149' N ; 147°, 03.914' E
On Bottom:	2016-07-02T23:13:41.957000 20°, 27.171' N ; 147°, 04.096' E
Dive duration:	10:8:53
Bottom Time:	3:14:28
Max. depth:	5005.7 m

Special Notes			
Scientists Involved	Diva Amon	University of Hawaii	divaamon@hawaii.edu

(please provide name / location / affiliation / email)			
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Purpose of the Dive

Benthic: This dive was on an un-named guyot that's in the process of being subducted below the Mariana tectonic plate and provides the means to document the "death" of a seamount, being cracked apart and dragged down thousands of meters until it ultimately disappears below the adjacent plate. The guyot is presumably a Cretaceous seamount, located within the Trench Unit of the Monument. The dive addresses two of the CAPSTONE priorities and has objectives that include exploring for high density communities of deep-sea corals and sponges and doing an initial characterization of Mn-crust habitats on one of the presumed oldest seamounts on the Pacific Plate. However, this guyot and Subducting Guyot 2 (Dive 20) are very unusual features and offer a unique exploration opportunity. Due to the flexure of the Pacific plate as it is being subducted, stress fractures have cracked the plate starting at a distance of about 45 kilometers from the edge of the Asia plate. These fractures have continued not only on the seafloor but through the guyots as well, splitting open these seamounts to a depth of hundreds of meters from the surface of their summits. On this particular seamount, a "scissors fault" occurred right in the center of summit with the southern part of the fracture being expressed as a 460 m high wall. This dive starts at the base of this wall and transits up to the top of the fracture, providing a unique look at the inside of a Cretaceous guyot potentially showing a "road cut" view of millions of years of Cretaceous reef growth that would otherwise not be possible to see.

Midwater: We strive to discover what lives in the water column in this area adjacent to this region of the trench wall over a potential subduction zone. The midwater of the oceans (500 m to our vehicle maximum of 6000 m) is the largest biome on Earth and unexplored. The quality of video obtained through Deep Discoverer II and the onboard instrumentation represent a unique capability to explore this part of the ocean. Using minimal time, we are able to gather unique information about this biome that significantly advances our understanding of the midwater.

Description of the Dive:

The guyot on which we dove today is presumably a Cretaceous seamount located within the Trench Unit of the Monument. One of the goals of this dive was to explore millions of years of Cretaceous reef growth that would otherwise not be possible to see. Although there was very little in the way of living organisms (one fish, a few shrimp, a couple anemones, and maybe a carnivorous sponge), there were fossils!

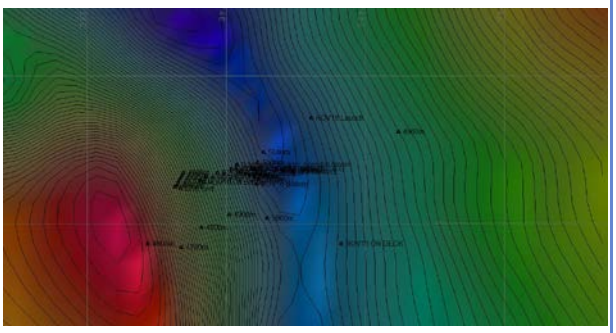
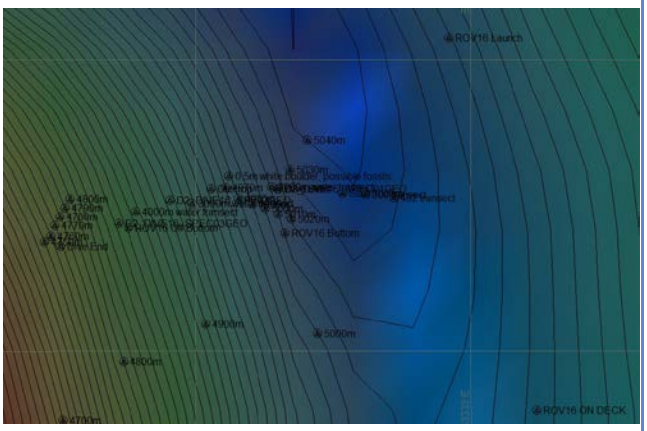
The dive began at 5,005 m, on a slope covered with talus consisting of sparse cobble- to boulder-sized rock fragments. The rocks were black MnO coated, variably-sized fragments sitting on a white pavement that had scattered patches of buff-colored sand- to fine-grained sediment. SPEC01GEO was collected at the beginning of the dive and was composed of what looked like elongate (shell?) fragments in a white (carbonate?) matrix. The talus slope varied in amount of rocky debris vs. sediment vs. pure-white, smooth sea floor as ROV Deep Discoverer (D2) climbed higher until about 23:49 UTC, when D2 zoomed on another much larger boulder that clearly had bivalve shells and numerous other structures reminiscent of fossils. At 00:11 UTC, D2 investigated another boulder that had a well preserved "scallop" shell exposed on the surface. As D2 neared the bottom of the steeper part of the wall, the sea floor had become primarily a smooth white surface, with fewer loose rocks. The wall itself revealed a sequence of layered accumulations of varying texture and fossil types. Bivalve fossils dominated the darker layers. These layers were generally thinner than the more massive white layers between them. Some layers were a pale yellow and had a more granular appearance. These granular, yellow sequences were first seen to outcrop as patches around 11:30 UTC, and intermittently after that until they became visible as discrete layers higher up on the wall. As D2 transited upslope, the outcrops showed high-angle fractures, and toward the end of the dive, small degrees of offset on some of these. In one place, an offset in the layers was overtopped by continuous lineation of horizontal layers, indicating an unconformity or hiatus in deposition of the upper layer, after a faulting event. At the shallower elevations of the wall, distinct vertical ridges and with chutes between them gave the wall a spectacular texture, easily viewed when the ROV was oriented so it looked parallel to the strike of the wall. The nearly horizontal layering in the outcrops on the wall emphasized its ruggedness. The layering also contributed to the variation in structure of the wall, as the dark, bivalve-rich layers were more resistant and thus made thin vertical outcrops between broader and more gently sloping "steps" composed of the white, less-resistant layers. We were able to collect two additional rock samples, one about half way through the dive that was a single, coiled fossil, and another near the end of the dive that was a boulder-sized limestone from one of the bivalve layers (deftly dislodged from its outcrop by the skeg of the ROV).

This was a great geology dive, but with little in the way of benthic animals. Some guesses as to why include: depth (5000 m), food availability (an oligotrophic ocean, so fewer food particles make it to the bottom), and maybe even the substrate (perhaps the deeper fauna don't like settling on carbonate).

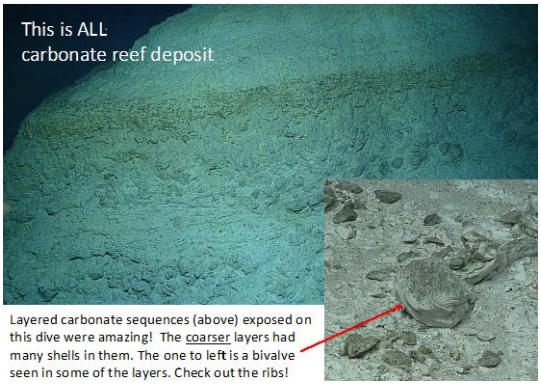
The dive continued with midwater transects. There was very little in the midwater at 4000 m, but the number and diversity of plankton and organic particles increased as we moved up the water column. Larvaceans (pelagic tunicates) were present throughout all depths—even at 4000 m. These animals build mucous “houses”, and they use a tadpole-like tail to filter bacteria (and other microscopic particles) from the water. After their “house” gets clogged, it collapses, and the animal builds another one. Biota in general increased during shallower transects. During the 800 m, 1000 m, and 1200 m transects, fauna observed included fish, larvaceans and housings, ctenophores, jellyfish, siphonophores. Mid- depth transects (2000 m and 3000 m) documented larvaceans, siphonophores, and a shrimp. The deep transect (4000 m) only documented a couple larvaceans. A number of organisms were also documented on every transect that the team had difficulty identifying on the spot. Video footage will be reviewed later to identify these organisms.

To our knowledge, this is the first deep-water water column work in the Mariana Trench and the deepest (4,000

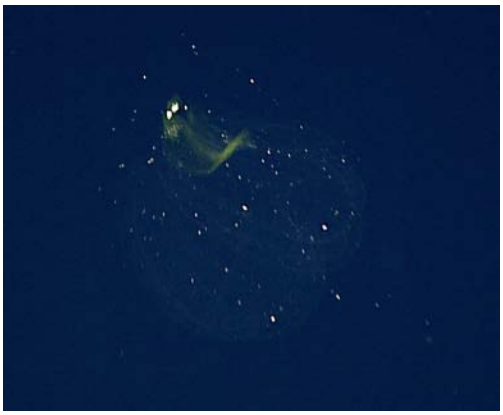
m) midwater exploration ever conducted!

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

Representative Photos of the Dive



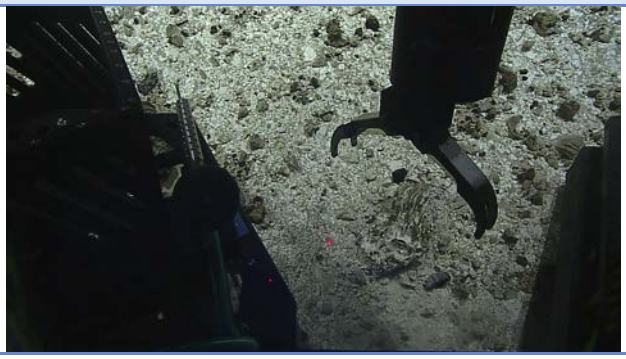
This image is a composite showing both the layering on the outcrop scale ~8 m from top to bottom of the upper image). The bivalve in bottom left is ~ 4 cm wide.



Larvaceans were observed at all depths of the midwater transects. This one was at 4000 m!

Samples Collected

Sample ID	SPEC01GEO
Date (UTC)	20160702
Time (UTC)	233122
Depth (m)	4997.05
Temperature (ºC)	1.52
Field ID(s)	ROCK WITH FOSSILS?

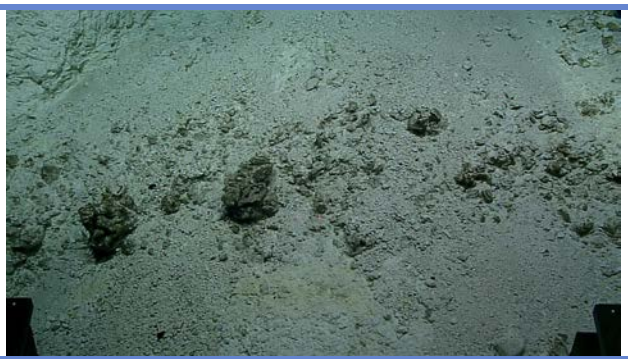


Comments	23x12x13cm, fossiliferous limestone with some bivalve shells.

Sample ID	SPEC02GEO
Date (UTC)	20160703
Time (UTC)	012406
Depth (m)	4847.8
Temperature (ºC)	1.51
Field ID(s)	FOSSIL GASTROPOD?

Comments	8x6x5cm, gastropod fossil

Sample ID	SPEC03GEO
Date (UTC)	20160703
Time (UTC)	021840
Depth (m)	4769.97
Temperature (ºC)	1.51
Field ID(s)	ROCK WITH FOSSILS



Comments	29x20x17, fossiliferous limestone with bivalve shells and possible rudist fossils. Partially recrystallized in some areas.

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