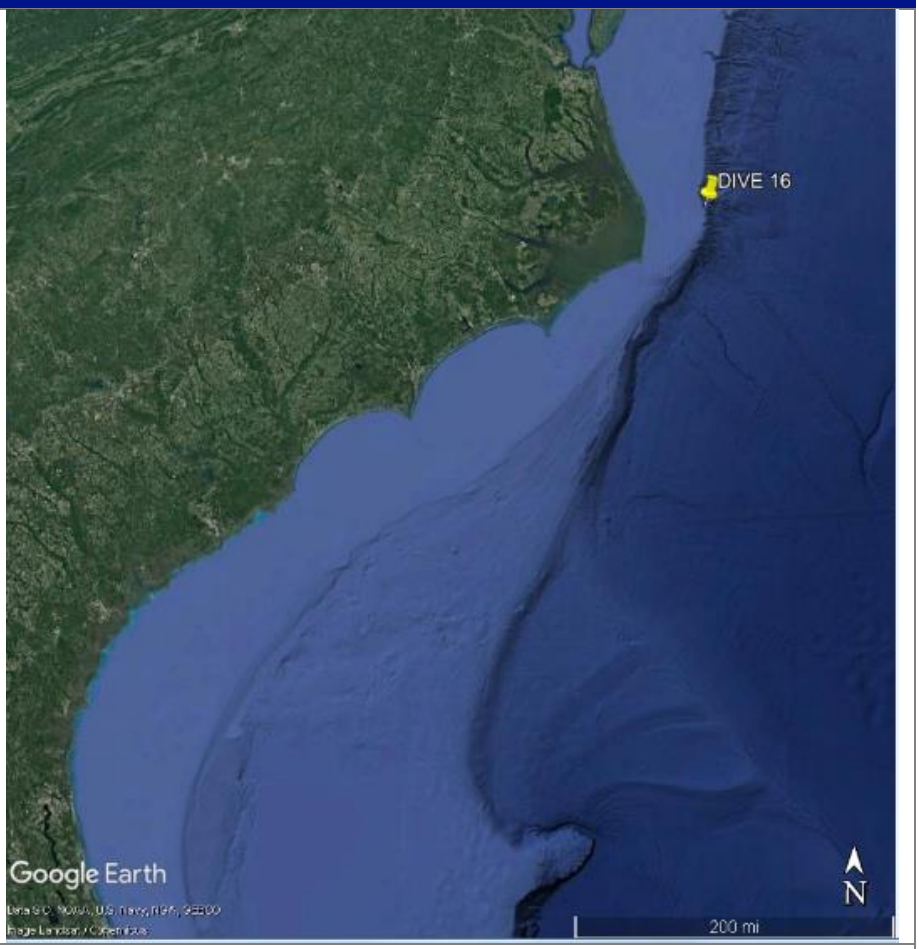
Ocean Exploration and Research

Okeanos Explorer ROV Dive Summary

Dive Information	
General Location	
General Area Descriptor	Southeast U.S. Continental Margin - North Carolina Canyons
Site Name	Pea Island
Science Team Leads	Leslie Sautter / Cheryl Morrison
Expedition Coordinator	Kasey Cantwell
ROV Dive Supervisor	Bobby Mohr
Mapping Lead	Derek Sowers
ROV Dive Name	
Cruise	EX1806
Leg	-
Dive Number	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 5
Equipment Malfunctions	
ROV Dive Summary (from processed ROV data)	Dive Summary: EX1806_DIVE16 ^^^ In Water: 2018-06-30T12:29:43.733075 35°, 42.424' N ; 74°, 48.62' W On Bottom: 2018-06-30T13:17:41.331814 35°, 42.459' N ; 74°, 48.77' W Off Bottom: 2018-06-30T20:16:20.529375 35°, 42.19' N ; 74°, 48.987' W Out Water: 2018-06-30T20:32:52.330808 35°, 42.15' N ; 74°, 48.67' W Dive duration: 8:3:8 Bottom Time: 6:58:39 Max. depth: 521.0 m
Special Notes	
Scientists Involved (please provide name, location, affiliation, email)	(see table below)

Name	Institution	email
Amanda Demopoulos	USGS	ademopoulos@usgs.gov
Andrea Quattrini	Harvey Mudd College	aquattrini@g.hmc.edu
Asako Matsumoto	Planetary Exploration Research Center, Chiba Institute of Technology	amatsu@gorgonian.jp

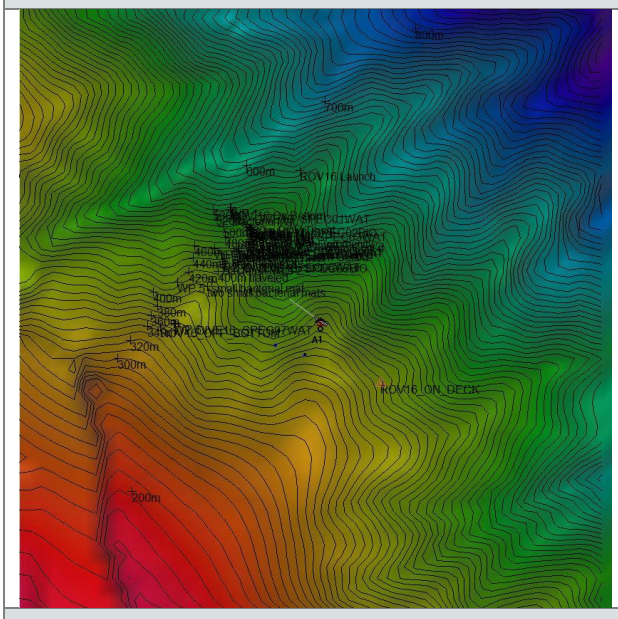
Bernard Ball	Duke University Marine Lab, and University College Dublin	bernie.ball@ucd.ie
Carolyn Ruppel	US Geological Survey	cruppel@usgs.gov
Cheryl Morrison	USGS Leetown Science Center	cmorrison@usgs.gov
Chloe Brown	Boston University	rrlab@bu.edu
Christopher Kelley	University of Hawaii	ckelley@hawaii.edu
Christopher Mah	Dept of Invertebrate Zoology, NMNH Smithsonian	brisinga@gmail.com
Erik Cordes	Temple University	ecordes@temple.edu
Heather Judkins	University of South Florida St. Petersburg	Judkins@mail.usf.edu
Isabela Trumble	Boston University	rrlab@bu.edu
Jason Chaytor	USGS	jchaytor@usgs.gov
Jenna Hill	U.S. Geological Survey	jhill@usgs.gov
John Kessler	University of Rochester	
Kate Rose	NOAA NCEI	kate.rose@noaa.gov
Kevin Jerram	UNH	kjerram@ccom.unh.edu
Leslie Sautter	College of Charleston	Sautterl@cofc.edu
Natalya Budaeve	Shirshov Institute of Oceanology RAS	
Nicole Morgan	FSU	nbmorgan11@gmail.com
Nolan Barrett	South Carolina University	barrettnh@g.cofc.edu
Scott Allen	NOAA Ship Okeanos Explorer	
Scott France	University of Louisiana at Lafayette	france@louisiana.edu
Scott Harris	College of Charleston	harriss@cofc.edu
Tamara Frank	Nova Southeastern University	tfrank1@nova.edu
Tina Molodtsova	Shirshov Institute of Oceanology RAS	tina@ocean.ru;

			tina.molodtsova@gmail.com
	Zach Proux	College of Charleston	prouxzs@g.cofc.edu

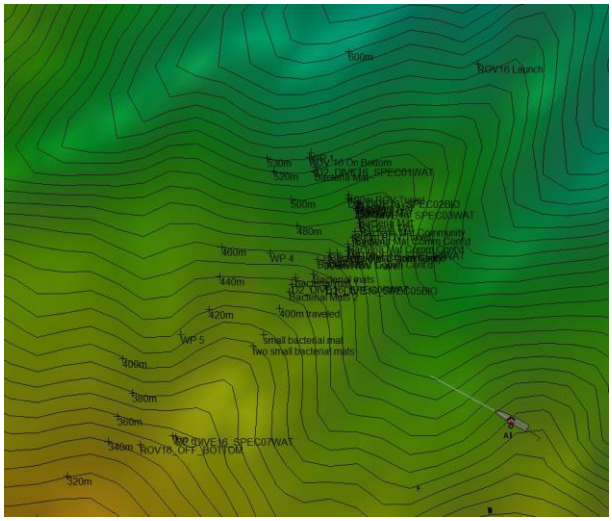
Purpose of the Dive	Several hundred seep locations were discovered through multibeam mapping efforts that began in 2012. However, many have not been visually verified. One of the primary goals of the DEEP SEARCH project is to investigate the mid-Atlantic region for chemosynthetic environments in order to identify vulnerable communities that may be adversely influenced by energy exploration. The autonomous vehicle *Sentry* has surveyed a handful of locations in the canyons off North Carolina, however visual information about the presence of seeps is still necessary. An ROV/HOV is required to visually examine possible seeps along these rugged, high profile features.
Description of the Dive	The ROV track for this dive was selected based on the locations of potential seeps identified from previous multibeam sonar surveys by both the NOAA Ship *Okeanos Explorer* and R/V *Hugh R. Sharp* (Univ. of Delaware). Overnight mapping also showed a possible gas seep. The track began at the base of an intra-canyon ridge and ascended the ridge, visiting seep locations. A small inactive seep was viewed at the beginning of the dive (depth ~534m), indicated by its reduced sediments and bacterial mat. During the first two hours, the landscape was mostly mud, with steeply sloping areas to each side of the ridge. Quill worms (hundreds! *Hyalinoecia tubicola*), eelpouts (*Lycenchelys verrilli*), hagfish *(Eptatretus lopheliae)*, mud stars (*Plutinaster* sp.) were very common and the area was rich with small midwater fauna and squid. Numerous inactive seep areas with bacterial mats were seen, many of which had eelpouts (*Lycenchelys verrilli*) somewhat clustered around them. At a depth of 482 m the first bubbles representing gas seepage were observed, though they were not vigorous. At a depth of ~470 m most of the viewable landscape was covered with bacterial mats, though no venting was observed. A rare observation included a *Brachioteuthus* octopus sitting on a bacterial mat. Empty bivalve shells (possibly Lucinidae) were observed, but no live individuals were found. The remainder of the dive, to a depth of 341 m, returned to the mud landscape, with little to no evidence of gas seeps. No coral were observed on this dive. Cnidarians included burrowing anemones (Hormathiidae) and cerianthid tube anemones (*Pachycerianthis borealis*) with teneids (peracarid crustaceans) living in small mud tubes on the cerianthids tubes. Other fishes included the silver and southern hake (*Merluccius* sp. and *Urophycis regia,* respectively), two batfishes (order Lophiiformes), a tonguefish, greeneye

	(*Chloropthalmus agassizi),* along with midwater fishes such as viperfish *(Chauliodus sp.),* barracudina (Peralipididae)*,* and snipe eels *(Nettenchelys exoria).* Two species of gastropods were observed, a common smaller species (Family Buccinidae, possibly *Colus* sp.) and a larger uncommon and unknown species. Several predation events (bentho-pelagic coupling) were caught on video, the most dramatic being the rapid capture of a barracudina (Peralipididae) by a midshipman (*Porichthys plectrodon*) that emerged briefly from its burrow. Another midshipman was seen capturing an Illex squid as well, and quill worms were seen eating a small squid. Crustaceans included hermit crabs, Rochinia spider crabs, a shrimp species that was mostly buried in the sediment (possibly *Mesopenaeus tropicalis*), another shrimp species (possibly *Plesionika* sp.), plus amphipods, sergestid shrimps and krill in the water column that are typical mid-water fauna.
Notable Observations	*Extensive bacterial mats and some gas seepage was observed close to sonar anomalies.* *The most abundant organisms were quill worms (Hyalinoecia tubicola), wolf eelpouts (Lycenchelys verrilli) and blackbelly rosefish (Helicolenus dactylopterus). Several predation events were observed, the most dramatic being midshipman quickly emerging from their burrows to snatch midwater organisms (a barracudina and squid).* *The only cnidarians at this site were burrowing anemones and cerianthids.*
Community Presence/ Absence (*community is defined as more than two species*)	☐Corals and Sponges Present ☐Chemosynthetic Community Present ☐High biodiversity Community Present
	X Active Seep or Vent ☐Extinct Seep or Vent ☐Hydrates Present

Overall Map of the ROV Dive Area

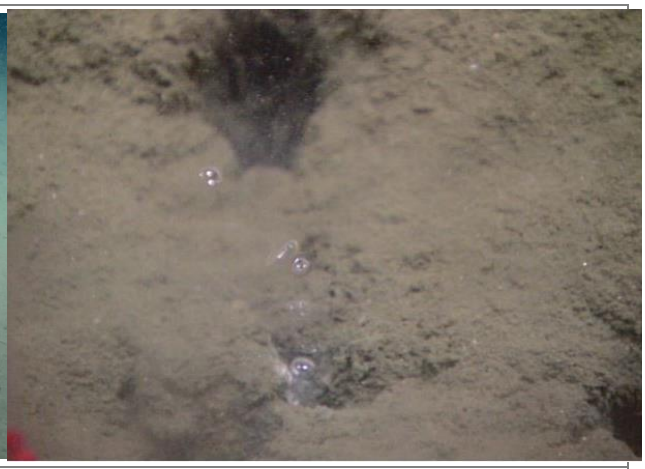


Close-up Map of Main Dive Site

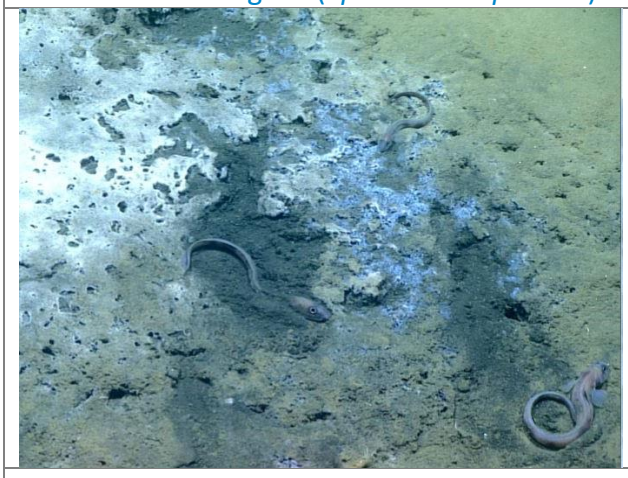


Representative Photos of the Dive

Most of the dive consisted of steeply sloped muds, and hosted hundreds of quill worms and numerous hagfish (*Eptatretus lopheliae*).



A small venting of bubbles was observed at 482 m.



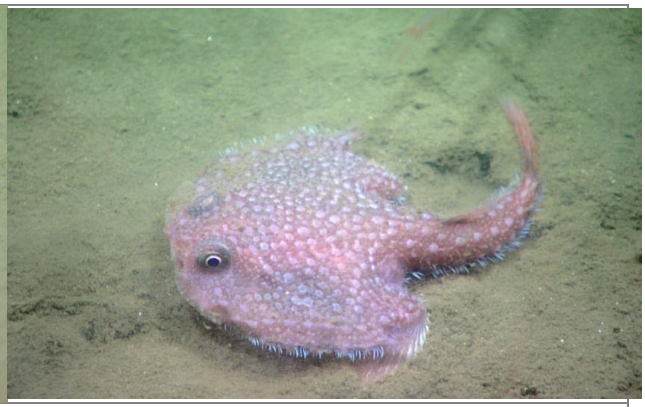
Eelpouts (*Lycenchelys verrilli*) were commonly resting in the bacterial mats.

The seabed was nearly covered by bacterial mats at a depth of ~420m, however no additional bubble plumes were observed.

An occasional *Rochinia crassa* spider crab was observed on the muddy substrate.

Quill worms (*Hyalinoecia tubicola)* were extremely prevalent.

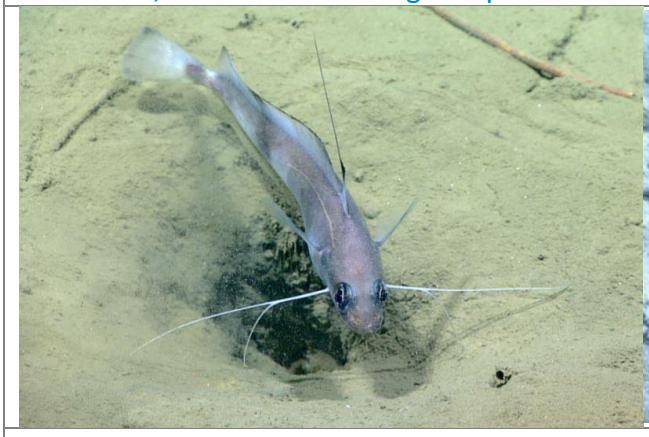
Several *Cancer* crabs were seen.



Two batfish (Family Ogcocephalidae) were seen.

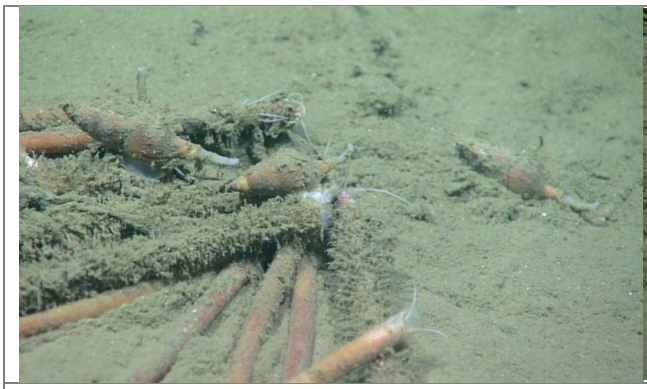
Several burrowing anemones (Hormathiidae) were seen, and one was eating a salp.

Mudstars (*Plutinaster* sp.) were common.



A silver hake (*Merluccius* sp.) was seen close to a burrow.

Small Blackbelly Rosefish (*Helicolenus dactylopterus*) were very common, and were often seen resting on the bacterial mats.

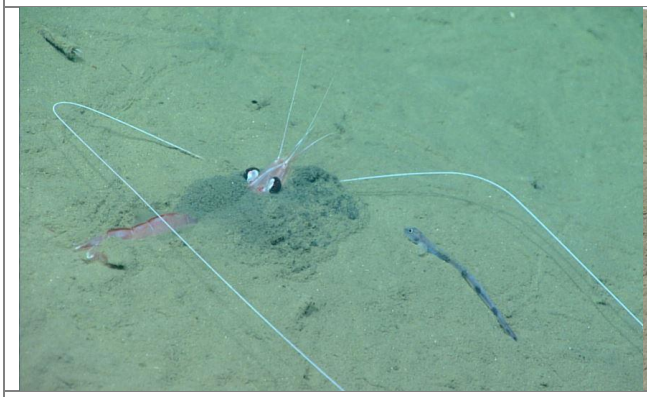


These small gastropods (Family Buccinidae, possibly *Colus* sp.) were very common and dined with the quill worms.

This midshipman (*Porichthys plectrodon)* snatched a passing barracudina fish seconds after this image was taken.

An unidentified tongue fish was observed.

Cerianthid tube anemones (*Pachycerianthis borealis*) were common. The outside of the cerianthid tubes were colonized by teneids (peracarid crusteaceans) each living in small mud tubes.

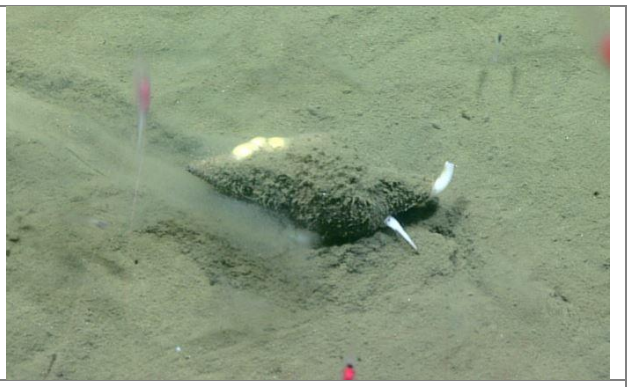


Several shrimp (*Mesopenaeus tropicalis*) with extremely long antennae were seen buried in the sediments.

A greeneye (*Chloropthalmus agassizi*) observed on soft sediment.

Samples Collected
Sample

Sample ID	SPEC02BIO
Date (UTC)	2018 06 30
Time (UTC)	14:09:36
Depth (m)	491.06
Temperature (˚C)	6.08
Field ID(s)	Unknown gastropod and mud



Reason for Collection	*unknown gastropod*
Notes	

Associates

[Notes section here can include number of organisms, condition of organism(s) upon retrieval or photos as needed]

Associate ID	Field Identification	Notes
A01	Sediment	fine-grained muds with terrigenous clays and pelagic calcareous microfossils. Soupy, dark brownish-black, label says mud but verified to be sediment
A02	eggcase	On dorsal shell, partially overlapping each other
A03	Brachioteuthis	Not part of initial collection, perhaps got in biobox later? Primary specimen feeding on this headless squid. USNM number not assigned. Morphological voucher not saved, only tissue samples for ID verification

Sample

Sample ID	SPEC05BIO
Date (UTC)	2018 06 30
Time (UTC)	16:33:39
Depth (m)	442.37
Temperature (˚C)	6.85
Field ID(s)	Quill worm and aplacophoran mollusc (possibly *Solenogaster*).

Reason for Collection	*Characteristic of Site*
Notes	
Associates	*[Notes section here can include number of organisms, condition of organism(s) upon retrieval or photos as needed]*

Associate ID	Field Identification	Notes

Sample

Sample ID	SPEC08BIO
Date (UTC)	2018 06 30
Time (UTC)	Unknown
Depth (m)	Unknown
Temperature (°C)	Unknown
Field ID(s)	Sergestes

Reason for Collection	*Opportunistic - came up with vehicle*
Notes	
Associates	*[Notes section here can include number of organisms, condition of organism(s) upon retrieval or photos as needed]*

Associate ID	Field Identification	Notes

Sample

Sample ID	SPEC09BIO
Date (UTC)	2018 06 30
Time (UTC)	Unknown
Depth (m)	Unknown
Temperature (°C)	Unknown
Field ID(s)	Myctophidae

Reason for Collection	*Opportunistic - came up with vehicle*
Notes	
Associates	*[Notes section here can include number of organisms, condition of organism(s) upon retrieval or photos as needed]* Associate ID | Field Identification | Notes | | | | | | | | |

Sample

Sample ID	SPEC10BIO
Date (UTC)	2018 06 30
Time (UTC)	Unknown
Depth (m)	Unknown
Temperature (°C)	Unknown
Field ID(s)	Nemichthys curvirostris

]

Reason for Collection	*Opportunistic - came up with vehicle*
Notes	
Associates	*[Notes section here can include number of organisms, condition of organism(s) upon retrieval or photos as needed]* Associate ID | Field Identification | Notes | | | | | | | | |

Sample

Sample ID	SPEC11BIO
Date (UTC)	2018 06 30
Time (UTC)	Unknown
Depth (m)	Unknown
Temperature (°C)	Unknown

Field ID(s)	Paralepididae
Reason for Collection	*Opportunistic - came up with vehicle*
Notes	
Associates	*[Notes section here can include number of organisms, condition of organism(s) upon retrieval or photos as needed]*

Associate ID	Field Identification	Notes

Sample

Sample ID	SPEC12BIO
Date (UTC)	2018 06 30
Time (UTC)	Unknown
Depth (m)	Unknown
Temperature (°C)	Unknown
Field ID(s)	Hyperiidae

Reason for Collection	*Opportunistic - came up with vehicle*
Notes	
Associates	*[Notes section here can include number of organisms, condition of organism(s) upon retrieval or photos as needed]*

Associate ID	Field Identification	Notes

Water Samples Collected

Though water samples were collected on this dive, there were issues with sample storage and preservation, therefore no water samples were retained nor archived. Sample numbering and data remains the same, as if water sampling did occur. Water samples have no physical specimen associated with them.

Please direct inquiries to:

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