



New Frontiers in Ocean Exploration

The E/V *Nautilus*, NOAA Ship *Okeanos Explorer*,
and R/V *Falkor* 2018 Field Season

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FRONT COVER

A bustling community of shrimp and squat lobsters in a towering city of glass sponges and soft corals (*Pinulasma nov. sp.* and *Parastenella cf. ramosa*). This delicate deep-sea metropolis, affectionately nicknamed “Spongetopia,” was discovered in July 2018 on the summit of Explorer Seamount in the Northeast Pacific. Explorer is Canada’s largest underwater volcano and one of 40+ seamounts located in the proposed Offshore Pacific Marine Protected Area. Image credit: D. Fornari (WHOI-MISO Facility), Northeast Pacific Seamount Expedition partners, and OET

The R/V *Falkor* team dove on “Rosebud,” a whale fall that was placed by researchers off San Diego, California, in La Jolla Canyon. Researchers noted changes in composition and life forms around the location in a beautiful, exciting dive investigating ecosystems unique to whale falls. Image credit: SOI



DEEP SEARCH: Deep Sea Exploration to Advance Research on Coral/Canyon/Cold Seep Habitats

By Erik Cordes, Amanda Demopoulos, Michael Rasser, and Caitlin Adams

Now in its second year, the Deep Sea Exploration to Advance Research on Coral/Canyon/Cold seep Habitats (DEEP SEARCH) project had a successful 2018 field season with three separate efforts on NOAA Ship *Okeanos Explorer*, R/V *Atlantis*, and R/V *Brooks McCall*.

PROJECT BACKGROUND

Led by the Bureau of Ocean Energy Management, the US Geological Survey, and NOAA's Office of Ocean Exploration and Research, and sponsored by the National Oceanographic Partnership Program, DEEP SEARCH is an interagency partnership to explore and characterize sensitive US Mid- and South Atlantic deep-sea habitats. The study brings together scientists from six US academic institutions and five USGS science centers for a multiyear research program.

By exploring and characterizing biological communities in the study area, examining their sensitivity to natural and human disturbance, and describing the oceanographic, geological, geochemical, and acoustic conditions associated with each habitat type, DEEP SEARCH will improve our ability to predict the locations of seafloor communities off the coast of the southeast United States that are potentially sensitive to disturbance. This area encompasses a variety of different habitat types, including submarine canyons, methane seeps, coral mounds, and soft sediments.

COLLABORATION WITH NOAA SHIP OKEANOS EXPLORER

After fieldwork in 2017 was disrupted by hurricanes, DEEP SEARCH planned an ambitious 2018 cruise schedule that originally included a 25-day expedition aboard NOAA Ship *Nancy Foster*. When that cruise was canceled due to emergency repairs, the multibeam mapping objectives were shifted to *Okeanos Explorer*, and the Windows to the Deep expedition team (see pages 82–85) worked quickly to incorporate DEEP SEARCH mapping priorities into an extended mission.

The highly successful *Okeanos Explorer* cruise acquired detailed bathymetry over the coral habitats of the southern DEEP SEARCH study area. These locations were selected using a combination of prior coral observation data and the results of preliminary predictive habitat models. The subsequent *Okeanos Explorer* ROV mission, Windows to the Deep, co-led by DEEP SEARCH co-PI Cheryl Morrison made a number of exploratory dives to coral, canyon, and seep habitats. This cruise provided the first glimpses of some of the new habitats that would become the core of the DEEP SEARCH program.

R/V ATLANTIS EXPEDITION

In August 2018, the DEEP SEARCH team completed a 15-day expedition on Woods Hole Oceanographic Institution (WHOI) operated R/V *Atlantis* using HOV *Alvin*. Eleven dives were completed at three canyons, two seep sites, and four coral sites, ranging in depth from 403 m to 2,169 m. Mapping data from the earlier *Okeanos Explorer* cruises were augmented by 8,233 km² (Figure 1). Biological, geological, and chemical samples were collected by *Alvin* and with CTD, moncore, and multicore instruments.

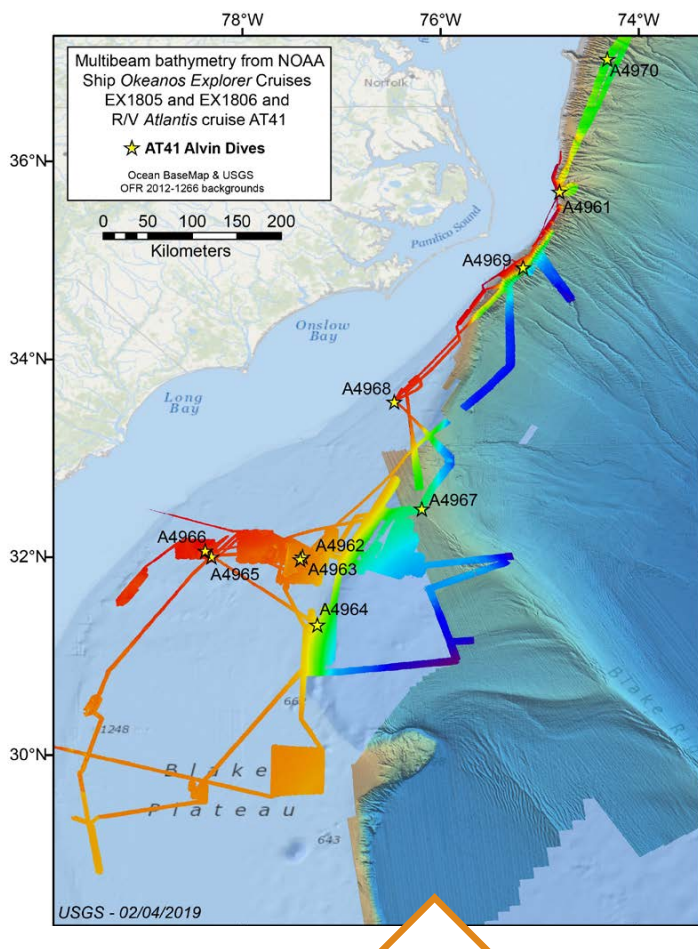
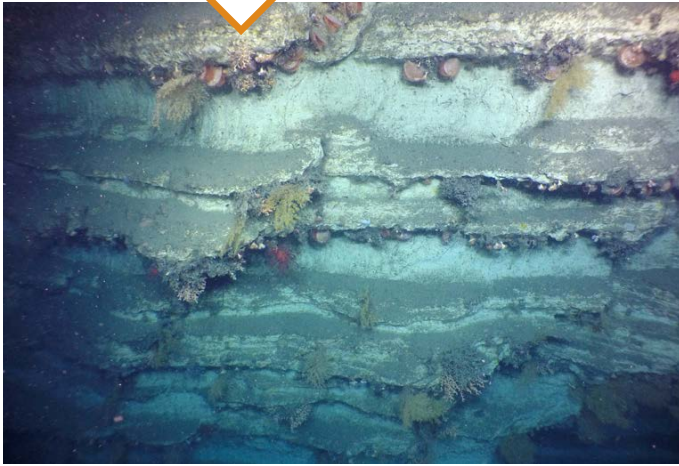


Figure 1. Map showing the study area and multibeam bathymetry data collected by NOAA Ship *Okeanos Explorer* and R/V *Atlantis*. Yellow stars indicate dive sites explored by HOV *Alvin*. Image credit: USGS

Figure 3. Squid circle *Alvin* during collection of images of abundant bacterial mats at Pea Island seeps. Image credit: BOEM, USGS, NOAA, ©WHOI

Figure 2. *Alvin* explored Pamlico Canyon off the coast of North Carolina and observed stunning rock walls covered in a diversity of corals. Image credit: BOEM, USGS, NOAA, ©WHOI



The expedition enabled more intensive investigations of seafloor environments previously covered only by preliminary visual surveys. Among these were the base of Pamlico Canyon, Pea Island seeps, and portions of Stetson Banks. The dives revealed persistent turbidity flows near the heads of the canyons and steep walls with numerous octocoral colonies throughout (Figure 2). The newly surveyed seeps were relatively shallow, located near the shelf break, and characterized by active methane bubble release and abundant bacterial mats (Figure 3).

One of the most exciting locations explored during the cruise was the series of long lines of cold-water coral mounds that together comprised approximately 140 km of coral reef beneath the Gulf Stream (Figure 4). While deepwater corals have been known to be in the area since the 1960s, modern mapping, imaging, and sampling tools are allowing the first comprehensive investigation of their complexity and extent.

R/V BROOKS McCALL

In October 2018, the DEEP SEARCH team completed its final fieldwork of the year on the TDI-Brooks International Inc.-owned R/V *Brooks McCall*. *Brooks McCall* was chartered to complete the remainder of the planned work from the canceled *Nancy Foster* cruise. The vessel deployed two benthic landers, one at the newly discovered coral reefs and the other at a canyon site. The landers will remain on the seafloor for up to a year, collecting continuous environmental data. The ship was also equipped to retrieve long piston cores from the reefs, which will provide valuable data on the age and geological history of these structures.

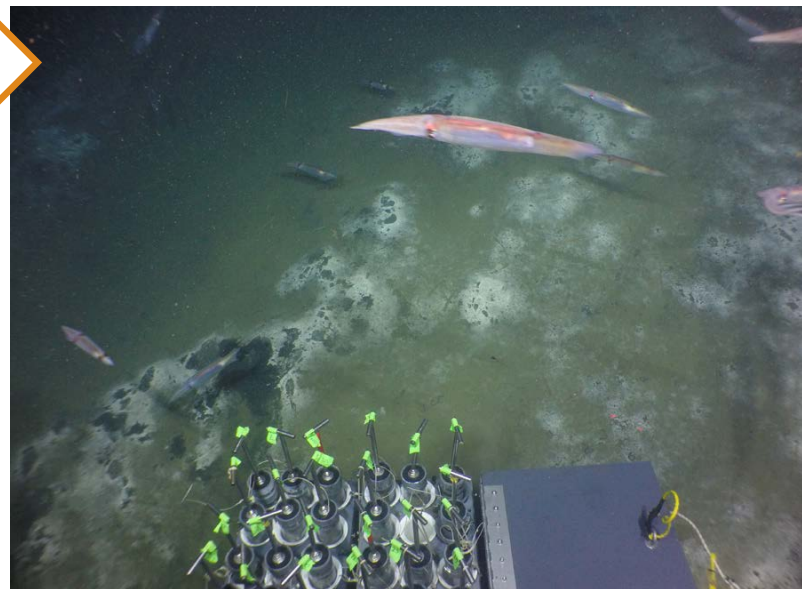


Figure 4. *Alvin* collects a sample of live *Lophelia pertusa*. On the third dive of the R/V *Atlantis* expedition, DEEP SEARCH explored thriving *Lophelia* reefs along a pronounced linear mound. These *Lophelia* reefs are among the deepest found to date along the US Atlantic coast. Image credit: BOEM, USGS, NOAA, ©WHOI

NEXT STEPS

In 2019, a DEEP SEARCH expedition aboard NOAA Ship *Ronald H. Brown* will further investigate the deep-sea habitats of the US Mid- and South Atlantic, using ROV *Jason* to capture video of the seafloor and collect samples. Data from the 2017 and 2018 cruises will inform dive site selection and sampling needs for this major field effort. Though 2019 will be the final field season directly supported by the project, DEEP SEARCH team members will continue to analyze data and build their final report throughout 2021. BOEM plans to publish the final report for this project in 2022. The results of this study will be used to further BOEM's understanding of how to protect these sensitive deepwater habitats and inform management decisions.