Exploring US Mid-Atlantic Margin Methane Seeps: IMMeRSS, May 2017

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The May 2017 Interagency Mission for Methane Research at Seafloor Seeps (IMMeRSS) expedition studied the geology, ecology, chemistry, and physics of methane seeps between Baltimore and Norfolk Canyons on the US Mid-Atlantic margin (Figure 1). IMMeRSS was led by US Geological Survey (USGS) scientists in collaboration with the British Geological Survey (BGS) and with support from NOAA's Office of Ocean Exploration and Research and the US Department of Energy.

The IMMeRSS team used Deep Sea Systems ROV *Global Explorer,* managed by Oceaneering International Inc., to complete five dives from May 3 to May 11, 2017, at water depths of 425 m to 1,450 m (Figure 1). The cruise marked the first time that the University of Delaware's R/V *Hugh R. Sharp* was used for ROV operations in water depths greater than 500 m.

Since 2012, over 600 methane seeps have been discovered between Cape Hatteras and Georges Bank on the US Atlantic margin. The seeps occur from the outer continental shelf (~100 m depth) to the middle of the continental slope (~1,500 m depth), with many located on the uppermost slope (150–450 m depth), just shallower than the landward limit of gas hydrate stability. Only a handful of these cold seep sites have been visited by ROVs or the submersible *Alvin*. During the 2017 IMMeRSS cruise, researchers carried out detailed surveys at seeps where chemosynthetic communities had previously been identified, and conducted discovery dives at recently detected seeps (Figure 2).

A key focus of IMMeRSS was acquiring samples of methane-derived authigenic carbonates, unique seafloor rocks that form in their present locations as a result of microbial processes. BGS scientists are analyzing the carbonates using uranium-thorium radioisotopic methods to constrain the age of methane emissions responsible for the formation of these rocks. To characterize benthic community ecology, researchers sampled chemosynthetic organisms such as mussels and surveyed the distribution of benthic biota along video transects that crossed seep fields. Biogeochemical data acquired from the organisms, surrounding sediment, and deep ocean waters are being analyzed to determine how environmental factors affect seep ecology. Researchers also collected samples that can be used to infer whether microbial processes or processes like those responsible for petroleum formation produce the methane that is leaking at the seeps.

Outreach activities included real-time video streaming of the ROV dives to onshore web portals managed by OER and Oceaneering International Inc. The video stream received more than 22,000 individual views, with the highest number accessing the portal when an intact baleen whale skeleton was found on the seafloor. The image-only video stream was supplemented with real-time social media updates coordinated by the USGS. The Facebook posts increased likes, reach, and engagement for the USGS Coastal and Marine Geology page by more than 2,000% according to detailed analytics compiled during the IMMeRSS cruise.

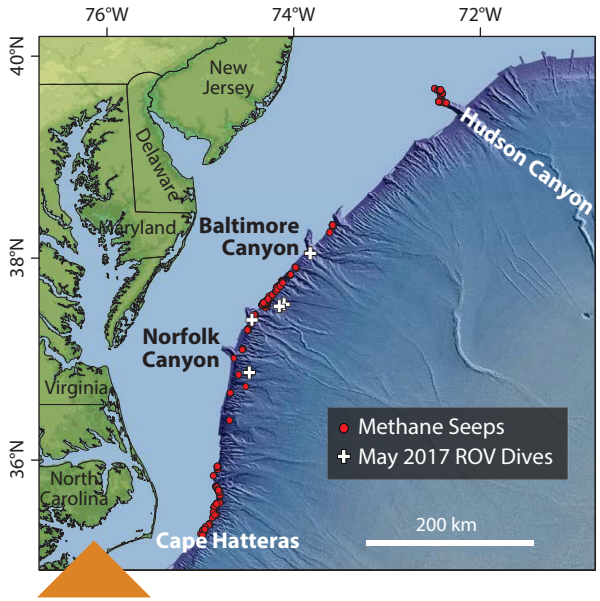

Figure 1. Map showing location of methane seeps (red circles) and dives led by the USGS using ROV *Global Explorer* from R/V *Hugh R. Sharp* in May 2017.

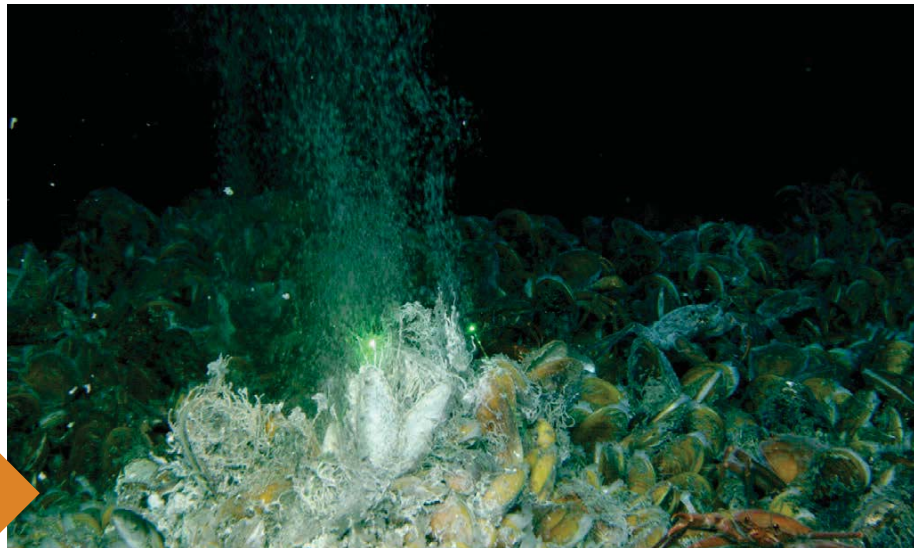

Figure 2. A newly discovered methane seep at approximately 1,000 m water depth offshore Virginia. The bubbles are emanating from a densely populated field of *Bathymodiolus* mussels. Lasers (green dots) are separated by 10 cm. *Image credit: USGS*