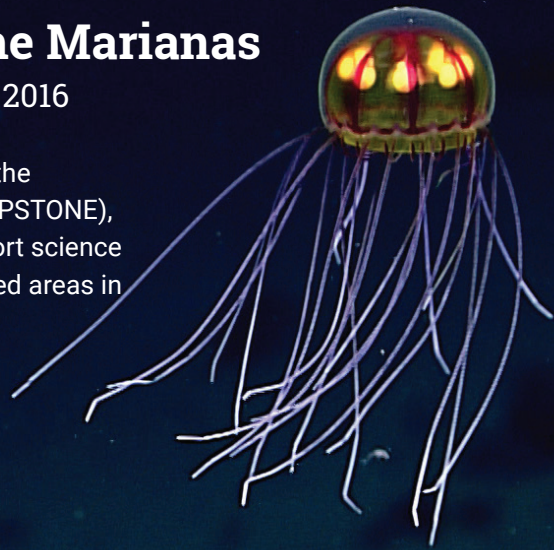


2016 Deepwater Exploration of the Marianas

NOAA Ship *Okeanos Explorer*, April 20 – July 10, 2016

This expedition is part of the three-year Campaign to Address the Pacific monument Science, Technology, and Ocean NEEds (CAPSTONE), an initiative to collect deepwater baseline information to support science and management decisions in and around U.S. marine protected areas in the central and western Pacific.

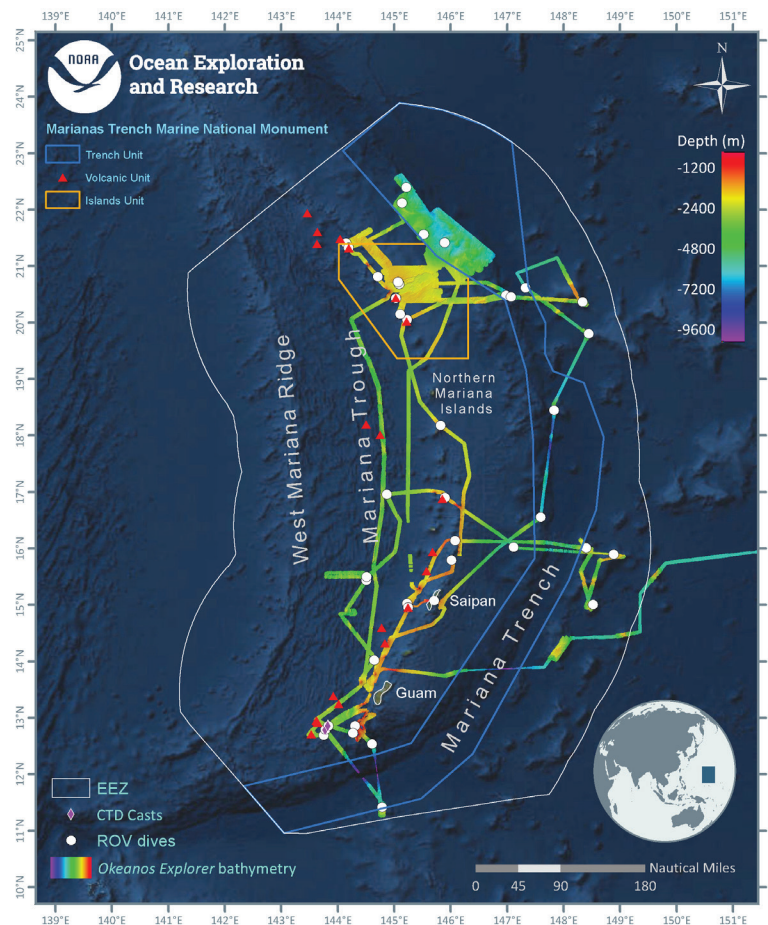


Summary Accomplishments

The 2016 Deepwater Exploration of the Marianas expedition was a 59-day, three leg telepresence-enabled expedition including remotely operated vehicle, CTD rosette, and mapping operations to explore unknown and poorly known areas in and around the Marianas Trench Marine National Monument (MTMNM) and the Commonwealth of the Northern Mariana Islands (CNMI). The primary expedition goal was to acquire baseline information in deepwater areas to support science and management needs and to understand the diversity and distribution of deepwater habitats in and around the CNMI and MTMNM. Major accomplishments from the expedition are summarized below.

Mapped more than 80,500 square kilometers of seafloor – an area larger than the state of West Virginia!

- Mapped approximately 32,800 square kilometers inside the Monument, including overtop of nine sites of the Monument's Volcanic Unit.
- Cruise Leg 2, a 13-day mapping-only cruise, involved collection of data from previously unmapped areas in the northwest area of the Trench Unit, including the definition of several mud volcanoes and the 6000-meter isobath (contour) line along the western wall of the trench and the central part of the Monument's Islands Unit, including a sharp ridge feature extending eastward from the Mariana Arc volcanic chain.
- On Cruise Leg 3, five dive sites were planned on newly resolved features not discernible in previous satellite data, and overnight mapping operations added significant additional coverage in the Trench and Islands Units. Other priority mapping efforts included: identifying the 400-meter contour at Santa Rosa Bank and the north side of Farallon De Medinilla, both areas of interest for fisheries resource management; conducting a mapping survey to search for several lost B-29 bombers from World War II; and adding to existing mapping data coverage in the region.



Overview map showing seafloor bathymetry, remotely operated vehicle (ROV) dives, and conductivity temperature and depth (CTD) casts conducted during the three-cruise Deepwater Exploration of the Marianas expedition. Bathymetry data collected during the transit to Guam prior to the start of the expedition is also shown.

Conducted 41 ROV dives from 240 to 6,000 meters depth to survey for precious coral or bottomfish fishery habitats; look at deep-sea coral communities and manganese-encrusted habitats at seamounts; search for hydrothermal vents, mud volcanoes, and associated communities; investigate subduction zone habitats and the abyssal/hadal transition zone; and better understand the geologic history of the region.

- Observed hundreds of different species of animals. There were dozens of potential new species, as well as an abundance of new records for the region and several significant range extensions. Many organisms were also seen alive for the first time.
- Collected 58 primary biological samples (and 102 commensals), most of which are potentially undescribed species. Seventy-three rock samples were collected for use in age-dating and geochemical composition analysis.
- Conducted 18 dives within the Monument, and four just outside, collecting critical baseline information to inform science and management needs. Four of these dives included midwater surveys to better understand this largely unknown biome.
- Conducted the first effort to discover and document deep-sea coral and sponge communities in the deep waters of the Marianas. Documented 10 high density communities and a rare high-density community of basket stars and crinoids.
- Addressed priority fisheries interests during 11 dives, confirming the presence of precious corals in the region and surveyed deepwater bottomfish fishery habitats. Found that while there was little overlap observed between bottomfish and precious corals, there was overlap between bottomfish and non-precious coral habitat.
- Surveyed five Cretaceous-age guyots with heavy ferromanganese crusts for initial characterization of biological communities, which may be relevant to potential future mining activities. Each dive was conducted on varying terrain with unique communities.
- Provided an initial look into subduction zone habitats on six dives and investigated the abyssal/hadal transition zone.
- Discovered a World War II B-29 Superfortress bomber in the channel between Tinian and Saipan. This was the first B-29 crash site discovered of over a dozen American B-29s lost in the area while flying missions against Japan in World War II. The sites represent America's final push to end the war, an historically significant time in U.S. history, and are of interest to multiple management groups and several universities and foundations working to identify crash sites for the families of lost servicemen.



Seen while exploring a ridge feature at a depth of ~2,500 meters, the fish measured about 10 centimeters long. It is in the same order (Ophidiiformes) as cusk eels, but belongs to a distinct family (Aphyonidae); this is the first time that a fish in this family has ever been seen alive! With its transparent, gelatinous skin, which lacked scales, and its highly reduced eyes that lacked pigment, the fish was truly a remarkable, and ghostly, find.



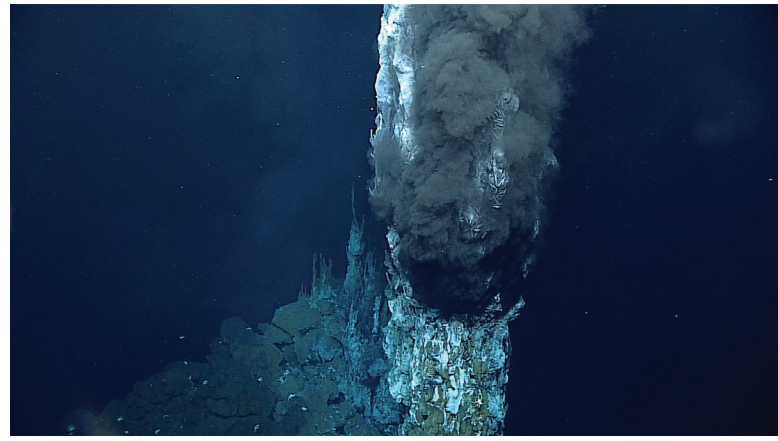
A huge blind lobster (possibly *Thaumastocheles* sp.) popping its head out of a hole on dive 8. This deep-sea lobster was seen guarding a series of large burrows with claws poised for action.

Investigated a variety of of different geological features, including extinct calderas, active volcanoes, mud volcanoes, fresh lava flows, and carbonate platforms.

- Discovered and documented three new hydrothermal vent sites including small amounts of hydrothermal activity at

Eifuku Seamount, an entirely new vent field at Chamorro Seamount (an area with no known history of eruptions), and a new active high-temperature “black smoker” vent field composed of multiple chimneys (one over 30 meters tall!) on the Mariana Back Arc spreading center.

- Investigated Ahyi and Daikoku submarine volcanoes to characterize the seafloor habitats and document changes following evidence of recent eruptions.
- Discovered a new mud volcano, mapped for the first time during Leg 2 of this expedition.
- Documented the first-ever petit-spot volcano in U.S. waters. This is the first time this type of volcano, which occurs at a fracture in the subducting plate as it bends prior to subduction, has been seen in the Marianas or anywhere outside of Japan and its discovery provides the first evidence that the petit-spot phenomena could be much more widespread than originally hypothesized.

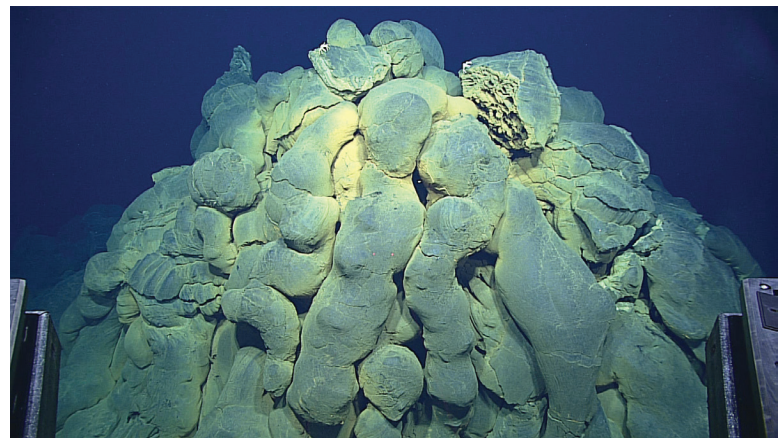


A “black smoker” on dive 11 of leg 1. Where the super-hot vent fluid meets very cold ambient sea water (2°C) of the deep sea, minerals that are carried in the fluid precipitate out of solution, forming spectacular vent chimneys. The temperature of the vent fluid was measured at 339°C.

Collected more than 48 TB of data, including multibeam sonar, single beam echo sounder, subbottom profiler, Acoustic Doppler Current Profiler (ADCP), eXpendable Bathy Thermograph (XBT), temperature and dissolved oxygen profiles, surface oceanographic and meteorological sensors, video, imagery, and associated dive and video products. All the data will be made publicly available through national archives.

Engaged the local communities in Guam and Saipan, as well as audiences around the world.

- Shared live video feeds of the expedition with the public worldwide via the Internet, with the live video receiving a record-breaking more than 3.1 million views!
- Brought a new Internet-1 based Exploration Command Center online at UnderwaterWorld Guam, allowing both scientists and the public to participate in dives in real time.
- Conducted nine live telepresence events, including five focused on educators and students in Guam and Saipan.
- Hosted ship tours in Guam and Saipan to share the expedition and ocean exploration technology with ~370 locals, including VIPs, scientists, students, educators, media, resource managers, and the general public.
- Engaged ~695 Guam and Saipan residents, including local educators, students, resource managers, stakeholders, and the general public, in presentations, workshops and events.
- Received news and media coverage by more than 110 outlets (including CNN, NPR, LA Times, Washington Post, Scientific American, Time, USA Today, BBC) and conducted 15 interviews with media during the expedition.



A mound of pillow lava. These pillow basalts form when basaltic lava erupts underwater. Cold seawater chills the erupting lava, creating a rounded tube of basalt crust that looks like a pillow. As the newly erupting lava pushes through the chilled basalt crust, it can form scratches on the pillow surface, called striations.

For More Information

<https://oceanexplorer.noaa.gov/oceanos/explorations/ex1605/welcome.html>

