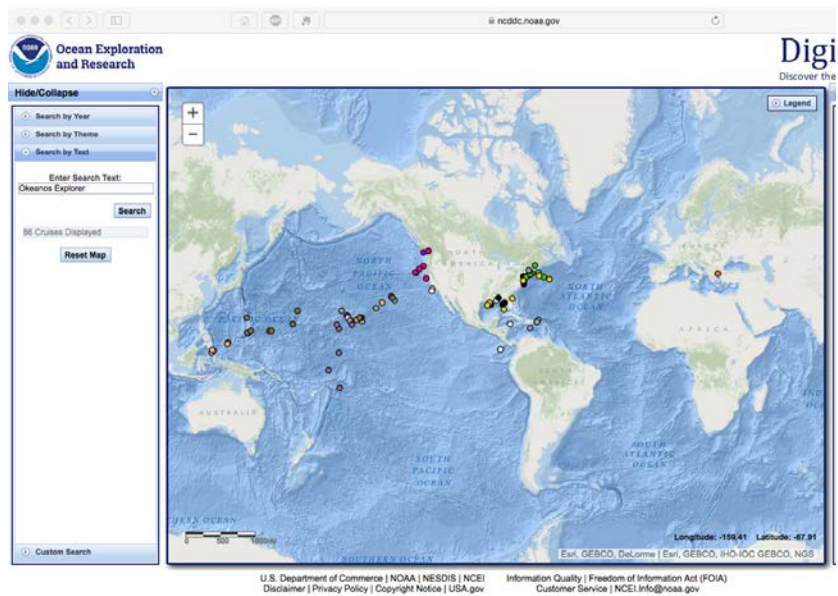


Northeast U.S. Canyons Expedition 2013: Mytilus Seamount

This activity illustrates how to use the Digital Atlas and how to use the Fledermaus software, and extends the Ocean Explorer Digital Atlas Supplement to explore a different location.

1. Open the Ocean Explorer Digital Atlas at http://www.ncddc.noaa.gov/website/google_maps/OE/mapsOE.htm.
2. In the left column click on the **Search by Text** tab at the bottom. In the text box type *Okeanos Explorer*. The dots that will appear on the map are all of the *Okeanos Explorer* expeditions color-coded by year.



3. In the column on the right, scroll to find the 2013 *Okeanos Explorer* Northeast U.S. Canyons Expedition (EX1304L2). Tell students that cruises are named with an abbreviation of the ship name ("EX" is used as an abbreviation for *Okeanos*

A screen grab from the map on the Digital Atlas web site showing sites of Ocean Explorer cruises. The database can be searched by Expedition, Year, Theme, Text or Custom Search. https://www.ncddc.noaa.gov/website/google_maps/OE/mapsOE.htm

Explorer), the last two digits of the year in which the cruise took place ("13"), the number of the cruise (this was the fourth cruise for 2013), and the segment or leg (this was the second leg of cruise 04). Click on this cruise and you will see a pop up box as illustrated in the figure below.

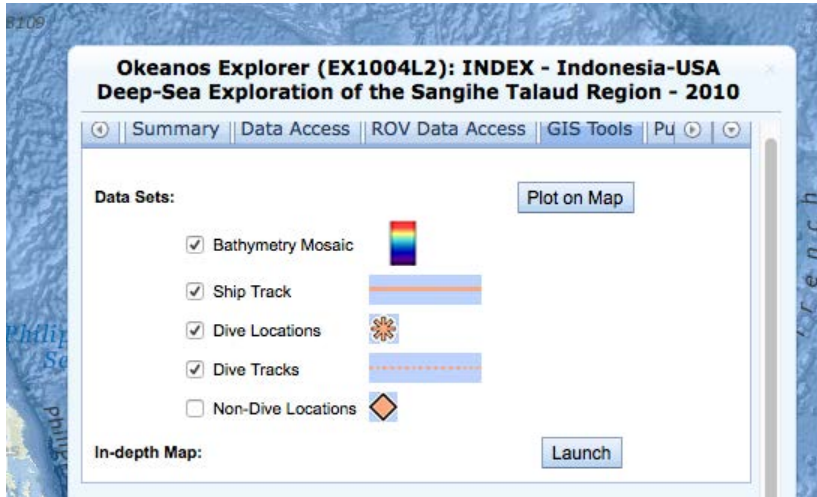


Notice the tabs provided at the top of the pop up window. For educator information related to this cruise, click on the **Education** tab. This will take you to several educational resources available on the Ocean Explorer website related to this expedition including an Expedition Education Module which provides background information, an introductory video, lessons and more resources associated with the expedition.

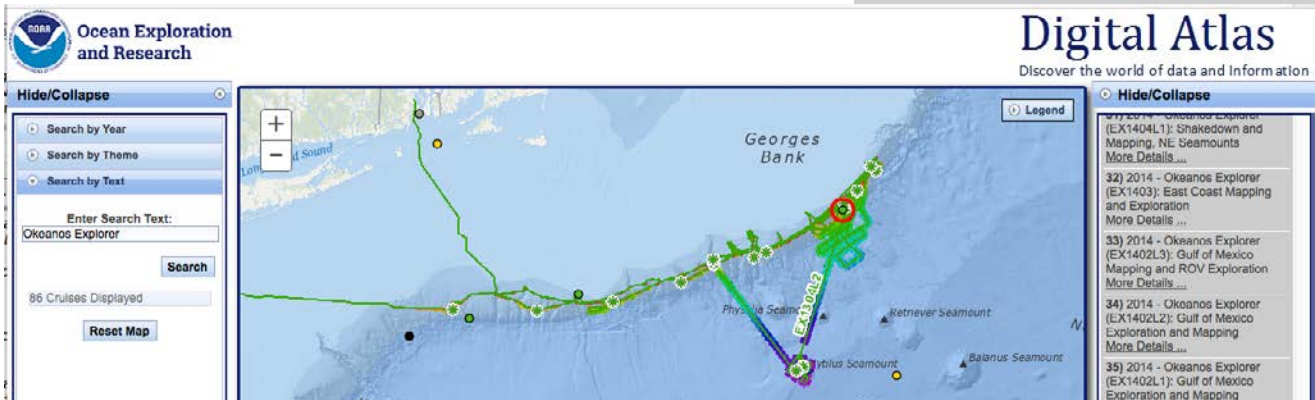
The Northeast U.S. Canyons Expedition <http://oceanexplorer.noaa.gov/okeanos/explorations/ex1304/welcome.html> took place during the summer of 2013. During this expedition, a team of scientists and technicians both at-sea and on shore conducted exploratory investigations on the diversity and distribution of deep-sea habitats and marine life along the Northeast U.S. Canyons and at Mytilus Seamount, located within the U.S. Exclusive Economic Zone. The 36-day expedition complemented work done through the 2012 Atlantic Canyons Undersea Mapping Expeditions (ACUMEN <http://oceanexplorer.noaa.gov/okeanos/explorations/acumen12/welcome.html>).

The expedition also marked the first time NOAA's new 6,000 meter remotely operated vehicle (ROV), *Deep Discoverer* <http://oceanexplorer.noaa.gov/technology/subs/deep-discoverer/deep-discoverer.html> and the *Seirios* <http://oceanexplorer.noaa.gov/okeanos/explorations/ex1708/logs/sept26/welcome.html> camera sled and lighting platform were used in a full telepresence-enabled ocean exploration with NOAA Ship *Okeanos Explorer*. When these systems were deployed from the ship, the expedition team was able to provide scientists and audiences onshore with real-time video footage from deepwater areas in important, largely unknown, U.S. waters.

4. Click on the **GIS Tools** tab in the pop up window, select the first four boxes, and click **Plot on Map**.

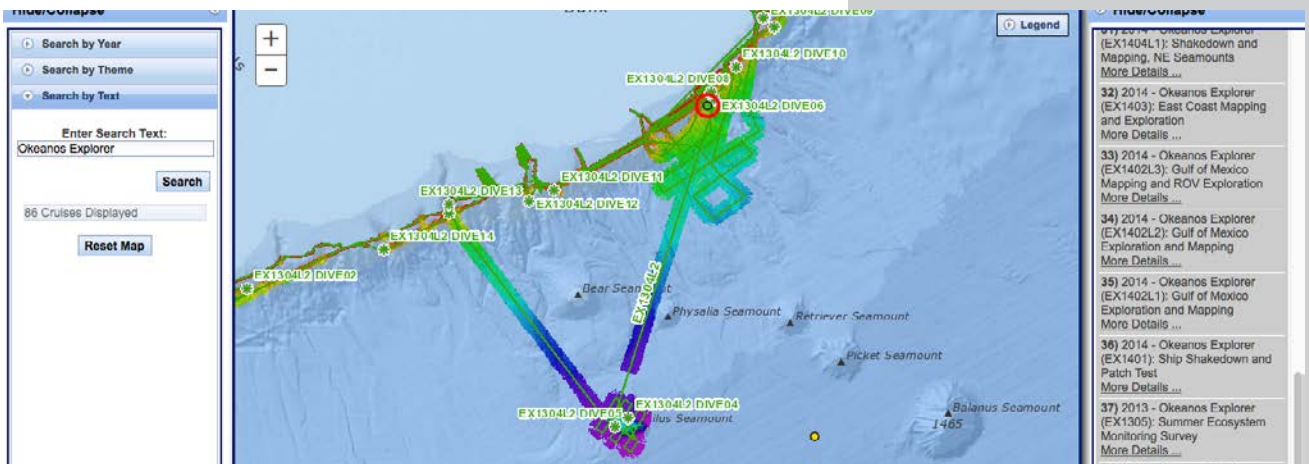


Give the map a moment to load and what appears should look like the figure below.



This shows the ship's entire cruise track and the bathymetric mapping work done throughout the expedition.

- Click on the map and holding the left cursor down, move the view slightly to the right. A number of named seamounts should come in to view. Notice that Mytilus Seamount was mapped during this mission.



Hide/Collapse ⊕

▶ Search by Year

▼ Search by Theme

- Biodiversity
- Bioluminescence
- Biotechnology
- Canyons
- Caves
- Chemosynthetic Communities
- Deep-Sea Corals
- Faults
- Habitat Characterizations
- Marine Archaeology
- Microbiology
- Sampling Operations
- SCUBA and Technical Diving
- Seafloor Mapping
- Seamounts
- Seeps and Vents
- Sound and Light
- Submersibles
- Telepresence
- Testing New Technologies
- Trenches
- Volcanoes

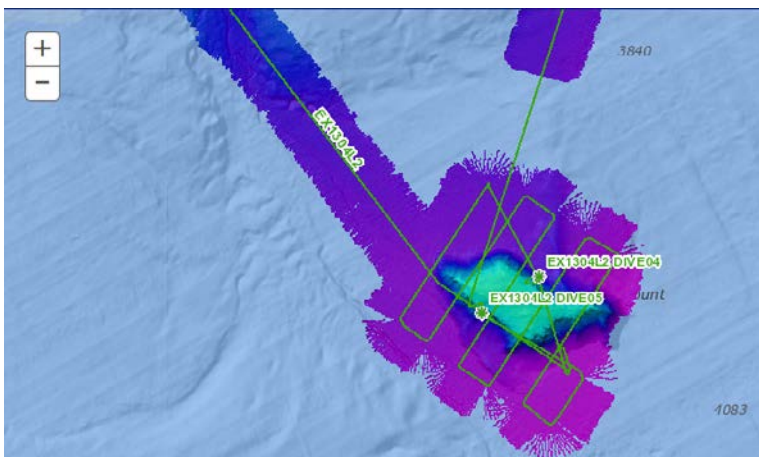
No Themes All Themes

312 Cruises Displayed

Reset Map

Themes that can be searched in the OER Digital Atlas.

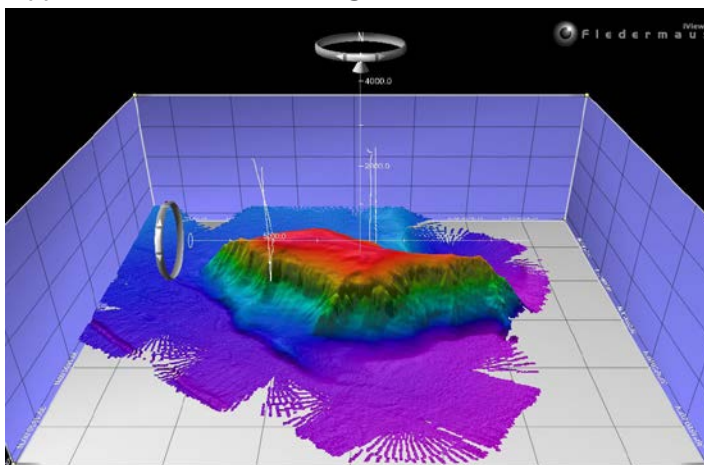
6. Using the center mouse button, zoom in on Mytilus Seamount as illustrated below. Point out the light green line, which is the ship's track, and ask students why the ship seems to be tracking back and forth. Explain to students that the first step in the ship's exploration strategy is mapping and that the ship is obtaining high-resolution multibeam maps of the area being explored (this is called "mowing the lawn," for obvious reasons). You will see both the track of the ship and the false color bathymetry of Mytilus Seamount.



You will also see that two dives took place on the seamount, EX1304L2 Dive 4 and Dive 5.

7. Click on service.ncddc.noaa.gov/rdn/oer-waf/media/ex1304l2/EX1304L2_MytilusSeamount.scene. This will open an interactive scene file of Mytilus Seamount within a three dimensional data visualization system called Fledermaus. (This free software must be downloaded to view and manipulate the image in the figure below. See iView4D software from <http://www.qps.nl/display/main/download>).

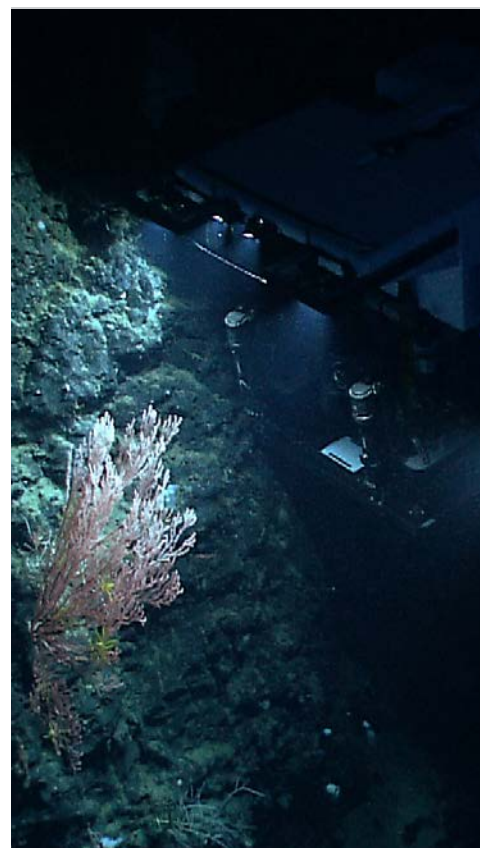
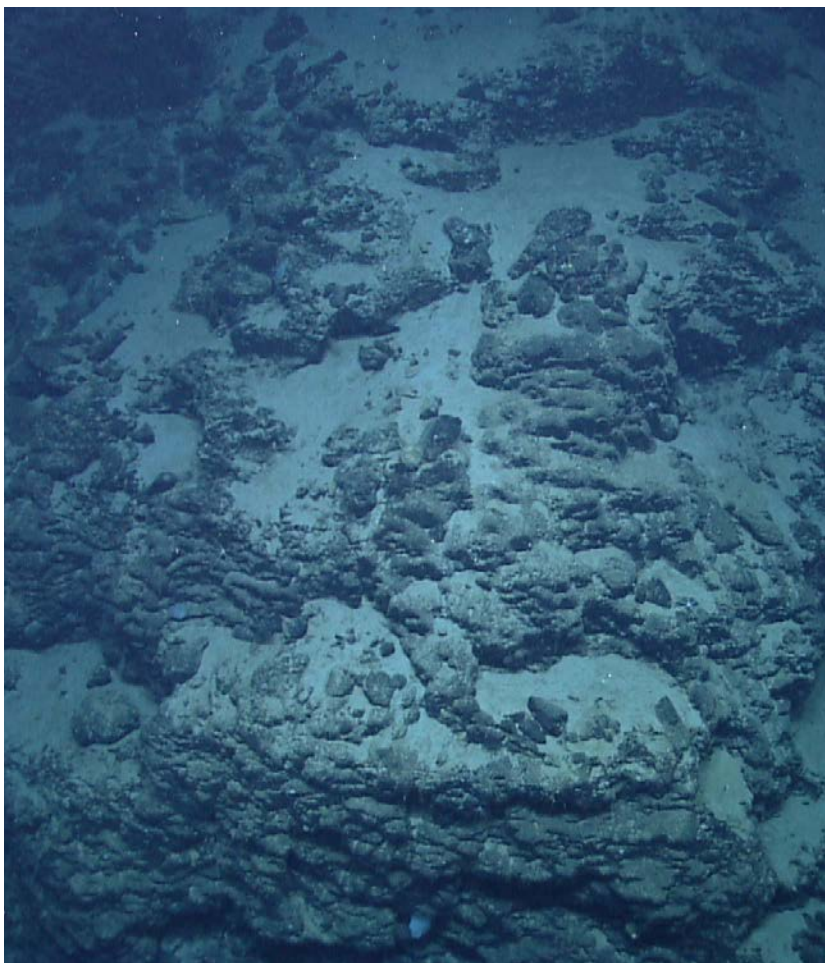
This is an image of the Mytilus Seamount created from the multibeam sonar data collected as the ship traveled over and mapped the seafloor in this region.



Fledermaus image of Mytilus Seamount.

8. Orientation to Fledermaus manipulation tools:

- a) Notice on the top left box that the exaggeration is set at 3.00x. The actual exaggeration is 1. The image has been exaggerated to three in order to view the structure in more detail.
- b) In the column on the left, viewers can select different views of the seamount. Checking the first box will provide a false color map of the seamount with purple being the deepest points and red being the shallowest points. Checking the second box will show the slope. Checking the final two boxes will produce vertical white lines indicating the tracks of the ROV deployed to explore the seamount.
- c) The white x and y axis orients the viewer to distance in meters.
- d) The rings on the left and at the top of the image can be used to manipulate the view. (Note: Use Camera and Reset Camera in the menu bar to return to the original view.)
- e) The ocean floor is shown as a three-dimensional image. The x-axis represents longitude, the y-axis represents latitude, and the z-axis represents depth. When you move the cursor over the image, the window near the bottom of the screen shows the geo coordinates (x, y, and z) for the location beneath the cursor.



NOAA's ROV, *Deep Discoverer*, examines a deepwater coral colony on the north flank of the almost wholly unexplored Mytilus Seamount. Image courtesy of NOAA *Okeanos Explorer* Program, 2013 Northeast U.S. Canyons Expedition.

<http://oceanexplorer.noaa.gov/okeanos/explorations/ex1304/dailyupdates/media/aug4.html>

This view of steep basalt pillars on the north side of Mytilus Seamount resembles a lava flow, illustrating the seamount's volcanic origin. Image courtesy of NOAA *Okeanos Explorer* Program, 2013 Northeast U.S. Canyons Expedition.

<http://oceanexplorer.noaa.gov/okeanos/explorations/ex1304/logs/aug6/media/rocks.html>



Sponges are abundant and diverse at Mytilus Seamount. Notice this large “witch’s hat” sponge provides structure for numerous hexactinellid or glass sponges as well as some orange brittle stars. Image courtesy of NOAA *Okeanos Explorer* Program, 2013 Northeast U.S. Canyons Expedition.
<http://oceanexplorer.noaa.gov/okeanos/explorations/ex1304/logs/aug6/media/sponge.html>



A crinoid or feather star hangs out on a deepwater coral on the south side of Mytilus Seamount. Image courtesy of NOAA *Okeanos Explorer* Program, 2013 Northeast U.S. Canyons Expedition.
<http://oceanexplorer.noaa.gov/okeanos/explorations/ex1304/dailyupdates/media/aug5.html>

Have students analyze the image and develop questions based on their own curiosity.

Questions for students to consider might include:

- What is the length of the seamount from east to west?
- What is the length of the seamount from north to south?
- What is the deepest point of this seamount? What is the shallowest point?
- What appears to be one of the steepest point on this seamount?

Based on what they observe in the image and where they know the seamount is located:

- What might be the reason this seamount has a flat top? (Note: one theory is that this seamount was once above sea level and was worn flat by wind and weather.)
- What is the geology like at this seamount? Type of rock? Hardness of rock or sediment?
- What organisms might live here? Why?
- Do you think different organisms live at different depths on this seamount? Why or why not?
- Why did the scientists select these dive locations? If you were the scientist leading this expedition and exploring this seamount for the first time, where would you choose to send the ROV? What considerations do you think need to be made when deciding what regions to select for further exploration?
- What differences might you expect between Dive 4 on the north side of the seamount and Dive 5 on the south side of the seamount?

9. Now go back in the atlas and click on the expedition box on the right, EX1304L2, again. In the pop up window **Summary** tab will be a link to the expedition on the Ocean Explorer website. Click on **Expedition Website**.

This is the main Northeast U.S. Canyons Expedition 2013 webpage. Find and click on the Daily Updates link.

Scroll to Dives 4 (north side of the seamount) and 5 (south side of the seamount) to have students read about what was found during each of these dives.

Ask students:

- Why did scientists select this seamount for exploration? (This is one of the least explored seamounts of the NE Seamount Chain.)
- What was the deepest point the ROV traveled during these two dives? (3271 meters)
- What is the primary type of rock present at this seamount? (basalt) Why? (The New England Seamount chain is a line of extinct volcanoes running from the southern side of Georges Bank midway across the western Atlantic.)
- Why do you think there were more fish found on the south side of the seamount vs the north side? (possible food sources; possible hiding places)

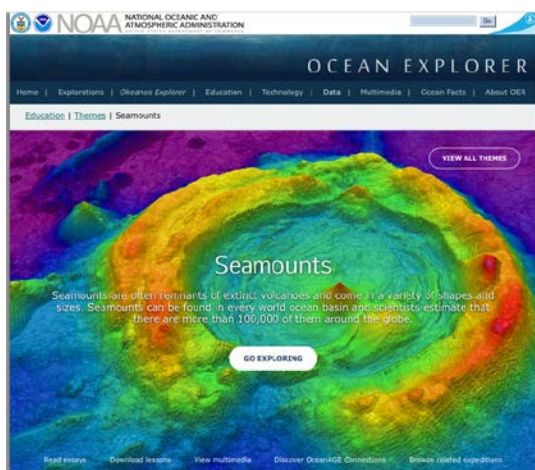
10. Now that students have read the two Dive logs, discuss possible answers to some of their questions from #8.
11. Ask students if they were to take what was learned from this exploration and go back to investigate further, what would be their area of interest? What would they want to know?
Possible areas of further exploration:
Why did the basalt rocks in Dive 4 have a manganese coating?
How did pillow lava form in this location?
Why do the hermit crabs found here have anemone houses?
Why did different organisms inhabit different locations on the bamboo coral?
What are some possible food chains and food webs in this region?
Do different corals live at different depths?
Why are there different organisms on the north vs the south side of this seamount?
12. Once students have shared their interests for further exploration, have them read the following Mission Log from August 6, 2013 following the two dives locations just explored.
<http://oceanexplorer.noaa.gov/oceanos/explorations/ex1304/logs/aug6/aug6.html>

Additional Resources

Ocean Explorer Seamounts Theme page

<http://oceanexplorer.noaa.gov/edu/themes/seamounts/welcome.html>

This page compiles some of the best ocean explorer education resources on seamounts including essays, lessons, multimedia activities and links to past expeditions.



Seamounts, Les Watling Ph.D., University of Hawai'i at Manoa

<https://vimeo.com/88841596>

In this 45 minute video, Dr. Les Watling, marine scientist at the University of Hawai'i at Manoa, provides an excellent description of the formation of seamounts, their geology and their associated ecological and biological diversity.



An octopus strikes a pose for the remotely operated vehicle near Shallop Canyon. Image courtesy of NOAA *Okeanos Explorer* Program, 2013 Northeast U.S. Canyons Expedition.

<http://oceanexplorer.noaa.gov/oceanos/explorations/ex1304/logs/aug16/aug16.html>

Information and Feedback

We value your feedback on this lesson, including how you use it in your formal/informal education settings.

Please send your comments to:
oceaneducation@noaa.gov

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