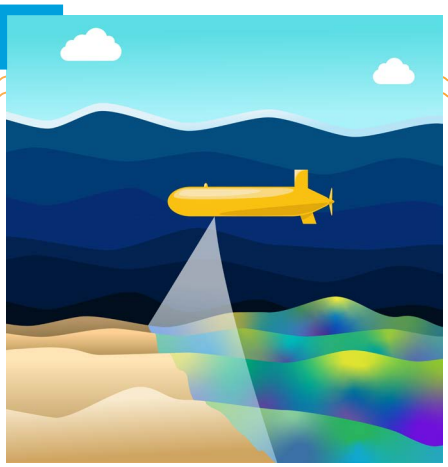
Mapping in the Highest Resolution

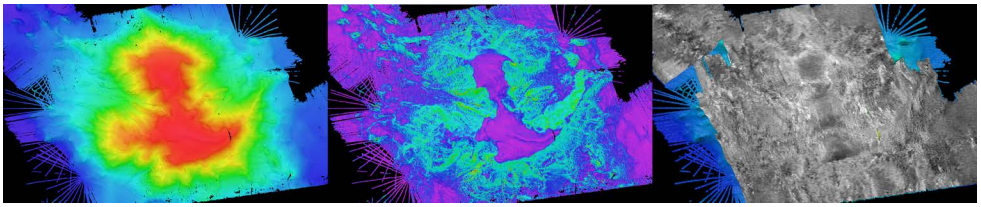
When mapping the seafloor, a multibeam survey does a broad sweep of the area, and is therefore an efficient way to systematically map large regions. However, one challenge of mapping from a vessel on the ocean surface is that the deeper the water depth, the lower the resolution of the map that can be produced. In order to map the deepest parts of the seafloor in very high resolution, it is necessary to have mapping sonars closer to the seafloor, which can mean towing them from ships or mounting them on remotely operated vehicles (ROVs) or autonomous underwater vehicles (AUVs). As this technology continues to develop, scientists across the globe hope to create a high resolution map of the entire seafloor by 2030.



An autonomous underwater vehicle (AUV) can be used to collect seafloor data using multibeam sonar. *Illustration courtesy of NOAA Ocean Exploration.*

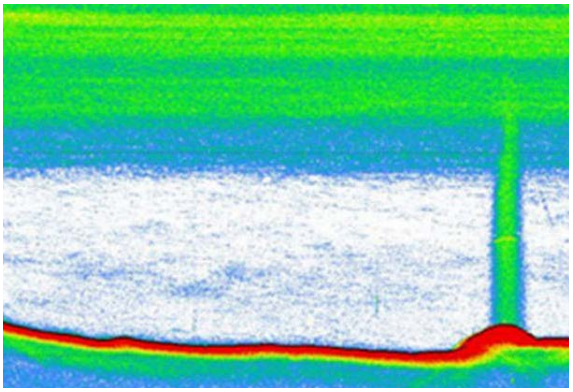
Backscatter

Multibeam sonar systems not only create a picture of what the seafloor looks like, but they also provide information about the geological makeup of the seafloor or objects on it. This is done by measuring **backscatter**, or the intensity of the reflected sound echo. Hard, rocky seafloor substrate generally reflects more sound than softer materials like mud or sand.

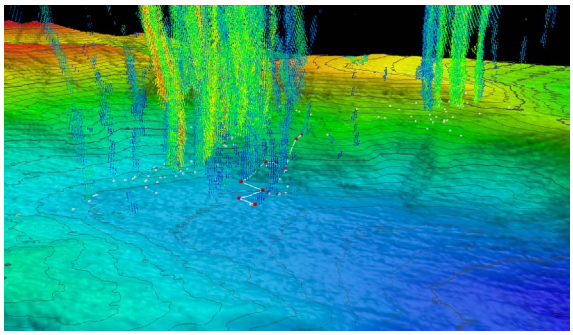


Michael Seamount: bathymetry (left), slope (mid), backscatter (right). *Image courtesy of NOAA Ocean Exploration, 2021 North Atlantic Stepping Stones: New England and Corner Rise Seamounts.*

Backscatter data can also be used to reveal objects in the water column, such as three-dimensional structures associated with shipwrecks, dense layers of organisms, and bubble plumes percolating from the seafloor.



In this sonar image, the red feature is the seafloor. Green and blue areas in the water column are features with high backscatter – the lines near the surface show dense layers of biology (zooplankton, fish, gelatinous creatures, etc.), while the vertical lines are bubble plumes coming from the seafloor. *Image courtesy of NOAA Ocean Exploration.*



Methane bubble plumes rising over 900 meters (2,950 feet) above the seafloor at Norfolk Seeps off the eastern US coast. *Image courtesy NOAA Ocean Exploration, Windows to the Deep 2019.*

Because these echosounders can also detect bubbles in the water column, explorers have been able to discover hundreds of previously unknown methane seeps off the Atlantic and Pacific U.S. coasts, many supporting robust chemosynthetic communities.

LEARN MORE

Many other types of sonar are used by ships of exploration. With continuing scientific and technological advances, our ability to observe the ocean environment and its resident creatures is beginning to catch up with our imaginations!

Sonar (video): https://oceanexplorer.noaa.gov/technology/sonar/sonar.html
Sonar (fact sheet): https://oceanexplorer.noaa.gov/edu/materials/sonar-fact-sheet.pdf
Surveying (image): https://noaacoastsurvey.files.wordpress.com/2015/07/surveying.jpg
Satellite altimetry and multibeam sonar (image): https://oceanexplorer.noaa.gov/world-oceans-day-2015/how-much-of-the-seafloor-is-left-to-explore.html
Multibeam sonar swath illustration (illustration): https://oceanexplorer.noaa.gov/edu/materials/ship-MB-depth-width-illustration.png
AUV collecting multibeam data (illustration): https://oceanexplorer.noaa.gov/edu/materials/auv-MB-illustration.png
Map of the entire seafloor (webpage): https://seabed2030.org/
Michael seamount (image): https://oceanexplorer.noaa.gov/okeanos/explorations/ex2104/features/mapping/media/planning-hires.jpg
Water column backscatter (image): https://oceanexplorer.noaa.gov/okeanos/explorations/ex1703/logs/mar11/media/echogram.html
Norfolk seeps (image): https://oceanexplorer.noaa.gov/okeanos/explorations/ex1903/logs/july12/media/norfolk-plume-hires.jpg
Methane seeps (webpage): https://oceanexplorer.noaa.gov/okeanos/explorations/ex1903/logs/july12/july12.html
Scientific and technological advances (webpage): https://oceanexplorer.noaa.gov/technology/technology.html

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