# Seafloor-mapping robot yields a host of new geologic discoveries

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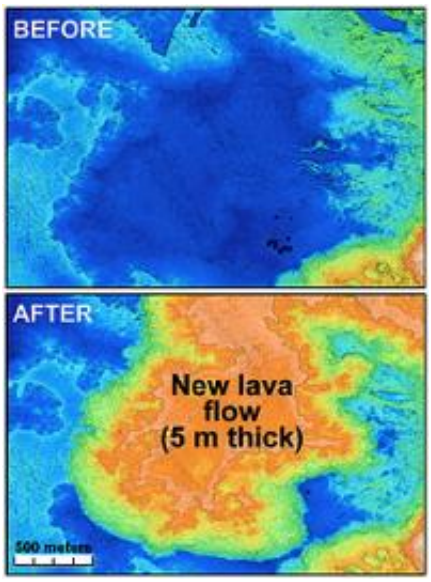
MBARI's seafloor-mapping AUV, the D. Allan B. Credit: Phil Sammet © 2010 MBARI

MBARI's seafloor mapping robot has had a busy year. It documented a huge lava flow from a three-month-old volcanic eruption off the Oregon coast; it charted mysterious three-kilometer-wide scour marks on the seafloor off Northern California; and it unearthed data that challenge existing theories about one of the largest offshore faults in Central California. MBARI researchers will describe these achievements, and others, in 10 different presentations at this week's meeting of the American Geophysical Union in San Francisco.

Technically speaking, this yellow, torpedo-like robot is known as an autonomous underwater vehicle (AUV). It is programmed at the surface, then released to fly within 50 meters (165 feet) of the seafloor, using

sonar to map ocean-bottom features as little as 15 centimeters (five inches) tall. MBARI's mapping AUV, the D. Allan B., carries three different types of sonar, which simultaneously provide information on seafloor depth, bottom texture, and sub-bottom features such as layers of buried sediment.

Last summer the mapping AUV helped make geologic history. In July and August 2011, two research teams from MBARI and Oregon State University (OSU) were using remotely operated vehicles (ROVs) to study Axial Seamount, an active volcano about 270 kilometers (170 miles) off the Oregon coast. The OSU team discovered that several instruments, placed on the seafloor during previous expeditions, had disappeared. Similarly, the MBARI team couldn't figure out why the seafloor looked very different from previous dives. After comparing notes, they realized that a recent volcanic eruption had covered large areas of the seafloor with up to three meters of fresh lava.




Portion of bathymetric maps showing Axial Seamount before and after the recent eruption. Credit: © 2011 MBARI

MBARI's marine operations crew scrambled to deploy the D. Allan B. In two days, the AUV had created a new bathymetric map that depicted the 10-million-square-meter flow with an astonishing one meter of horizontal resolution and 20 centimeters (eight inches) of vertical resolution. The map showed not only the exact boundaries of the new flow, but also lava pillars, individual lava pillows, and other small flow features.

By painstakingly comparing the new map with an older map created by the mapping AUV, the MBARI team was able to get a precise estimate of the amount of lava released during the recent eruption. They also discovered that the new eruption reoccupied many of the same fissures and followed a flow pattern that basically mimicked the existing flows—information that would have been impossible to gather through ROV dives or sonar surveys using surface ships. Needless to say, the new map also made it much easier for scientists to navigate and find geologic features of interest during subsequent ROV dives.

In addition to creating the world's most detailed map of an underwater lava flow, the D. Allan B. provided data that led to a number of other exciting geologic discoveries:

• The AUV mapped the supposed trace of the San Gregorio fault in Monterey Bay. But the resulting sonar profiles failed to show obvious signs that the fault cut through young seafloor sediments. This suggests that this section of the fault is either improperly located on existing maps, or is not as active as previously believed.

• The AUV mapped a large underwater landslide in Monterey Canyon known as Tubeworm Slump. The sonar data showed that Tubeworm Slump formed during several small slope failures rather than one large event. Previous research suggested that if Tubeworm Slump had failed in one event, it would have generated a large enough tsunami to threaten

the entire Monterey Bay region.

• The AUV mapped 60-meter-high underwater mounds near Eel Canyon, off Northern California. These mounds are likely to be the sources of 1,400 meter-high plumes of natural gas that were detected by previous shipboard studies.

• Mapping AUV images revealed two giant scour marks on the seafloor in Eel Canyon, off Northern California. The larger of these seafloor gouges is about 100 meters deep and over three kilometers wide. Geologists are still trying to figure out what kind of undersea flow eroded the shoreward edges of these scours but filled in their seaward margins.

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