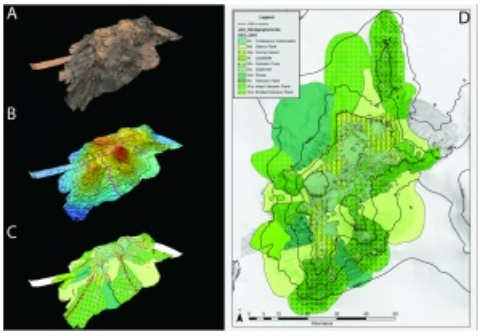
Evolution of Underwater Landscapes in the Johnston Atoll Revealed



In a recent research expedition sponsored by Schmidt Ocean Institute (SOI) and led by University of Hawaii scientist Dr. John R. Smith, over 11,000 square kilometres of the ocean floor were mapped in high-resolution for the first time. Smith, working with Jonathan Tree, University of Hawaii, and Joyce Miller, used multibeam sonar on SOI's research vessel *Falkor* to generate detailed maps of portions of the remote Johnston Atoll Unit (JAU) of the Pacific Remote Islands Marine National Monument (PRIMNM).

The mapped region, which is almost the size of the state of Connecticut, falls within the recently expanded boundaries of a U.S. marine protected area. The area is populated with high-density deep-sea corals and sponges and is of great interest to researchers who view it as a stepping-stone between distinct marine ecosystems in the Northwestern Hawaiian Islands and the Central and South Pacific. According to Smith, detailed seafloor maps are the first step toward more focused follow-on studies with manned and robotic submersibles. Much like planning a road trip, the first thing you go to is a paper map or Google maps. In this case, the seafloor features provide the habitat for the biological communities that call these seamounts their home, and the mapping data are used to locate them by knowing their preferences from previous studies.

Big Top Seamount

Compiling the days of multibeam mapping results revealed fascinating structures under the ocean surface. The last of these features to be mapped, and perhaps the most interesting, is a large seamount dotted with smaller peaks currently referred to as 'Big Top', as it resembles the broad striped big top tents commonly seen at carnivals. In addition to revealing the shape of these seamounts, the mapping that was completed on this expedition also yields valuable insight into their geologic composition. Although 'Big Top' is now one large mass, this analysis demonstrates that it was potentially four distinct volcanoes reaching thousands of feet above the ocean surface in the past. Since then, continued remodelling in the form of volcanic eruptions and erosion has morphed it into one large, sub-surface mountain.

A dedicated science outreach team to engage the public in these essential mapping expeditions accompanied Smith, Tree and Miller on this three-week expedition from Guam to Honolulu. Adventure cartoonist Lucy Bellwood created a comic book series presenting the science of multibeam mapping and highlighting the findings of this expedition, which were also turned into a short film (below). Additionally educators including Jena Kline ('Iolani School, HI) and 11th Hour Racing grantee Brock Callen Sr. (Martha's Vineyard Regional High School & Sail Martha's Vineyard, MA) designed curriculum for students based on the data collected at sea, and along with 11th Hour Racing Ambassador Brock Callen Jr., conducted Ship-to-Shore connections from the ship to engage classrooms in oceanographic research and conservation.

The image includes four sub-items that includes more information.

1. Big Top's "backscatter" data layered over a 3-D model of the bathymetry. The light coloured bronze colours are softer substrate like sediment and mud while the darker coloured bronze reflects areas of hard rocky areas;
2. Bathymetry of the Big Top seamount with 200m minor and 1,000 m major contours to show depth, also based on the colour of the seamount where the cool colours are the deepest and the warm colours are the shallowest. The deepest parts of the seamount rise from depths of about 5,500m below sea level to about 1,200m below sea level;
3. The geological interpretive maps showing the boundaries between different kinds of rocks. The same map is shown in D.
4. The key to understanding the different colours and symbols that are used to show each geological unit. The green shaded shapes show the interpreted age of these rocks in Cretaceous period (more than 65 million years old);

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