Mission of Opportunity - Collaborative Mapping of Earth's Newest Island
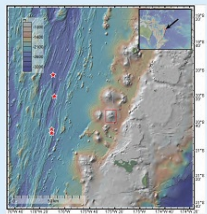
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COLUMBIA UNIVERSITY | EARTH INSTITUTE

Lau Basin 2016

The primary objectives of a recent research cruise (FK150407) on *R/V Falkor* were high-resolution geologic mapping, ecosystem imaging, and biological sampling of hydrothermal vent fields in the Lau Back-arc Basin (red stars above). Due to inclement weather that limited ROV dives, the vessel was used to fulfill an important mission of opportunity to map the newly formed island (red box above).

Hunga Tonga-Hunga Ha'apai

BEFORE   AFTER

"Scientific collaborations forged on the basis of common exploration interests such as those illustrated in Tonga enable serendipitous discoveries that contribute to scientific understanding of key systems on Earth..."

In addition to bathymetric mapping, scientists and crew of *Falkor* were able to capture a series of high-resolution photographs of the island morphology. Together, these data sets will be instrumental in understanding the evolution of this new landform. Preliminary analysis showcase why the new island has lost nearly 30 percent of its initial land area in only 15 months since the eruptive activity ended in late January 2015.
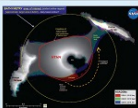
R/V Falkor

R/V Falkor is a state of the art mapping platform that is equipped with two multibeam sonar systems (Kongsberg EM710 and EM302), an extensive suite of mapping software and telepresence capability. *Falkor* is operated by the Schmidt Ocean Institute.
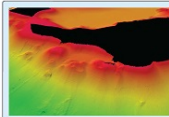
Evolution of the island based on DEMs collected in May 2015, September 2015 and January 2016.

High-resolution mapping along the southern rim of the caldera reveal a series of crated domes. There is evidence of volcanic eruptions eminating from some of these domes.

New Island (subaerial)
New Island (submarine)

Topography
Meters
150
0

Bathymetry
Meters
15
0
-140
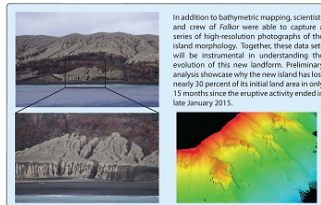
0   0.5   1 Kilometers

Hunga Tonga-Hunga Ha'apai

Hunga Tonga-Hunga Ha'apai (HTHH) is a submarine volcano in the Kindom of Tonga. In November and December 2014, volcanic activity and a series of earthquakes occurred north of Tonga for several weeks, indicating renewed volcanic activity in the area. By January 16, 2015 a new island had been formed by a "surtseyan" eruption connecting two pre-existing islands on the rim of a large submarine caldera.
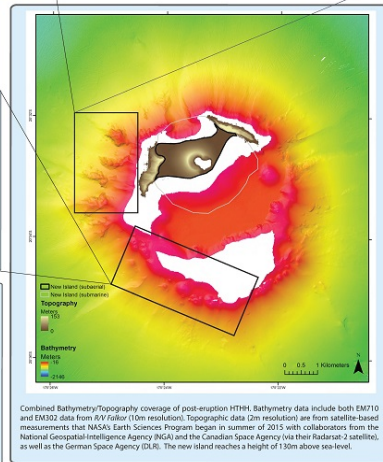
Bathymetric Change
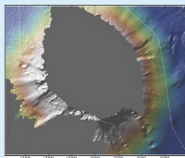
Bathymetric change analysis is underway at LDEO to compare this new data set with processed pre-eruption data (e.g. KM0806 acquired with *R/V Kilo Moana* in 2008). These data are available through the Global Multi-Resolution Topography (GMRT) Synthesis. Although pre-eruption data are not of the same spatial extent, several key bathymetric features are evident in both data sets.

Combined Bathymetry/Topography coverage of post-eruption HTHH. Bathymetry data include both EM710 and EM302 data from *R/V Falkor* (10m resolution). Topographic data (2m resolution) are from satellite-based measurements that NASA's Earth Sciences Program began in summer of 2015 with collaborators from the National Geospatial-Intelligence Agency (NGA) and the Canadian Space Agency (via their Radarsat-2 satellite), as well as the German Space Agency (DLR). The new island reached a height of 130m above sea-level.