

Explorations of Active Volcanic Sites in the Pacific Ocean- Preliminary Results from the Submarine Ring of Fire Ocean Exploration Program

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Abstract: The Submarine Ring of Fire project is a three-phase program funded by the NOAA Office of Ocean Exploration. The goal of the program is to compare and contrast the volcanic and hydrothermal systems at the two "end-members" of the Pacific plate boundaries, a segment of the Mid-Ocean Ridge in the NE Pacific and the submarine portion of the Mariana Island Arc in the western Pacific.

Phase I took place at the Explorer Ridge, a 140 km-long ridge segment lying southwest of Vancouver Island, in June and July 2002. The first part of the program utilized an EM300 multibeam sonar on T. G. Thompson, the autonomous vehicle ABE, and a CTD/rosette system to map the seafloor and conduct hydrothermal plume surveys. While ABE conducted detailed surveys in the area where the most intense hydrothermal plume was found on the initial CTD survey, the T.G. Thompson conducted additional multibeam surveys, CTD casts and CTD tow-yos on the other sections of the ridge up to 60 km away. This increased the efficiency of the expedition by at least 30%. After 12 days on site, a multibeam map was completed of the entire segment, the spatial distribution and character of the hydrothermal plumes were mapped out and a section of seafloor measuring 2 x 5.5 km was mapped in detail with ABE. The ABE used two sonar systems, a previously proven Imagenex pencil beam sonar, and, for the first time, a multibeam

sonar (SM2000). In addition to the high-resolution bathymetry (1 m grid-cell size resolution for the SM2000), ABE collected temperature, optical backscatter, eH redox potential, and magnetic field data. Using the CTD and ABE data, the Magic Mountain hydrothermal system was easily located on the seafloor during the second part of the exploration program with the ROPOS remotely operated vehicle. The active venting is concentrated in clusters of high temperature chimneys, each about 50 m in diameter, lying on the eastern shoulder of the axial valley.

During Phase II, which took place in February and March of 2003, we surveyed 1000 km of the Mariana Arc using the Thompson's EM300 multibeam, the Hawaii Mapping Research Group's MR1 towed sonar and a CTD/rosette system. Of the more than 50 individual submarine volcanoes surveyed, about 25% showed indications of hydrothermal activity.

The 2002-2003 Submarine Ring of Fire program successfully explored two areas of active submarine volcanism at a large range of scales in a short amount of time by optimizing the survey strategy for the geologic setting, the amount of time in the field, and the scale of the features to be explored. These initial data sets set the stage for more detailed exploration of these areas in the future.