Morphologic changes in hydrothermal vent sites in the Lau Basin and their implications for the resiliency of vent fields in Back-Arc Basins

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Recent proposals for the commercial mining of sulfide deposits from hydrothermal vents make long term study of these environments necessary to ascertain the effect of mining on the ecological communities residing in vent fields. Current knowledge of hydrothermal vent site stability drawn from fields adjacent to mid-ocean ridges (MORs) characterizes these environments as transient. It is unlikely, however, that data from MORs are a suitable representation of the longevity of vent fields in back-arc basins. In this study we compare high-resolution bathymetry data acquired in 2005 and 2016 from the Mariner, ABE, Tow Cam, and Tu'i Malila vent sites in the Lau back-arc basin to better quantify morphologic changes in hydrothermal vent fields. The bathymetric data were acquired with multi-beam sonar systems attached to Remote Operated Vehicles (ROVs) *Jason 2* (2005) and *ROPOS* (2016). After correcting navigational inaccuracies of the ROV system and cleaning the swath bathymetry, we created and imported detailed .5 m resolution digital elevation models for each site into ArcGIS. At each study site we identified regions of interest, including vent fields and faults, determined the morphological changes between the 2005 and 2016 elevation data, and interpreted the changes in the fields over the 11−year period. Preliminary results show no overarching changes to the vent fields studied. A few regions of localized slip and possible collapse reveal changes as large as ±15 m along fault scarp at Tow Cam and ABE. Profiles also show growth in a small number of hydrothermal vents on the order of 2 to 7 m, primarily in Tu'i Malila and Mariner, which may indicate increasing hydrothermal edifice growth from north to south. Studies of MORs indicate lava flows, hydrothermal activity, and eruptions occur as frequently as every few years, and, as a result, MOR vent communities must often rebound from short and abrupt geologic events. We did not observe any such large events in our study sites, and thus further observations are needed to determine the frequency of such events at this site and to determine if vent sites in the Lau back-arc basin are as resilient as their MOR counterparts. Knowledge of this resilience is required to make more informed decisions regarding back-arc basin deep sea mining.