Geophysical Research Abstracts
Vol. 14, EGU2012-6643, 2012
EGU General Assembly 2012

Creation and Deformation of Hydrous Lithosphere at the Southern Mariana Margin

F. Martinez (1), K. A. Kelley (2), and R. J. Stern (3)

(1) University of Hawaii, HIGP/SOEST, Honolulu, HI, United States (fernando@hawaii.edu), (2) Graduate School of Oceanography, University of Rhode Island, Narragansett, RI, United States (kelley@gso.uri.edu), (3) Geosciences Department, University of Texas at Dallas, Richardson, TX, United States (rjstern@utdallas.edu)

Mantle lithosphere formed at mid-ocean seafloor spreading centers is thought to be essentially anhydrous because water is strongly partitioned into melt and removed from the mantle during crustal formation. Since water weakens olivine this dehydration process is also thought to strengthen oceanic mantle lithosphere above solidus depths, perhaps helping to focus deformation and melt delivery to the narrow plate boundary zones observed at mid-ocean ridges. In contrast, convergent margins are sites of high water flux from subducting slabs and thereby provide an opportunity to study the creation and deformation of lithosphere in a hydrous environment. The southern Mariana margin presents a rare case in which the upper plate is undergoing active extension parallel to the trench and directly above the subducting slab. The extension has rifted preexisting Paleogene lithosphere resulting in the present-day creation of new lithosphere in this hydrous environment. Here we present preliminary results from R/V Thomas G. Thompson cruise TN273 in December 2011-January 2012 utilizing the Hawaii Mapping Research Group's IMI-30, a 30 kHz deep-towed side-scan sonar, and ship-based Simrad EM302 multibeam bathymetry. The sidescan sonar imagery and multibeam bathymetry map the tectonic and volcanic structure of a 32 x 80 km area referred to as the southeast Mariana forearc rifts (SEMFR), which extend from near the backarc spreading center toward the trench. The sonar imagery shows a complex volcanic and tectonic structure with no single spreading or rifting axis. Volcanism appears to be widely dispersed and separated by faulted areas. Bathymetry data show several rifts spanning this area but no single rift appears to be focusing tectonic activity as earthquake seismicity is broadly distributed across this region. The data depict a broad volcano-tectonic zone of complex deformation and distributed volcanism unlike the narrow plate boundary zones of mid-ocean ridges. This distributed style of tectonic and volcanic activity may characterize the creation and deformation of a weak "hydrous" class of oceanic lithosphere formed above subduction zones.