Geophysical Research Abstracts, Vol. 8, 03009, 2006
SRef-ID: 1607-7962/gra/EGU06-A-03009

Integrated In-Situ Approaches to Determine the Role of Fluid Chemistry and Microbial Biofilms on the Colonization and Distribution of Hydrothermal Vent Fauna

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Biologists have long proposed that the chemistry of hydrothermal vent fluids induces settlement of larvae and ultimately controls the distribution and composition of vent fauna. Over the past six years, we have utilized *in-situ* chemical sensors in conjunction with experimental studies of colonization as well as observational studies of established communities at deep-sea hydrothermal vents. Our experimental work involves studies of how microbial community composition and the development of microbial biofilms at vent openings vary in response to vent fluid chemistry, and potentially facilitate or inhibit the settlement of macrofaunal species; and our observational studies have focused on the spatial and temporal characterization of the fluid chemistry of tubeworm, mussel, and amphipod habitats. We are using time-series studies that combine molecular genetic characterization of microbial communities and metazoan colonists and *in situ* measurements of fluid at the East Pacific Rise Integrated Study Site and the Galápagos Rift in complementary studies that address temporal scales specific to each site. Colonization substrates (native and non-native basalt panels, blocks, and a combination of panels and blocks) were deployed for periods of days to months with *in-situ* chemical sensors that recorded H_2, H_2S, pH, and temperature at the EPR and H_2S, O_2, HS^-, and temperature at the Galápagos Rift. The position of

the settlement substrates and the *in-situ* chemical sensors was documented using digital time-lapse camera deployments. Preliminary results of the pattern of microbial and metazoan colonization indicate that: 1) microbial biofilms formed on native and non-native basalt substrates in less than two weeks; 2) the species composition of the biofilms notably shifted within three days, and 3) macrofaunal colonization and active grazing on biofilms by limpets began within one week following deployment. Our *in-situ* real-time observational results reveal correlative changes in faunal distribution and sulfide and oxygen concentrations over small temporal (minutes) and spatial (cm) scales, and both positive and negative correlations between temperature and sulfide concentration in mussel and tubeworm habitats. Through integrated biological studies with real-time measurements of H_2, H_2S, pH, and temperature, we hope to assess patterns of short-term microbial community development, evaluate the role microbial communities and fluid chemistry play in the macrofaunal colonization of basalt, and the relative importance of fluid chemistry on structuring the diversity of vent-endemic communities.