Letters of Intent: EPR
Target Date: August 15, 2002

Integrated, Multidisciplinary Studies of a Deep-Sea Hydrothermal Vent Ecsystem Along the East Pacific Rise

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Description of planned research for a proposal to be submitted to the Ridge 2K Program (EPR Integrated Study Site) for the August 15 target date:

Our planned studies represent an integrated program of measurement, observation and sampling the area between 9°49' and 9°51'N along the East Pacific Rise. The objective of this multi-disciplinary effort is to gain a fundamental new understanding of the microbiological, ecological, geochemical and physical characteristics, variability and processes associated with an area designated as the "bull's-eye" of an R2K Integrated Study Site. All sampling (microbial and vent fluid chemistry), imaging activities, measurements (*e.g.* time-series temperature recordings) and experimentation (*e.g. in situ* microbial culturing) will be carried out, by design, at 6 high-temperature and 7 low-temperature vents (all of which have been extensively studied over the past decade) between 9°49' and 9°51'N (hereafter referred to as 9°50'N).

The proposed work will seek to maximize advantages of co-located measurements, observations, and sampling strategies. Current measurements, in-situ fluid chemistry, time-series temperature, colonization (including larval/sediment traps, detailed imaging surveys, and time-lapse camera deployments) and genetic studies will be combined to address inter-related questions of biological community succession in response to the physical environment, as well as the influence of arriving colonizers (e.g., pulses of larval cohorts) on the observed spatial and temporal changes in community structure.

The overall goal of our microbial studies is to understand how microbial communities fluctuate in response to the steep temperature and chemical gradients found at deep-sea hydrothermal vents. The main focus is to obtain novel isolates characteristic of vent habitats, with special emphasis on thermophilic chemolithotrophs, oligotrophs, hydrocarbon degraders, and metal-resistant organisms. Our experiments conducted to date on the isolation of novel microbial species from deep-sea vents are showing more and more evidence that hydrocarbon degradation is an important (and poorly documented) microbial process in these environments. We will be interacting closely with geochemists

in order to identify the reduced organic sources of energy used in the microbial transformations at 9°50'N. A component of the proposal will investigate the presence of dehalogenating bacteria, as our culture-independent studies suggest the presence of such organisms at 9°50'N. To this end, we are very interested in detecting and measuring halogenated hydrocarbons. We know that PCE and TCE have been detected in volcanic gases, but we believe there are no available data on their concentrations (or presence for that matter) at deep-sea vents. Also, we would like to correlate the microbial resistance to mercury and heavy metals with measurements of Hg, Zn, Cd, and Pb in hydrothermal fluids.

Planned studies of geochemical fluids at the high- and low-temperature vents within the region will be carried out utilizing: (1) a manifold sampler on DSV Alvin; (2) discrete titanium water bottles; and (3) a specially designed and tested electrochemical analyzer capable of making in situ measurements of a variety of chemical species. From results obtained to date, it is anticipated that our proposed studies will shed considerable light on the relationship between the distribution of vent organisms (both invertebrates and

microorganisms) and vent fluid chemistry (in particular, significant differences in oxygen, iron and sulfur speciation at the vents; see Nature, 401: 813-816).