Letters of Intent: Endeavour
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Corridors of Productivity: Flux and Dispersion of Organic-Carbon Through a Mid-Ocean Ridge Hydrothermal Plume System

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Although hydrothermal plumes are major contributors to the redistribution of geothermally-derived heat and chemical mass and to larval dispersion, most mechanisms contributing to these processes remain poorly constrained. Little is known about potential linkages, rates of transfer, or specific modes of transport between plumes and the overlying ocean. A highly significant case in point is the dispersion of hydrothermally-derived organic-carbon within the overlying ocean waters. Studies have documented a substantial production of organic carbon in hydrothermal environments. The major sources have been idenitified as: combined subseafloor microbial and abiotic processes; vent field microbial and macrofauna production; chemosynthetic production in situ within hydrothermal plumes (utilizing H2, CH4, NH3, and possibly sulfur and iron), and background oceanic organic carbon entrained into hydrothermal systems. However, the production and especially export of this organic carbon is poorly quantified.

We propose a field study of the dispersion of organic carbon via the current driven hydrothermal plumes over the Endeavour Segment of the Juan de Fuca Ridge. We will study the current velocity within and over the axial valley of the Endeavour Segment using both Eulerian and Lagrangian methods. We will examine the effects of both ridge topography and entrainment processes (e.g., during buoyant phase of hydrothermal plume formation) on tide- and wind-forced currents. In conjunction with the Eulerian (moored current meters) we will also deploy particle traps to monitor the correspondence between temporal changes in the vertical flux of organic carbon and current velocities vectored back to known hydrothermal vent fields. In addition, all samples from the combination ascending/descending particle traps will be carefully examined for larvae. Moorings will be equipped with temperature and light scattering sensors to monitor the intensity or periodic absence of a plume signal at mooring locations. Lagrangian floats will be deployed over vent fields several times per year to capture the actual drift pattern of parcels of hydrothermal plumes in complement to the moored current meters.

We will also conduct detailed 3 dimensional surveys of the water column using CTD-light sensors-rosette (Niskin bottles) tow-yo casts throughout of the axial valley, as well as outside of the ridges. Vertical CTD-light sensor-rosette and in situ pump casts will be used to provide detailed sampling for key chemical and biochemical parameters diagnostic as tracers of hydrothermal origins and of diagnostic in situ biogeochemical processes.

Field work:

We propose to deploy moorings in spring/summer of 2004 and recover them in summer/fall of 2005. The intense water column surveys will be performed during both deployment and recovery cruies. We will also request several (3 dives) submersible dives to collect the diffuse and focused vent fluid samples for organic carbon concentrations and characterization. The submersible dives can best be ancillary to another dive cruise.