Letters of Intent: EPR
Target Date: August 15, 2003

Broad-scale Integrated Geologic and Plume Intensity/Chemistry Traverse (BIGPICT) of the East Pacific Rise, 8º-11ºN

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At its largest scale, the East Pacific Rise ISS extends from just north of the Clipperton transform fault to just south of the Siqueiros transform fault (8º-11ºN), encompassing 3 widely contrasting second-order segments. Only the central segment from the 9º03'N OSC to Clipperton is mapped at a fine scale necessary to define the geologic setting of hydrothermal venting along the ridge axis. These observations have led to a widely-debated conceptual model for the geological context of hydrothermal venting. However, very few of these studies have extended beyond the overlapping spreading center to the south or the transform fault to the north of this segment. Furthermore, no systematic studies of hydrothermal plumes on the scale of whole vent fields have been done since 1991 to examine large-scale changes in hydrothermal discharge over the past decade. This proposal is designed to address our gaps in understanding of the basic patterns of volcanic, tectonic, and hydrothermal activity in space and time for over 70% of the ridge within the ISS.

We propose a spatially complete sampling of hydrothermal plume distribution, intensity, and character with simultaneous high-resolution sonar mapping necessary to establish links between geologic setting and hydrothermal processes. We plan a nested approach that uses the EM300 30 kHz multibeam system to obtain high-resolution bathymetry within the entire ISS from 8ºN to 11ºN over the full width of the plate boundary zone at the EPR, and the DSL-120A side scan sonar to map the fine-scale seafloor features such as fissures, pillow mounds, and collapse troughs, while simultaneously collecting hydrothermal plume data using MAPRs, SeaCATs, and VISA (an in situ chemical analyzer of Fe, Mn, and pH). This permits a very accurate co-location of the plume data with the features in the side-scan records. Finally, a series of ~20 CTD casts over the locations of observed plumes will calibrate and supplement the MAPR/VISA data. Integration of these datasets will allow us to correlate hydrothermal plumes with specific type of volcanic terrain on the ridge axis. This will allow us to see how volcanic morphology varies over several ridge segments, and correlate the character of hydrothermal venting with geologic setting.

This study directly pertains to the Ridge 2000 program fundamental goals of (1.) understanding the impact of hydrothermal venting on ridge structure, composition, and morphology, and (2.) understanding the thermal and permeability structure of the crust. In addition to the science goals, this study also provides the RIDGE community with baseline bathymetry necessary to recognize changes due to tectonic or magmatic events, and the response of biological and hydrothermal systems to be studied.