Anatomy of an Overlapping Spreading Center: Links among Geochemisty, Geology and Sub-Axial Melt Distribution

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Our proposed work is at the 9°03'N OSC, and represents both a complement and a contrast to the work planned for the 9°50'N 'bulls-eye site'. From previous work the bulls-eye area can be regarded as a normal-type ridge segment (albeit one that has the virtue of being magmatically, hydrothermally and biologically robust), while the 9°03'N OSC is a highly perturbed and variable area. It is this variability that holds the promise of revealing important linkages between sub-ridge melt distribution and surficial variations in lava composition, geology and hydrothermal activity. Recent seismic and tomographic imaging of the sub-ridge upper mantle and crust beneath the 9°03'N OSC provides an unprecedented view of the distribution of melt at depth. It is within this context that we are proposing a detailed geochemical, geological, geophysical and hydrothermal study of the second-order 9°03'N OSC. Our study will consist of a nested survey of DSL-120 side scan sonar to obtain regional coverage of the geologic characteristics of the overlapper, and Jason II to obtain continuous photographic and sampling coverage (rock and hydrothermal). The plan is to 1) Identify and characterize the extent of lava flows, and faulting and fissuring on both limbs of the overlapper as well as within the overlap basin. 2) Obtain a substantial suite of lavas from flows on each limb of the OSC and the overlap basin to explore spatial and temporal variations in composition and link these to both the geologic and the seismic results. In addition, we will determine ages of eruption for a subset of samples by U-series dating techniques. 3) Survey for evidence of hydrothermal activity, using the CTD deployed on the Jason II sled and photographic images. The primary aim is to use the geochemisty of lavas to explore the relationships of lava flows of distinct compositions to the variations in melt lens and mantle melt parameters, and thus be able to tie deep crustal and upper mantle processes to their surface manifestations including hydrothermal venting.