Letters of Intent: Endeavour
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3-D magnetometric resistivity (MMR) survey around the Endeavour vent field on the Juan de Fuca Ridge (JDF)

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We propose a 3-D magnetometric resistivity (MMR) survey around the Endeavour vent field on the Juan de Fuca Ridge (JDF), to measure the electrical resistivity of the crust. Electrical conductivity is determined primarily by the porosity and temperature of the pore-fluid. In hydrothermal areas, temperature is the dominant property determining shallow conductivity structure. Regions of hydrothermal upflow are expect to be much more conductive than regions of cold recharge of the hydrothermal system. A primary target of our survey will be a series of magnetic anomalies (``burnholes'') identified by near seafloor high resolution magnetic profiling (Tivey and Johnson, in press). These anomalies are roughly circular areas of seafloor from which the normal magnetic signature of fresh lava has been removed, and appear to correspond to areas of either active or relict hydrothermal venting. It is hypothesised that their formation is due to the percolation of hydrothermal fluids that raise the crustal temperature, and cause alteration of the rock, removing magnetism imparted on eruption and initial cooling. Our experiment will also measure the regional resistivity structure to a distance of 20km either side of the ridge crest.

We will deploy 30 seafloor magnetometers of which 14 will be placed carefully around these burnholes (both in active and inactive venting sites). We will place the other 16 instruments in a profile away from the ridge crest and use these to measure the regional crustal resistivity structure. We will transmit to these seafloor magnetometers using a vertical bipole transmitter. The strength of the magnetic field caused by this bipole is influenced by the electrical resistivity of the seafloor. If indeed these burnholes are carrying hot fluid to the seafloor, then they will have an electrical conductivity significantly elevated above that of the surrounding seafloor, that we can measure and use to constrain their temperature and depth extent. The regional resistivity structure, obtained by measurements made by all instruments (on and off-axis), will provide a comparative profile to that measured on the EPR in an earlier experiment and will help understand the differences in hydrothermal cooling between a rifted and non-rifted ridge setting.y welcome and are invited to contact the PIs above for details.