Ridge-hotspot interaction at the Central Indian Ridge, 20°S: New helium isotope results

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In order to study the interaction between the Central Indian Ridge (CIR) and the off-axis Réunion hotspot, we performed an extensive helium isotope survey of the CIR axis between the Marie Celeste and the Egeria fracture zones (i.e. between 16.70° and 20.16°S), and the adjacent Gasitao, Three Magi, and Rodrigues ridges [1].

We present new helium isotope and abundance data for submarine basalts from the CIR. He isotopic ratios range from 7.1 to 12.2R_A and lie between the values expected for depleted MORB mantle (8 ± 1R_A [2]) and the $^3He/^4He$ ratios of lavas from Réunion Island (~12.9R_A [3]). MORB-like $^3He/^4He$ ratios are found in the vicinity of the Marie Celeste Fracture Zone in the northern part of the CIR segment, while the highest $^3He/^4He$ ratios (~11R_A) are observed between 18.91° and 19.95°S. However, even higher ratios (up to 12.2R_A) were measured in some glass samples recovered off-axis, from the Three Magi and the Gasitao ridges. He concentrations decrease southward along the CIR axis (from ~17,000 to 700 ncm^3STP/g) and are highly variable along the off-axis volcanic structures.

We propose that the elevated $^3He/^4He$ ratios towards the southern end of the ridge axis (adjacent to the Gasitao Ridge) indicate that enriched Réunion hotspot material is migrating eastward (> 1000 km) into the sub-ridge mantle of the CIR. The He characteristics of the northernmost CIR samples can be explained by closed-system radiogenic ^4He in-growth in ancient mantle influenced by the Réunion hotspot. In this scenario, the enriched mantle would have been isolated from mixing since the Réunion hotspot intersected the CIR ~34 Myr ago.

Combination of the He data with major/trace element and volatile data will provide further details of ridge-hotspot interaction on the CIR.

[1] Füri *et al*. (2008) *InterRidge News* **17**, 28-29. [2] Graham *et al*. (2002) in *Noble Gases in Geochemistry and Cosmochemistry*, 247-317. [3] Graham *et al.* (1990) *Nature* **347**, 545-548.

Pillow lava as microbial habitat for 3.5 billion years: Petrographic signatures of bioalteration

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Textures developed during microbial etching of basaltic glass in pillow lava rims and hyaloclastites of *in situ* oceanic crust, ophiolites and Archean greenstone belts [1-2], will be summarized and models presented. Microbial etching of basaltic glass produces conspicuous petrographic textures of micron-sized cavities and tunnels, formally described as five species of ichnofossils [2]. In particular, tubular textures are now recognized to indicate the activity of microbial cell extensions and their distinct features may be used to help indicate the organisms responsible for their formation [1]. Subsequent to the generation of these textures, the originally empty space is filled with authigenic minerals. We argue that these textures are reliable trace fossils, recording microbial activity in submarine volcanic environment. Their biogenicity may be supported by elevated concentrations of C, N, P, S, and $\delta^{13}C$ of disseminated carbonate and antiquity is shown by textural relationships and/or by U-Pb dating [1]. Recognition of these biologically-produced textures, distinct to abiotic alteration textures, make them useful for mapping the distribution of microbial life in the oceanic crust through the Earth's history.

[1] Staudigel *et al*. (2008) *Earth-Science Rev*. **89**, 156-176. [2] McLoughlin *et al*. (2009) *Jour. Geol. Soc., London* **166**, 159-169.