Major, trace element and Sr-Nd-Hf-Pb isotopic composition of basalts from the southern Central Indian Ridge and the Rodrigues Triple Junction

G. JACQUES*[1], H. FRANKE[1] AND U. SCHWARZ-SCHAMPERA[1]

[1] Federal Institute for Geosciences and Natural Resources (BGR), D 30655 Hannover, Germany (*correspondence:guillaume.jacques@bgr.de)

The southern Central Indian Ridge (CIR) with the Rodriguez Triple Junction (25.6°S; RTJ) is an intermediate to slow-spreading ridge causing complex petrogenetic processes and exhumation of deep oceanic lithosphere. Active hydrothermal systems occur along the southern CIR, mainly associated with off-axis volcanic ridges and talus aprons such as Kairei (25.3°S) and Edmond (23.9°S) vent fields. We present major, trace element and Sr-Nd-Hf-Pb isotope data from moderately altered to fresh basalts, microcrystalline dolerites and gabbros from on-axis RTJ and off-axis ridges, recovered during a number of INDEX (Indian Ocean Exploration For Seafloor Massive Sulfide) cruises.

Based on their geochemistry, three lava groups have been characterized: (1) the Kairei and some of the RTJ samples, showing an extreme depletion in the most incompatible elements (e.g. lower Th/Yb, Nb/Yb, LREE/HREE) and having high εNd (~8.5), εHf (~16) and Sr isotope ratios (~0.7031), but extremely low $^{206}Pb/^{204}Pb$ (~17.4) and $^{208}Pb/^{204}Pb$ (~37.3); (2) this group contains olivine-bearing samples from the RTJ and volcanic glasses from Edmond, having the lowest Sr isotopes (~0.7029), lower εHf (~14.5) but similar εNd, and intermediadte $^{206}Pb/^{204}Pb$ (~17.8); and (3) a group, formed by Edmond basalts, extending to lower εNd (~8), εHf (~13) and higher Sr (~0-7032) and Pb (~18.05) isotope ratios. Group 2 and 3 have characteristic N-MORB to E-MORB trace element patterns. In plots of MgO versus major element oxides, the samples form a fan-shaped trend converging to a common high-MgO source (group 1). Group 2 basalts have systematically higher Na_2O, K_2O, TiO_2 and lower CaO at a given MgO than group 1 and 3 lavas. We propose that group 1 lavas represent a strongly depleted mantle component with little seawater contribution. Elevated heat flow in the area of the RTJ may have triggered high degrees of mantle melting associated with a possible plume-ridge interaction. Group 3 lavas extends to slightly more enriched composition, typical for Indian MORBs where group 2 is somewhat intermediate.