Geophysical Research Abstracts
Vol. 17, EGU2015-15434, 2015
EGU General Assembly 2015

Red Sea Rift-Related Quseir Basalts, Central Eastern Desert, Egypt: Petrogenetic and Geodynamic Evolution

Esam Farahat (1), Shehata Ali (1), and Christoph Hauzenberger (2)

(1) Geology Department, Faculty of Science, Minia University, 61519 El-Minia, Egypt, (2) Institute of Mineralogy and Petrology, Karl-Franzens University, Graz, Austria

Mineral and whole rock chemistry of Tertiary Red Sea rift-related basalts occurred in south Quseir city, Central Eastern Desert, Egypt has been presented to investigate their petrogenetic and geodynamic evolution. The South Quseir basalts (SQB) have been classified as high-Ti tholeiitic lava (TiO_2 >2 wt. %) emplaced in anorogenic tectonic setting. Their Mg# varies from 48 to 53. Pearce element ratios (PER) suggest that the SQB magmas have evolved through fractional crystallization of olivine + clinopyroxene ± plagioclase assemblages, however, the absence of Eu-anomaly argues against plagioclase fractionation. The clinopyroxene compositions provide evidence for polybaric fractionation of the parental mafic magma. Estimated temperatures of crystallization range from 1143 to 1323 oC for olivines, 1031 to 1207 oC for clinopyroxenes, 600 to 900 oC for feldspars, and 638 to 787 oC for Fe-Ti oxides. Oxygen fugacity (fO_2) values range from -15.16 to -19.5.

The incompatible trace element signatures of the SQB (La/Ba = 0.08-0.10 and La/Nb = 0.89-1.04) are similar to those of ocean island basalts (OIB) generated from asthenospheric mantle source unaffected by subduction components. Modelling calculations indicate that the SQB primary magmas were derived from 4-5% partial melting of a garnet-bearing lherzolite mantle source which had a potential temperature (Tp= 1334–1432 °C; based on olivine liquid equilibria) corresponding to ambient temperature of MORB (i.e. passive rifting). This ambient mantle would have to rise to shallower depths (< 100 km) in the upper mantle to cross the dry mantle solidus and stimulate adiabatic partial melting. These estimates along with absence of HIMU (high μ refers to high 238U/204Pb) components (based on trace element data) show that the SQB volcanism isn't associated with thermally driven mantle plumes. Thus, the SQB magma generation is related to extensional regime through passive upwelling and adiabatic decompression melting of an asthenospheric mantle source associated with Red Sea rifting.