Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.31100

The mantle beneath Réunion examined by olivine-hosted melt inclusions

RUBEN RUHEKENYA MUHUNE[1], IGOR NIKOGOSIAN[1], GARETH R. DAVIES[1], SARAH LAMBART[2] AND JANNE M. KOORNNEEF[1]

[1]Vrije Universiteit Amsterdam
[2]University of Utah

Oceanic islands basalts (OIB) formed by melting within mantle plumes record the heterogeneity of the Earth's mantle resulting from complex geological processes over billions of years. Reunion Island, located in the Indian Ocean, is the current manifestation of a mantle plume that has been active for at least 65 Ma since the eruption of the Deccan Traps. The island consists of 2 volcanoes, the older Piton des Neiges (2-0.43 Ma) with primitive eruption products, and the currently active Piton de la Fournaise (<0.53 Ma) that erupts more evolved lavas. Reunion bulk lavas record restricted Sr-Nd-Hf-Pb isotopic compositions resulting either from a relatively homogeneous mantle source or efficient mixing and mingling during melt ascent. The Sr and Nd isotope compositions have previously been interpreted as derived from a depleted mantle component with minor contributions of recycled material.

In this study, we performed elemental (major and trace) and Sr-Nd isotopic analyses on primary melts inclusions (MI) found in olivines (Fo>86%) from two picritic samples from Piton des Neiges. The MI compositions are more variable compared to bulk lavas, with both more depleted and enriched compositions. Two groups of MI are distinguished: one enriched in alkalis (Na_2O and K_2O), TiO_2, Nb, Rb, Ba, P_2O_5 and volatiles (Cl & SO_3) with lower CaO contents and $^{87}Sr/^{86}Sr$ ratios, and another relatively depleted in alkalis and incompatible elements with paradoxically higher $^{87}Sr/^{86}Sr$ ratios. These data suggest the existence of two mantle components that are only recognised based on MI compositions. The decoupling between elemental and isotopic compositions in melt inclusions are evaluated in light of melting of a heterogeneous source and melt reaction processes. A polybaric melt mixing model will be presented to explain source enrichment processes.

Keywords: OIB, Réunion island, Sr-Nd in melt inclusions, mantle heterogeneity, enriched mantle.