The oxidation state of Fe in melt inclusions from Reunion Island

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Correlations between isotopic ratios and the oxidation state of Fe in MORBs and OIBs can constrain the evolution of their sources. We present μ-XANES measurements of the oxidation state of Fe in olivine-hosted melt inclusions from high $^{87}Sr/^{86}Sr$ oceanite lavas from Piton de la Fournaise volcano, Reunion.

MgO contents of glassy Reunion inclusions (4.4-6.5 wt%) correlate negatively with Fe^{3+}/Fe_{total} (0.21-0.14). Major elements in inclusions with >6 wt% MgO agree with previous data and suggest ol+cpx+plag+sp fractionation. However, inclusions with lower MgO suggest ol-only crystallization after entrapment. Inclusions with >6 wt% MgO were corrected to equilibrium with Fo_{91} ol., indicating source fO_2s of QFM-0.05 to -0.66, similar to or lower than MORB sources.

Previous results [1] on MORB and OIB (Iceland, Ontong Java, and Hawaiian volcanoes) define a positive trend between $^{87}Sr/^{86}Sr$ and source fO_2s. The fO_2s inferred for the high-$^{87}Sr/^{86}Sr$ Piton de la Fournaise source (i.e., QFM-0.05 to -0.66) are significantly lower than what would be expected (>QFM+0.75) if they fell on this trend.

The radiogenic isotope ratios of Piton de la Fournaise lavas have been interpreted as mixtures of depleted upper mantle, HIMU, and EMI end members; as representative of the 'C-component', a shared component of many OIBs; and/or a characteristic of the DUPAL anomaly, perhaps reflecting the incorporation of ancient sublithospheric mantle. Some of these components are thought to have been recycled from near-surface, oxidized materials, but our results suggest that such components cannot be dominant controls on fO in Reunion sources. [1] Brounce et al., 2016 AGU abstract D13B-04