

Aluminum and iron behavior in glasses from destabilized spinels: A record of fluid/melt-mineral interaction in mantle xenoliths from Massif Central, France

MICHEL FIALIN^{1*} AND CHRISTIANE WAGNER²

¹Centre de Microanalyse Camparis, UPMC Univ Paris 06, IPGP, CNRS-UMR 7094, F-75005, Paris, France; (*correspondence : michel.fialin@upmc.fr)

²Sorbonne Universités, UPMC Univ Paris 06, CNRS-UMR 7193, ITeP, F-75005, Paris, France

Infiltrations of melts/fluids in mantle rocks are witnessed by the presence of glass-bearing pockets in peridotite xenoliths scavenged by alkaline volcanism. We investigate by electron microprobe the chemical composition, including the $\text{Fe}^{3+}/\Sigma\text{Fe}$ ratios, of several glass-bearing pockets around spinels corroded at different degrees. This study shows (1) how the structure of the percolating melt is modified by the accommodation of chemical elements produced by the dissolution of minerals and (2) how this process could modify the oxidation state of the melt.

The dissolution/recrystallization of spinels enriches the melt in alumina. The spinel-derived Al^{3+} ions are first accommodated to the melt network as network-modifiers. Then Al^{3+} ions were network-formers using K^+ ions, extracted from the aqueous fluid upon melt dehydration, as stabilizers within the tetrahedral site. The transfer of K^+ from the aqueous fluid to the melt network is counterbalanced by an inverse transfer of CaO molecules that form crystalline phases exsolved upon eruption. As the melt dehydration proceeded, an increasing fraction of the spinel-derived alumina molecules were exsolved. Spinel corrosion could generate melt oxidation through dehydrogenation reactions resulting in the formation of Al^{3+} and Fe^{3+} anionic complexes within the melt network.