



## Halogens chemical diffusivities in silicate melts

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Halogens may exert a significant influence on the physico-chemical properties of silicate glasses and melts, on their structure, as well as on their phase relations. Knowledge of the transport properties of halogens in silicate melts is a necessary prerequisite in order to model the information contained in halogen concentrations of eruptive products and volcanic gases in terms of the potential influence of kinetics in controlling degassing.

Therefore, chemical diffusion of halogens (fluorine, iodine, chlorine and bromine) has been investigated for melts in the system Na-Fe-Si-O over a wide range of temperature (450 – 1400°C) using diffusion couple techniques. Halogens were added to starting melts in the form of FeF<sub>3</sub>, FeCl<sub>3</sub>, FeI<sub>2</sub> or FeBr<sub>3</sub>. The investigated melts were stirred prior diffusion experiments for several hours at 1000-1100°C using a concentric cylinder viscometer. The synthesis temperature was restricted to 1100°C to limit the volatilization of halogens. Melted and doubly polished discs were then put into platinum tubes (5mm diameter) for diffusion experiments, where the halogen-rich sample was located at the bottom, and sealed by welding. During the experiments the temperature was monitored with a thermocouple located at the vicinity of the capsule. Run durations were between 30 minutes and 1 hour. The recovered samples were analyzed using an electron microprobe in order to determine the diffusion profiles of the halogens. The experiments for the I-containing samples were conducted between 450 and 1050 °C and for a run duration of 30 to 60 min., the Cl-containing materials were investigated between 800 and 1100°C for 45 to 60 min., the F-containing samples between 600-1400°C for 45 to 60 min, and the Br-containing materials between 750 and 1000°C for 45 to 60 min..

Preliminary results suggest that the diffusion coefficients for F, Cl, Br and I at 1000°C range within at least 3 orders of magnitude. This raises the possibility of significant

kinetic disequilibrium during foaming and rapid degassing of magma prior to and during eruption. The broad diffusion coefficients estimated in this work may also imply that the diffusion of halogens in magma under these conditions is intrinsic in nature and not controlled by melt viscosity.