Structural properties of Carbonate-Silicate melts: An EXAFS Study on Y and Sr

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Carbonatite volcanism generally occurs in intraplate settings associated with continental rifting. The only active carbonatitic volcano is the Oldoinyo Lengai, generating sodium-rich carbonatites. The processes of carbonatite genesis are still unresolved; however carbonate-bearing melts play a crucial role during mantle melting, in diamond formation and as metasomatic agents. Silicate and carbonate melts are immiscible at low pressures invoking trace element fractionation [1]. Using extended X-ray absorption fine structure (EXAFS) spectroscopy, we investigate the influence of carbonate con-centration on the structural incorporation of the geo-chemically important trace elements Y and Sr in silicate and carbonate melts in the system Na_2O-CaO-Al_2O_3-SiO_2-CO_2. Data of silicate glasses with up to 10 wt% CO_2, quenched from melts under high pressure/temperature (HP/HT), indi-cate no or only a slight effect of CO_2 on the local structure of Y and Sr. Compositions with higher CO_2 contents could not be quenched to glasses. In-situ data along the join from silicate to carbonate composition were collected under HP/ HT using the Paris Edinburgh-Press. In-situ experiments re-veal shorter Y-O-bond lengths (~2.2 instead of ~2.3 Å) as well as a higher degree of disorder (σ^2 of ~0.02 instead of ~0.005 Å^2) compared to the glasses. Furthermore, there is a slight increase in Y-O bond length along the join silicate – carbonate composition from ~2.2 to ~2.3 Å. The XANES region of the spectra show distinct differences between the glass and in-situ data as well as along the join silicate – carbonate, which implies significant changes in average site symmetry. Information derived from the trace elements' local structure is used to develop a structural model for carbonate-silicate melts in order to better understand chemical fractionation processes in carbonate-bearing magmatic systems.

[1] I.V. Veksler, C. Petibon, G.A. Jenner et al., *J. Petrol.* **1998**, *39*, 2095.