

Fluid-melt partitioning of Rb and Sr: Classical quench vs. *in situ* experiments

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Rubidium and strontium are important petrogenetic indicators for granite-forming processes. Because exsolution of aqueous fluids during the ascent of granitic melts may strongly alter the composition of the coexisting phases, fluid-melt partitioning of Rb, Sr, and other trace elements has been the subject of several experimental studies, e.g., Webster (1992), Bai and Koster van Groos (1999). The majority of these experimentally determined partitioning data is based on analyses of quenched samples. However, intrinsic uncertainties are associated with fluid-melt partitioning data from quench techniques, which make it problematic to obtain unambiguous data, particularly for the trace element content in the fluid. The uncertainties are related to the difficulty of isolating the fluid phase for sampling and analysis, fluid unmixing, precipitation of solids during quenching, and possible back reactions between fluid and melt during cooling (Adam et al., 1997).

In this study, we compare partition coefficients of Rb and Sr between haplogranitic aluminous melts and aqueous fluids (H₂O or H₂O+NaCl+KCl+HCl) obtained from both classical quench and *in situ* experiments. Several series of quench experiments in externally heated cold-seal pressure vessels were performed at 750°C and pressures of 200 or 500 MPa. The trace element content was determined with ICP-OES analyses of the fluid and EMP analyses on the quenched melt. The *in situ* experiments were carried out using hydrothermal diamond-anvil cells and synchrotron-radiation XRF microanalyses of the fluid (Schmidt et al., 2007) at similar PT conditions. The melt droplets cannot be analysed *in situ* with confidence due to coexcitation of the aqueous fluid around the droplets. Therefore, EMP analyses were performed on the quenched glass droplets after the run.

The fluid-melt partition coefficients from both techniques were in good agreement for experiments with Cl-bearing fluids at similar PT conditions. The *in situ* D values are 0.47±0.08 (Rb) and 0.24±0.03 (Sr). Using quenched samples, D^{f/m}_{Rb} of 0.43±0.04 and D^{f/m}_{Sr} of 0.28±0.04 were calculated. For experiments with H₂O as starting fluid, the D^{f/m}_{Rb} of 0.0028±0.0001 and D^{f/m}_{Sr} of 0.0016±0.0001 calculated from quenched samples were in good agreement with partitioning data from other studies, e.g., Bai and Koster van Groos (1999) reported D^{f/m}_{Rb} of 0.006 and D^{f/m}_{Sr} of 0.002 at 750°C and 200 MPa. In contrast, the *in situ* D^{f/m} values of 0.01±0.002 for Rb and 0.006±0.001 for Sr were distinctly higher.

References

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