

Chlorine-hydroxyl diffusion in pargasitic amphibole

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ABSTRACT

Chlorine-hydroxyl diffusion was measured in pargasitic amphibole from Yunnan province, China at 1.0 GPa, 625 to 800 °C. Experiments were performed by immersing unoriented crystals in water-bearing NaCl in a piston cylinder for durations from 100 to 454 h. Diffusion profiles were on the order of greater than tens of micrometers in length, and electron microprobe analysis allow us to extract semi-quantitative diffusivities from these experiments. The preliminary diffusion coefficients for chlorine in amphibole in the water-bearing experiments are 2.6×10^{-16} m²/s at 625 °C, 4.9×10^{-16} m²/s at 650 °C, 7.6×10^{-16} m²/s at 700 °C, 1.8×10^{-15} m²/s at 750 °C, 2.8×10^{-15} m²/s at 800 °C. For temperatures between 625 and 800 °C, the Arrhenius relation for chlorine-hydroxyl diffusion has an activation energy of 106.6 ± 7.8 kJ/K mol and a D_0 of $4.53 (+7.3, -2.8) \times 10^{-10}$ m²/s. Our measurements do not show evidence of anisotropy in the diffusion of Cl-OH into amphibole, but future experiments need to better investigate this possibility.

Keywords: Diffusion, chlorine-hydroxyl, pargasitic amphibole, crystal-chemistry, high temperature and pressure