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In-situ determination of Pb partition between aqueous fluids and haplogranite melts under HTHP conditions

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Using a micro-focused synchrotron x ray at Synchrotron SOLEIL (France), in-situ x-ray fluorescence (XRF) spectra of Pb, Rb, and Sr are obtained from aqueous fluids and haplogranite/jadeite melt at 0.3-1.3 GPa and 730-830C. Partition coefficients between aqueous fluids and melts are obtained for Pb, Sr and Rb ($D^{fluid/melt}_{Pb}$, $D^{fluid/melt}_{Rb}$, $D^{fluid/melt}_{Sr}$) with and without Cl. As pressure increases, $D^{fluid/melt}_{Pb}$, $D^{fluid/melt}_{Rb}$, and $D^{fluid/melt}_{Sr}$ increase. As salinity increases, $D^{fluid/melt}_{Pb}$, $D^{fluid/melt}_{Rb}$, and $D^{fluid/melt}_{Sr}$ increase. $D^{fluid/melt}_{Pb}$ are larger than unity in 5 M (Na, K)Cl bearing solution-haplogranite melt system. $D^{fluid/melt}_{Rb}$ are larger than unity in 2.5 M NaCl bearing solution-jadeite melt system. Under the identical conditions, $D^{fluid/melt}_{Sr}$ are smaller than 0.6 and 0.1, respectively. The present study confirms that saline fluids can transfer large ion lithophile elements such as Pb, Rb, and Sr from subducting oceanic lithosphere to the mantle wedge, whereas Cl-free aqueous fluids cannot.

Keywords: magma, aqueous fluid, elemental partition, high temperature and high pressure, synchrotron X-ray fluorescence, lead