In situ constraints on volatiles in slab-derived fluids and melts

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Volatiles released to the mantle-wedge by slab-derived fluids (aqueous fluids, hydrous melts or solute-rich supercritical liquids) are expected to have a significant impact on the chemistry of the mantle wedge, and have been suggested to favor the development of oxidative conditions in the sub-arc mantle [1]. The actual composition of such fluids remain mostly unconstrained, mainly due to the difficulty in preserving their high P-T chemistry when returning natural samples to the surface, and in quenching and analysing experimental run products.

I*n situ* measurements, for example by SXRF or Raman, conducted in externally-heated diamond-anvil cells up to 600-800 °C and 1-10 GPa have proven to be a powerful tool to investigate the speciation and solubility of volatile elements in fluids and melts at the P-T conditions characteristic of subduction zones, and thus provide empirical constraints on volatile element concentrations and speciation in subduction zone fluids [2,3,4,5]. However, these high P-T studies remain too scarce to validate the most recent thermodynamic models of volatile transfer upon fluid/slab/mantle interaction in subduction zones or during early atmosphere formation [6,7].

Here, we present results from two new *in situ* studies. First, *in situ* SXRF and XAS measurements that are used to assess the efficiency of Br recycling from the subducting slab, *via* the determination of 1) Br fluid-melt partition and 2) Br speciation in diluted aqueous fluids to increasingly polymerized 'supercritical' liquids and hydrous melts. Secondly, new Raman measurements that aim at constraining the speciation of C and S upon the dissolution of siderite, anhydrite and/or pyrite in H_2O±Cl, Si, Na, Al. The potential implications for mantle redox conditions and the impact of volcanic degassing on the Earth's past and present atmosphere will be discussed.

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