



Fluids geochemistry in the synchrotron light

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High pressure fluids (aqueous fluid, hydrous melt or supercritical fluid) are major vectors for mass transfer at crustal and mantle depths, where they are involved in processes leading to ore enrichment and mass recycling. The poor understanding of the atomic-scale mechanisms that controls the mobilization and transport of elements at relevant conditions, however, limits the quantitative modelling of these processes. In the last decade, new experimental designs combining high-pressure vessels and synchrotron-based spectroscopies have opened the possibility for monitoring in situ the chemical composition, the molecular structure and thermodynamic quantities for high-pressure fluids. Here we illustrate progress in the study of fluid-rock interactions under pressure at synchrotron sources using new results on the solubility and speciation of iron in high pressure fluids. The experiments were conducted in hydrothermal autoclaves and diamond anvil cells at P-T, up to 2.5 GPa and 800 [U+FOB0]C, and redox conditions relevant for ore deposits and subduction zones. Iron-bearing mineral assemblages were equilibrated with chlorinated aqueous fluids and hydrous granitic melts, and the redox state of iron monitored by X-ray absorption spectroscopy (XAS). The role of coordination chemistry involving halogens and polymerized species in the stability and transport of oxidized iron will be discussed. Ultimately, we will present constraints on the oxidizing capacity of iron-bearing ore and metasomatic fluids, and discuss the transfer of the oxidizing signature and the conditions for the genesis of oxidized arc magmas.