

## Speciation and solubility of Fe(III) in crustal fluids

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The speciation and stability of Fe(III) in crustal fluids are still virtually unknown despite the ubiquity of iron species in many processes of geological interest such as iron release from hydrothermal oceanic vents, iron redox reactions during subduction and arc-magma generation, or the role of iron in ore-forming magmatic-hydrothermal processes, to name a few. The data that are definitely needed are for: Fe(III)-Cl complexing under hydrothermal conditions to improve existing speciation models based on limited low-temperature data [1], redox stability of Fe(III) at high temperatures, and solubility of Fe-bearing minerals such as hematite and magnetite in hydrothermal fluids and silicate melts.

In situ X-ray Absorption Spectroscopy data of slightly acid iron-bearing aqueous solutions were collected up to 1000 bar and 500°C, by using a dedicated autoclave [2,3] and by dissolving magnetite, hematite, and hematite-magnetite-quartz mineral assemblage. The simultaneous speciation and solubility data obtained in this micro-batch reactor confirm the occurrence of the octahedral-tetrahedral structural transition upon temperature and salinity increase, and the predominance of tetrahedral highly chlorinated ferric iron species at high temperatures, which leads to enhanced iron solubility, in agreement with theoretical predictions [1]. The ratio of soluble Fe(II) to Fe(III) was also monitored in situ to determine the temperature range of the stability of ferrous versus ferric iron species.

[1] Liu et al. (2006) *Chem. Geol.* **231**, 326-349. [2] Testemale et al. (2005) *Rev. Sci. Instrum.* **76**, 043905. [3] Testemale et al. (2009) *Chem. Geol.* **264**, 295-310.