



## **1 Speciation of iron in high pressure high temperature H<sub>2</sub>O-CO<sub>2</sub> fluids**

### **2 D. Testemale (1), F. Dufaud (2), I. Martinez (2), F. Guyot (3) and J.L. Hazemann (4)**

(1) ESRF, SNBL, BP 220, 38043 GRENOBLE CEDEX 9, FRANCE, (2) IPGP, Centre de recherches sur le stockage géologique du CO<sub>2</sub>, 4 place Jussieu, 75251 Paris cedex 01, France, (3) Dept of Mineralogy, IMPMC and IPGP and center for CO<sub>2</sub>, 140 rue de Lourmel, 75005 Paris, France, (4) Lab. de Cristallographie et CRG BM30B, BP 220, 38043 Grenoble Cedex 9, France.

Injection of CO<sub>2</sub> in the subsurface will result in the production of acidic H<sub>2</sub>O-CO<sub>2</sub> fluids which will dissolve iron, among other ionic species, from major iron-bearing minerals, mainly siderite FeCO<sub>3</sub>. It is important to understand the speciation of Fe in those fluids since it will determine the thermodynamics of iron-bearing silicate and carbonate alteration under subsurface storage conditions.

An original experiment was designed for monitoring in-situ the speciation of iron in H<sub>2</sub>O-CO<sub>2</sub> fluids, by X-ray absorption spectroscopy at beamline BM30B (FAME) of the ESRF synchrotron ring. Siderite FeCO<sub>3</sub> was loaded in fluids, in some cases containing additional CO<sub>2</sub> in the form of oxalic acid, in an high pressure cell [1, 2], well adapted to mineral/fluid interactions studies at deep storage conditions. Speciation of Fe<sup>2+</sup> ions in the H<sub>2</sub>O-CO<sub>2</sub> fluids was studied by interpreting the XANES and EXAFS of the X-ray absorption spectra at different pressure (0-800 bar), temperature (25-300°C), pH and ionic strength.

It is shown that the presence of CO<sub>2</sub> and Cl<sup>-</sup> has no major effect on Fe speciation at the investigated conditions. Distinct changes in the first coordination shell are ob-

served above 150°C which are tentatively interpreted as entrance of  $\text{Cl}^-$  in this coordination shell. Finally, the interpretation of spectra obtained on the  $\text{CO}_2$ -richest solutions as iron-organics complexes due to a reduction of  $\text{CO}_2$  by  $\text{Fe}^{2+}$  above 200°C will be discussed.

#### REFERENCES:

1. D. Testemale et al., Review of Scientific Instruments, submitted.
2. G. S. Pokrovski et al., Chemical Geology, accepted