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Solubility of Aragonite in Aqueous Fluids at High Pressure and High Temperature

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Deep crustal and mantle aqueous fluids play a crucial role in geologic processes occurring in the Earth's interior, especially at high PT conditions. Dissolved carbon appears to be a major element constituting these aqueous fluids, occurring under the form of molecular species (CO_2, CO, CH_4), ionic species such as carbonate or bicarbonate ions or some more complex organic compounds [1]. However, the nature and the content of the chemical species constituting these C-bearing aqueous fluids may strongly be affected by the environmental geologic conditions such as the pressure and the temperature range. If fluid speciation and solubility of carbonate minerals are well characterized at HT and relatively low pressure, less is evident at pressure above 2 GPa where experimental challenges make trickier speciation and solubility measurements.

Thanks to recent advances in theoretical aqueous geochemistry [1–3], combined experimental and theoretical efforts allow now the investigation of speciation and solubility of carbonate minerals with pure water at higher PT conditions than previously feasible [4]. However, direct measurements of solubility of carbonate minerals at HP–HT conditions are still needed to help to the development of quantitative models of carbon transport by aqueous fluids in subduction zones and validate existing aqueous speciation model.

In this study, we present recent X–ray fluorescence measurements and thermodynamic model of solubility of carbonate in aqueous fluids at pressure up to 5 GPa. The amount of dissolved aragonite in the fluid has been measured from the intensity of the Ca K–lines at the ESRF–ID27 using an externally-heated membrane-type diamond anvil cell and an incident monochromatic focused X–Ray beam at 20 keV. The combination of the XRF data on dissolution of $CaCO_3$mineral combined to previous speciation results permits now to calculate the solubility K_S of aragonite a pressure in excess of 2 GPa.

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[2] Sverjensky, D. A et al., *Geochimica et Cosmochimica Acta* (2014, in press).

[3] Pan et al., *Proceedings of the National Academy of Sciences*, **110**, 6646 (2013)

[4] Facq et al, *Geochimica et Cosmochimica Acta* (2014, submitted).