# Gypsum solubility under conditions relevant to $CO_2$ geological storage - insights from experimental data

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The solubility of gypsum has been widely studied under various experimental conditions (e.g. temperature, ionic strength and degrees of saturations), but only few studies considered the impact of pressure and $CO_2$ concentration. In the present study, the investigation of gypsum growth has been extended from atmospheric pressure to pressures up to 100 bar and to various molal concentrations of dissolved $CO_2$.

A series of pressurized semi-batch experiments (flow-through experiments with extremely slow flow rate) were conducted in order to establish the solubility of gypsum at high pressures (25, 35, 50, 70, 100 bar) and with various molal concentrations of dissolved $CO_2$ (0.12, 0.3, 0.54). Experiments were performed at 25°C in a high pressure titanium reactor by mixing $CaCl_2$ and $NaSO_4$ solutions, reaching an initial degree of saturation with respect to gypsum of $\Omega$=1.81 and $\Omega$=1.05.

Solubilities attained in the semi-batch experiments match (within a 3% uncertainty) the new PHREEQC ver.3 predictions ([1] Appelo *et al*, 2014), in which pressure and dissolved $CO_2$ concentrations are two of the new variables. Accordingly, gypsum solubility was found to increase as pressure rises and to decrease as $CO_2$ concentration ascends. In addition, preliminary flow through experiments show that the rates of crystal growth decrease as pressure rises, and increase as a function of $CO_2$ concentration.

[1] Appelo, Parkhurst & Post (2014), *Geochim. Cosmochim. Acta* **125**, 49-67.