A review of carbonate minerals solubility and thermodynamic properties

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Carbonate minerals are ubiquitous in nature, widely studied (and used) in various geological (industrial) settings, and in particular over the last decades, for their potential to Geo-Sequester CO_2 emissions (mineral trapping). Despite large amount of works devoted to acquire solubility and thermodynamic data of the main carbonates-bearing minerals (calcite, magnesite…), a literature review [1] showed, for instance, wide disparity in their solubility at 25°C and almost no data above room temperature. Moreover, various databases exist, used in many geochemical codes [2], but failed to accurately reproduce either field data or some new experimental solubility obtained at higher temperature [1]. Is it the effect of inconsistent set of thermodynamic properties of the solid phases and/or the aqueous species involved in the reaction of interest, including the equilibrium constants? Data not directly measured but rather derivatives or extrapolated? In order to be able to answer to these questions, one of our extensive efforts since many years, is to acquire very accurate experimental data (solubility and rate constants) for a wide range of minerals, as a function of temperature (25 to 300°C) and solution composition. Among these studies, the solubility (and stability) of various carbonates-bearing minerals (e.g., dawsonite, siderite, magnesite, hydromagnesite, dolomite…) [3-6] will be presented, discussed and compared with numerical modelling that are used to improve, in particular, our understanding and numerical simulation of CO_2 water-rock interactions.

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