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Quartz solubility in H2O-CO2 fluids as function of H2O density

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The available experimental data on quartz solubility in H2O – CO2 fluids at high temperatures and pressures (500-900°C, 1.5 - 10 kbar) [1]-[7] are found to follow the same linear dependence (in log units) on the concentration of water, expressed as H2O, as observed for solubilities in pure water [8], provided that the polymerization of aqueous silica and the non-ideal mixing properties of H2O-CO2 mixtures are accounted for as activity coefficients. The available equilibrium constants for aqueous silica polymerization [7,9] have been revisited to be consistent with the linear dependence law for the aqueous silica monomer (in pure water). Using these activity coefficients make the difference between the present study and that of Akinfiev & Diamond [10].
This conclusion provides a quite simple expression for the isothermal quartz solubilities as the sole function of H2O, regardless of the CO2 mole fraction and of the pressure. It is consistent with the concept of "complete" equilibrium constant [11,12] that resulted in the density model [13] of extrapolation of aqueous equilibrium constants to high temperatures and pressures. This suggests that the density model might be extended to H2O-CO2 (and CH4, CO,...) fluid mixtures and used for computing fluid-mineral equilibria in deep crust surroundings.

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