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Synthetic Hydroxybastnäsite-(La) Solubility and Speciation in Carbonate Bearing Aqueous Solutions at 175-250 °C: An Experimental Study

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The transport and enrichment of rare earth element (REE) ore bodies are dependent on the stability of aqueous metal ligand complexes and the solubility of REE bearing minerals. REE ores are commonly associated with igneous systems and associated aqueous fluids with high carbonate concentrations. REE solubilities have been shown to be dependent on temperature and anion ligands present in solution. Here we present solubility experiments of hydroxybastnäsite-(La) at elevated temperatures in aqueous solutions of varying carbonate concentrations. The results show that at lower temperatures, hydroxybastnäsite-(La) solubility is controlled by neutral mono-carbonate $LaCO_3OH°$ but at higher temperatures and activities of carbonate species, charged di-carbonate $La(CO_3)_2^-$ is predominant. This divergence, and the difference in solubility products of other REE-hydroxybastnäsite phases, provides a potential mechanism for REE fractionation in carbonate dominated aqueous solutions. To illustrate one such mechanism the solubility data of hydroxybastnäsite-(La) is compared with previously reported data of hydroxybastnäsite-(Nd) at elevated temperatures.