

Co-precipitation of zinc and calcium carbonates in porous media at ambient conditions

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Anhydrous zinc carbonate ($ZnCO_3$, mineral smithsonite) is isostructural with calcite ($CaCO_3$, S.G. 167) under ambient conditions. In nature it is usually formed, as a secondary mineral, by the supergene alteration of zinc sulphides such as sphalerite, when they are affected by carbonated water. Along with smithsonite, other zinc carbonates like hydrozincite ($Zn_5(CO_3)_2(OH)_6$), and a variety of zinc oxides and hydroxides are frequently found. The precipitation of the different solids, their stability and subsequent evolution depend on multiple factors: water pH, carbonate concentration, the presence of surfaces on which neoformed phases can precipitate and grow etc.

The phase relationships in the Zn^{2+} - Ca^{2+} - CO_3^{2-} - H_2O system are in any case complex and still poorly understood, even though it may have a great geological and also economic and environmental interest. With the aim of throwing some light into it, the present experimental study has been carried out. Calcium and zinc carbonates have been coprecipitated in aqueous solutions under ambient conditions in a counterdiffusion-reaction system, using the silica gel technique. In order to check the influence of supersaturation on nucleation and crystal growth, different initial concentrations of zinc, calcium and carbonate have been tested.

The obtained results reveal the influence of the presence of zinc in the crystallization of calcium carbonates and the very important role that saturation plays on the selection of the Zn phases that that can precipitate from carbonated water and their later evolution in the aqueous media