The role of Se(IV) in the $CaCO_3$ polymorphism

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Crystallization of $CaCO_3$ from aqueous solutions is a topic of great interest in geology and geochemistry, biomineralization, materials science and also industrial crystallization. The presence of different foreign ions in the fluid can inhibit the precipitation of calcite, the most stable polymorph of calcium carbonate at ambient conditions, and promote the precipitation of vaterite, aragonite or hydrated and amorphous phases of $CaCO_3$. The foreign ions can also affect the sequence of polymorphic transformations that can eventually occur after precipitation.

The nucleation and growth of metastable calcium carbonate polymorphs is commonly related to the predominance of kinetic factors over thermodynamic properties. However, in the interpretation of these phenomena, both kinetic and thermodynamic factors have to be considered.

The possibility of incorporating Se(IV) in the crystal structure of calcite have been studied in a number of experimental works (see for example [1] and [2]), but the influence of this anion in $CaCO_3$ polymorphism is poorly known.

In the present work, $CaCO_3$ have been precipitated in aqueous solution in the presence of different amounts selenite at room temperature. After precipitation, the solids have been aged in the remaining water for one month. The structural and compositional of the solids have been monitored during the aging period by X-ray powder diffraction and EDS.

It has been observed that the oresence of Se(IV) in the aqueous solution promotes the precipitation of vaterite and inhibits its transformation into calcite. In the first stages, the precipitated vaterites present poor crystallinity and have incorporated up to 16% of Se in its structure. However, vaterites increase their crystallinity and chemical purity with aging time.

[1] Aurelio G *et al* (2010) *Chem. Geol.* **270 (1-4)**, 249-256. [2] Renard F. *et al* (2013) *Chem. Geol.* **340**, 151-161.