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Calcite crystallization in the presence of europium: Preliminary results

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Ubiquitous calcite is found in natural abiogenic and biogenic environments. Europium radionuclide is enlisted as a rare Earth element and frequently occurs in natural samples of calcite. In this study two complementary crystallization methods are tested to investigate possible conditions of europium uptake by calcite. Counter-diffusion-reaction of (Ca^{2+}, Eu^{3+}) and (Na^{+}, CO_3^{2-}) ions through a porous silica gel (Prieto *et al.,* 1997) was used to examine possible Ca-Eu-Na carbonate solid solution formation. A variety of calcium, carbonate and europium aqueous solution compositions were prepared at high supersaturation with respect to calcite. Crystallization in gel media enables to improve crystal size and facilitates with its characterization. Here, polymorphs of calcium carbonate were obtained in the presence of europium in one month duration gel experiments. An alternative quick method of crystallizing calcium carbonate is the method of vapour diffusion on a crystallization mushroom (Hernández-Hernández *et al.,* 2008). Ammonium bicarbonate solution releases $NH_{3(g)}$ and $CO_{2(g)}$ and in a sitting drop of calcium chloride, nucleation of calcium carbonate is observed. In both diffusion processes calcite crystals and its polymorphs of aragonite and vaterite were obtained and analyzed by scanning electron microscopy (SEM-EDS) and microprobe (EMP). Crystals exhibited a wide variety of forms as a function of the europium mole fraction ($X_{Eu,aq.}$) in the aqueous solution. At $X_{Eu,aq.}$ = 0.02 trace of europium was detected into solid calcite crystal structure. This study examines calcite as a potential host mineral for radionuclide deposits such as europium.

References

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