

The Effect of $[\text{Ca}^{2+}]/[\text{CO}_3^{2-}]$ and $[\text{Na}^+]/[\text{CO}_3^{2-}]$ on Crystal Morphology of Inorganic Calcite

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Laboratory-precipitated inorganic calcite exhibits a range of crystal habits that reflect differences in the relative growth rates of different faces. We have been growing inorganic calcite from CO_2 -fed solutions at constant temperature (25°C) and pH (8.3) but variable salinity (3.5–85 g/kg) to investigate how these environmental variables influence trace element and isotopic uptake into calcite. SEM images of our run products reveals variable calcite morphologies, leading us to question what controls crystal habit and whether variations in crystal habit might be correlated with isotopic composition or solution parameters.

Previous studies have shown that increasing solution $[\text{Ca}^{2+}]/[\text{CO}_3^{2-}]$ and degree of supersaturation [1], as well as the addition of monovalent salts such as NaCl [2], lead to a shift from rhombohedral to scalenohedral crystal morphology at $[\text{Ca}^{2+}]/[\text{CO}_3^{2-}] \sim 1\text{--}1.5$ [1]. The earlier studies also suggest that minor amounts of $[\text{Na}^+]$ promote departures from rhombohedral morphology [2].

Our experimental results are at odds with these expectations. Our solutions span a range of $[\text{Ca}^{2+}]/[\text{CO}_3^{2-}]$ from 11000 to 1300, which should favor a scalenohedral morphology, and yet, almost every experiment ($n=21$) contained at least some rhombohedral crystals. Furthermore, rhombohedral crystals predominate in some of the low, intermediate and high salinity experiments (3.5, 25, 35 and 75g/kg). Replicate experiments also yield different morphologies, suggesting that calcite crystal habit is complicated and requires further study. Ongoing time-series experiments will characterize shifts in morphology and growth rate of different crystal faces over the course of a single experiment.

[1] Carmona, Morales & Clemente (2003), *J. Colloid and Interface Sci.* **261**, 434-440. [2] Jung, Kim & Choi (2005), *Cryst. Res. Technol.* **40**, 586-592.