Sr Incorporation into Aragonite: Effects of Temperature and Supersaturation

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Aragonite is one of common polymorphs of natural calcium carbonate. It occurs via biological or physical processes through precipitation in many different enviroments including a marine ecosystems. It is known that aragonite growth could be dependant on several parameters such as concentrations of chemical species and temperature. Strontium (Sr) is often used to be an indicator to determine climate changes because it is one of ocean conservative elements but also because it can substitute Ca element in the structure of ocean corals mainly cosisting of aragonite. In this study, we investigated Sr incorporation into aragonite over a range of degree of supersaturation and temperature.

Aragonite was synthesized through the constant-addition method with varying concentrations of species (i.e., Ca^{2+} and CO_3^{2-}), injection rates and temperatures. XRD shows that all synthesized precipitates even with Sr incorporation are pure aragonite. Growth rate of Sr-incorporated aragonite crystals was calculated by the specific BET surface area for samples. Although the crystal size and growth rate for Sr-incorporated aragonite increase, crystallinity of the aragonite does not change with increasing temperature and supersatuation with respect to calcium carbonate. Note that partition coefficient of Sr into aragonite decreases from 2.37 to 1.57 with increasing degree of the supersaturation. It is also found that the partition coefficient for Sr decreases 1.90 to 1.54 at a range of 15-40 °C. We, therefore, note that high temperature and supersaturation with respect to aragonite increase growth rate of aragonite crystals and decrease Sr partition coefficient into the structure of aragonite. Our results suggest that the partition coefficient for Sr into biogenic aragonite could be seriously affected by solution temperature and degree of supersaturation with respect to calcium carbonate .

Keywords: aragonite, Sr, incorporation