Strontium partitioning in calcite and its controling factors

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Strontium (Sr) is a common trace element in calcite which is incorporated during calcite precipitation through either inorganic or organic pathways. The ratio of Sr to calcium (Ca) in carbonate rocks and minerals has been widely used in studies of paleoceanography, marine sediment diagenesis, and hydrothermal alteration of oceanic crust. The partitioning coefficient of Sr (K_{Sr}) describes fundamentally the partitioning of Sr between calcite and aqueous solutions, but is a complicated function of environmental conditions and water composition. It has long been recognized that K_{Sr} is strongly dependent on the precipitation rate of calcite (R_p), which has been formulated in a surface kinetic model [1] and a subsequent ion-by-ion model [2]. We re-evaluate available experimental data of Sr partitioning in calcite and find apparent dependence of K_{Sr} on calcite oversaturation and solution pH [3]. An ion-by-ion model is developed that successfully reproduces the observed K_{Sr} values at given solution chemistry [4]. Our model also reproduces observed K_{Sr}-R_p relationships at various temperatures of 5, 25 and 40 ^{o}C. This model provides an opportunity to evaluate effects of past seawater composition on Sr partitioning and their possible roles in reconstructing seawater Sr/Ca ratio in the geological history [5], in using pore fluid Sr concentration to extract sediment-fluid exchange rates in deep sea carbonate sediments [5], and in understanding Sr partitioning in biogenic calcite such as foraminifera.

Reference

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