Low and High Temperature Dolomite Synthesis: Testing Catalysing Factors

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ABSTRACT

Predictions of reservoir quality in carbonate rocks require, beyond sedimentological studies, significant diagenetic research, because of the high reactivity of carbonate minerals. Fluid-rock interactions play an important role in modifying the properties of carbonate rocks, and have a high impact on porosity and permeability changes. A common diagenetic process altering limestones, is dolomitization, the transformation of calcium carbonate to calcium magnesium carbonate. The fairly rare occurrence of dolomite in Holocene environments compared to its high abundance in older rocks, and the challenge of growing well-ordered stoichiometric dolomite inorganically in lab experiments at near surface conditions of 20-30 degrees C and 1 atm pressure, have become known as the “dolomite problem”, having intrigued researchers for decades. Whereas inorganic precipitation of dolomite at elevated temperature has been achieved in the lab by multiple research groups, inorganic low temperature dolomite formation in lab conditions remains more challenging. Lab experiments by our research group focus both on low and high temperature experiments, testing a series of catalysing factors. In particular, the presence of CaCl2 in solution in addition to MgCl2 and limestone has different effects on dolomite synthesis at low temperature versus high temperature. These results highlight that controlling factors determined in high temperature experiments cannot be all extrapolated to low temperature dolomite formation. Our experiments have tested the potential impact of several chemical components as potential catalysts for dolomite formation. In addition, our low temperature experiments aimed to identify the impact of cyclicity. The concept behind the design of those experiments is that fluctuations in concentration, temperature or pressure on a local scale in a solution are crucial for nucleation processes.