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From poorly-ordered precursors to crystals: Factors contributing to spherulitic growth of dolomite

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Dolomite is one of the most abundant carbonate minerals in the geological record, yet it barely forms in the present. The contrast in the abundance of dolomite between geological and modern records combined with the impossibility of synthesizing stoichiometric dolomite in the laboratory at ambient conditions are known as the 'dolomite problem'. This enigma has been in the scope of research for decades, trying to understand dolomite formation, mechanisms and the contributing factors. Dolomite is known to form via two abiotic mechanisms; through (1) dolomitization or (2) dolomite cementation. Also, the contribution of microorganisms can result in biotic dolomite crystallization. The mechanisms of dolomite formation at the molecular and nanoscale in biotic and abiotic environments are relatively well-described, but we still struggle to develop a unified model of dolomite formation in modern and ancient settings. In this contribution, we summarize the development of research related to the dolomite formation processes and in particular the direct dolomite precipitation via spherulitic growth of proto-dolomite.