



A comparative study of low-temperature dolomite formation driven by exopolymers from hypersaline microbial mats and clays

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Recent studies have shown that surfaces rich in functional groups can facilitate nucleation of low-temperature (low-T) dolomite. However, to date few experiments have investigated the details of the nucleation mechanisms nor determined how naturally occurring substances influence crystallization pathways of low-T dolomite. In this study we isolated and characterized extracellular polymers (EPS) from a hypersaline sabkha, as well as clay standards and performed mineralization experiments with these surfaces as seed material. Mineralization experiments were carried out in batch reactors in a solution supersaturated with respect to dolomite. Our results showed that over a five-month period the rate of low-T dolomite formation in samples seeded with EPS was significantly higher compared to those seeded with clay. The observed rates were also shorter than previously published experiments using bacterial cultures (e.g., Kenward et al., 2013, Deng et al., 2019). Precipitates from samples seeded with EPS show crystallization of dolomite precursors after several days and assemblages of dolomite crystals from 10-days forward **[Figure 1]**. Measurements from EPS seeded samples showed significant depletion of Ca and Mg in solution within one week as well as elevated alkalinity that coincided with dolomite crystallization. Samples seeded with clay and control samples without seed materials showed little and no dolomite crystallization, respectively, during the same time-frame. Overall, the results of this work shows that EPS isolated from microbial mats are preferential nucleation surfaces for carbonate precipitation when compared to clays. Additionally, the findings reveal that the properties of nucleation surfaces such as functional group type and concentration are a key factor driving low-T dolomite precipitation.

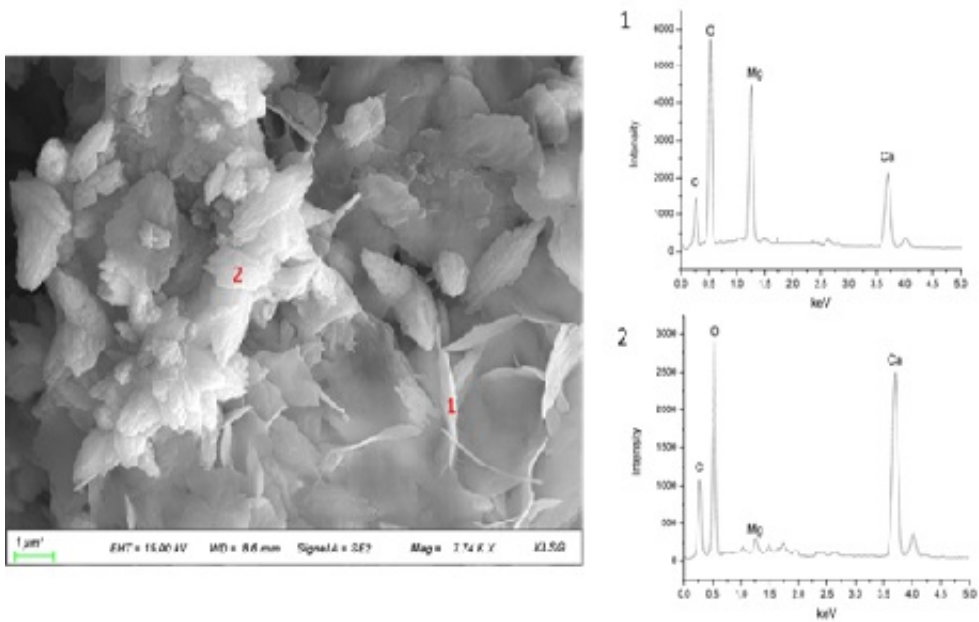


Figure 1: Dolomite like phases and representative EDS spectra from a solution seeded with EPS.

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