Are decaying microbial mats in the modern sabhkas of Qatar niches of dolomite formation?

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The dolomite problem has remained a long standing enigma within the earth sciences, reflecting the paucity of low-temperature dolomite in modern environments vs. its staggering abundance in ancient geologic sequences. Most notable of advances in this respect is the hypothesis that carboxylic functional groups contained within exopolymeric substances (EPS) of microbial origin act as nucleation sites [1].

However, studies examining this mechanism have been largely restricted to laboratory settings. This leaves many questions such as the effect of changing environmental conditions, geographic location, and microbial community composition, open. With these questions in mind recent studies have looked to modern dolomite forming environments, such as the sabkhas of Qatar, where it has been suggested that salinity facilitates dolomite precipitation [2]. Salinity increases due seasonal temperature fluctuations leads to events termed decaying microbial mats (DMM).

In this study, data collected over three sampling seasons suggests that DMM events drive dolomite precipitation and result in a repetitious expression of microbial communities and EPS character. Our data shows that during DMM events, salinity drastically incresases, and the microbial community shifts from one dominated by cyanobacteria to one dominated by anoxygenic phototrophs and heterotrophs. In conjunction with community changes, EPS composition becomes more favourable to dolomite precipitation due to an increased amount of uronic acids. The repeating nature of these events has an implication for the identification of key biomarker groups for low-temperature dolomite within ancient geologic sequences.

[1] Roberts *et al.* (2013). PNAS 110(36), 14540-14545.
[2] DiLoreto *et al.* (2019). Extremophiles, 1-18.