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# Significance of Oxygenic and Anoxygenic Photosynthesizers for Dolomite Formation in Modern Hypersaline Environments

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Significant advances in our understanding of dolomite precipitation have been made, however, the abundance of ancient dolomitic sequences remains an enigma. Interestingly, large deposits of dolomite exist within the Archaean and Phanerozoic at a time when earth's atmosphere was not fully oxygenated [1]. It has been shown that benthic anoxygenic microbial communities from freshwater environments can trigger the precipitation of dolomite [1]. Although this connection has been examined under laboratory conditions, its occurrence in natural environments, and the biogeochemical factors responsible, remain unclear and can be considered much more complicated. Our multi-seasonal work with microbial mats in the hypersaline sabkhas of Qatar shed light on the interplay between in environmental conditions, microbial communities and dolomite formation.

The presented three-year-long study reports cyclical fluctuations in microbial community composition which shift from growing microbial mats (GMM) to decaying microbial mats (DMM). During GMM, microbial mats are dominated by cyanobacterial oxygenic species and underlain by anoxygenic phototrophs. In contrast, during DMM mats are dominated by anoxygenic phototrophs. These shifts from GMM to DMM are triggered by salinity fluctuations and are accompanied by increases of carboxylic groups within extracellular polymers during the lifetime of DMM. Our findings suggest that the interplay between oxygenic and anoxygenic phototrophs is a key factor for dolomite formation. We hypothesize that the evolution of oxygen concentrations in ocean and atmosphere may be responsible for the lack of modern dolomite by restricting environments where oxygenic and anoxygenic phototrophs coincide [2].

[1] Daye, M., Higgins, J., and Bosak, T. (2019). Formation of ordered dolomite in anaerobic photosynthetic biofilms. Geology 47, 509-512.
[2] Johnston, D.T., Wolfe-Simon, F., Pearson, A., and Knoll, A.H. (2009). Anoxygenic photosynthesis modulated Proterozoic oxygen and sustained Earth's middle age. PNAS 106, 16925-16929.