Dolomite formation within microbial mats from the Dohat Faishakh sabkha, Qatar

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The hypersaline coastal sabkha of Dohat Faishakh (Qatar) was one of the first settings recognized as a rare modern geological environment where dolomite formation occurs (Illing *et al*., 1965). Although the origin of dolomite remains one of the most debated subjects in sedimentary geology, microbial mediation has been recently proposed as a possible solution for this controversy. Until now, the relationship between microbial activity and dolomite precipitation in the Dohat Faishakh sabkha has not been evaluated. The limited previous studies of the Dohat Faishakh sabkha considered dolomite formation to be the result of a penecontemporaneous replacement of authigenic aragonite. However, no conclusive evidence confirms this hypothesis. To evaluate whether a "microbial factor" is important in this classic evaporitic environment, we collected core samples along a transect from the lower intertidal to the surpatidal zone of the sabkha. A preliminary investigation of the sampled sediments revealed a close association between buried microbial mats and dolomite. The exopolymeric substances constituting the microbial mats are recognized as an important component for dolomite nucleation. We, therefore, hypothesize that the main factor controlling the occurrence of dolomite within the sediments of the Dohat Faishakh sakha is the presence of an organic matrix (i.e., the buried microbial mats) and not a replacement process transforming primary aragonite into dolomite. Aragonite and dolomite likely precipitate nearly simultaneously from highly evaporated marine waters. The presence/absence of an organic matrix determines whether the carbonate minerals will have a dolomitic vs. an aragonitic composition. Applying a geomicrobiological approach to study mineral formation beneath the Dohat Faishakh sabkha will provide new insights into evaporite mineral associations in the rock record, as well as into extraterrestrial environments, as evidenced by recent observations of evaporitic sediments on Mars.

[1] Illing et al., 1965, SEPM Spec. Publication **13**, p. 89-111.

A new aqueous phase protocol for the mechanism generator GECKO-A used for the CAPRAM mechanism extension

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The ubiquitous abundance of organic compounds in natural and anthorpogenically influenced eco-systems has put these compounds into the focus of environmental research. To investigate the chemistry of organic compounds in the tropospheric multiphase system, explicit modelling can provide a useful tool.

However, the oxidation of large organic molecules (typically $C_{>5}$) involves a huge number of intermediate compounds produced during the oxidation process. Furthermore, most of the needed experimental thermodynamic and kinetic data are unavailable in the literature. Therefore, the creation of explicit mechanisms relies on automated self-generating mechanism construction as achieved with GECKO-A (Generator for Explicit Chemistry and Kinetics of Organics in the Atmosphere) for the gas phase.

As the chemistry in deliquescent particles and cloud droplets can be important for the oxidation process, a protocol has been developed to describe the degradation of aliphatic organic compounds in the aqueous phase. This aqueous phase protocol has been implemented into GECKO-A and was used to advance the aqueous phase mechanism CAPRAM 3.0n (Chemical Aqueous Phase RAdical Mechanism). The latest CAPRAM version was extended by about 3500 reactions, where, besides the addition of new subsystems, branching ratios were introduced in the mechanism.

Box model studies were performed with a non-permanent cloud scenario to reveal more insights into the degradation and formation of organic compounds in deliquescent particles and cloud droplets as well as the feedback on gas phase concentrations. Detailed time-resolved investigations of the chemical fluxes assisted the investigations of concentration-time profiles. Comparisons with previous model studies and experimental data from field and laboratory investigations were used to validate the mechanism generator and show significant improvements in the generated model results.

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