Salinity controls on microbial surface functional groups: Impacts on precipitation of Mg-carbonates

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Recent microbial models and experimentation have demonstrated that dolomite precipitation is possible at low temperatures (<50°C) in laboratory settings, by microbial influence and mediation. Many of these studies have observed dolomite precipitates that are intimately associated with microbial surfaces and microbial exopolymeric substances. One mechanism of nucleation and precipitation by microbial surfaces is high (>0.06 groups angstrom^{-2}) carboxyl-group densities, through dewatering of Mg^{2+}, favoring carbonation and dolomite formation. This study investigates the role of solution salinity in determining cell wall carboxyl-group density and therefore, the likelihood for specific organisms and environments to favor low-temperature dolomite formation.

Three microorganisms, two that have been shown to precipitate dolomite in laboratory and field settings (*Desulfovibrio brasiliensis*; *Haloferax sulfurifontis*) at a range of salinities and a control organism that is not associated with dolomite precipitation (*Shewanella putrefaciens)* were exposed to growth media of varying salinities. Cells were titrated and carboxyl group density was calculated.

Carboxyl group densities increased by 275% and 170% when doubling salinity concentrations for *Desulfovibrio brasiliensis* and *Shewanella putrefaciens*, respectively. Similarly, carboxyl group densities decreased by 47.5% when decreasing salinity by 75% for *Haloferax sulfurifontis*.

The high carboxyl group densities for *D. brasiliensis* and *H. sulfurifontis* are consistent with previous research that suggests that carboxyl group density (>0.6 sites Å^{-2}) is necessary for dolomite nucleation. These results, however, tie microbial physiology to environmental conditions and give insight into microbial controls on low-temperature dolomite precipitation in mixing zones, sabkha and hypersaline lagoon environments.