

Accepted Manuscript

The role of microbial sulfate reduction in calcium carbonate polymorph selection

Chin Yik Lin, Alexandra V. Turchyn, Zvi Steiner, Pieter Bots, Giulio I. Lampronti, Nicholas J. Tosca

PII: S0016-7037(18)30334-X
DOI: <https://doi.org/10.1016/j.gca.2018.06.019>
Reference: GCA 10808

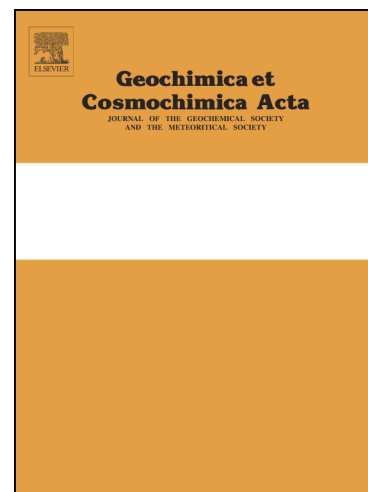
To appear in: *Geochimica et Cosmochimica Acta*

Received Date: 9 February 2018

Accepted Date: 17 June 2018

Please cite this article as: Yik Lin, C., Turchyn, A.V., Steiner, Z., Bots, P., Lampronti, G.I., Tosca, N.J., The role of microbial sulfate reduction in calcium carbonate polymorph selection, *Geochimica et Cosmochimica Acta* (2018), doi: <https://doi.org/10.1016/j.gca.2018.06.019>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



The role of microbial sulfate reduction in calcium carbonate polymorph selection

Chin Yik Lin¹, Alexandra V. Turchyn¹, Zvi Steiner¹, Pieter Bots², Giulio I. Lampronti¹, Nicholas J. Tosca³

¹Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ, United Kingdom.

²Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow G11XJ, United Kingdom.

³Department of Earth Sciences, University of Oxford, South Parks Road, Oxford OX1 3AN, United Kingdom.

ABSTRACT

Microbial sulfate reduction is a dominant metabolism in many marine sedimentary environments. The influence of this metabolism on the kinetics of CaCO₃ growth, as well as the dominant polymorphs precipitated, is poorly understood. To investigate the role of microbial metabolism on CaCO₃ precipitation and polymorph selection, we conducted growth experiments with the sulfate reducing bacteria (*D. bizertensis*) in media with varying Mg/Ca and different seeding materials (calcite and kaolinite). Our results suggest that sulfate reducing bacteria both induce carbonate mineral precipitation through an increase in alkalinity and serve as nucleation sites for the growing carbonate mineral; the majority of the carbonate minerals produced were on cell material rather than mineral seeds. We also find the Mg/Ca and presence of phosphate in the media play a key role in controlling the rates of carbonate mineral precipitation and calcium carbonate polymorph selection. In media where the Mg/Ca is greater than 2, crystalline monohydrocalcite (MHC) is the primary carbonate mineral produced. Although phosphate concentrations have a lesser effect on which polymorph initially precipitates, a series of transformation experiments suggests that the presence of phosphate stabilizes MHC crystals and prevents its transformation to more stable calcium carbonate polymorphs. Collectively, these results suggest that the polymorph of microbially-mediated calcium carbonate cements is determined by the solution chemistry upon nucleation.

Download English Version:

<https://daneshyari.com/en/article/8910632>

Download Persian Version:

<https://daneshyari.com/article/8910632>

[Daneshyari.com](https://daneshyari.com)