Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35428

Microbial contribution to calcite microtopography and reactivity: Insights from incubations in lake waters

MALAURY LUZET[1], KARIM BENZERARA[2], DELPHINE TISSERAND[3], DIDIER JÉZÉQUEL[4], LUCA STIGLIANO[5], PHILIPPE ACKERER[6] AND DAMIEN DAVAL[7]

[1]ISTerre - Université Grenoble Alpes/CNRS
[2]Institut de Minéralogie, de Physique des Matériaux et de Cosmochimie (IMPMC), Sorbonne Université, CNRS UMR 7590, MNHN
[3]CNRS ISTerre Grenoble
[4]IPGP, CNRS UMR 7154, Université de Paris & UMR CARRTEL, INRAE-USMB
[5]ISTerre - CNRS
[6]ITES - CNRS
[7]ISTerre - Université Grenoble Alpes/CNRS/IRD

Microorganisms are known to influence mineral alteration in natural environments. However, their quantitative contribution relative to chemical weathering remains debated. Moreover, the specific microtopographic features they generate on mineral surfaces, and how distinctive they might be, remain unresolved. In this study, we aim to quantify the contribution of lake water microbial communities to calcite dissolution and assess their influence on calcite surface microtopography.

To reach these goals, polished calcite coupons were incubated in waters from four French lakes showing different states of calcite saturation. Experiments were conducted at two different ecological scales. At the microcosm scale (in the laboratory), dissolution experiments were performed under controlled conditions (temperature, light, pCO_2) in 0.2 µm-filtered lake water (microorganism-free) or unfiltered lake water. At the lake scale, calcites chips were incubated *in situ* in Lake Chavoley (Ain, France), either directly exposed to lake water or enclosed in devices preventing direct contact with microorganisms.

We employed several microscopy techniques, in particular vertical scanning interferometry, to characterize surface topography at high vertical resolution. Dissolution rates were calculated from these images, and microtopography was analyzed using quantitative parameters (*e.g.,* surface roughness) and statistical approaches (power spectral density, semi-variograms)

Together, the results collected so far suggest that relationships between microtopography and dissolution conditions (fluid saturation state and microbial presence), previously demonstrated under controlled laboratory conditions with single-strain biofilms [1, 2], may also apply in natural settings.

[1] Stigliano, L.; Ackerer, P.; Benzerara, K.; Daval, D. (2023). *Chem. Geol. 637*, 121680.

[2] Stigliano, L.; Benzerara, K.; Ackerer, P.; Menguy, N.; Travert, C.; Skouri-Panet, F.; Daval, D. (2025) *Astrobiology,* 25(4)*,* 296–308.