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The Effect of Microbial Attachment on Crystal Dissolution Kinetics: Experimental Results and Computer simulations

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Mineral dissolution kinetics have been studied extensively under abiotic conditions. As a result, a large pool of data and observations is available, both in experimental and field settings. More recently, experimental studies have demonstrated that microbial interaction at the crystal surface can have dramatic effects on dissolution rates and mechanisms.

A fundamental understanding of mineral dissolution processes requires a model that fully incorporates the three-dimensional crystal lattice and the relevant bond-breaking and forming processes as well as surface diffusion, molecular arrival and detachment rates. The participation of microorganisms in such complex dissolution reactions will require experimental and computational strategies that can explore microbe-solution-crystal interactions at a variety of different length and time scales.

We employ a combination of direct observational techniques, e.g., atomic force microscopy (AFM) and vertical scanning interferometry (VSI), in concert with parameterized Monte Carlo (MC) simulations to explore crystal dissolution kinetics in the presence of microorganisms, e.g., *Shewanella oneidensis* MR-1. Recent studies demonstrate that the attachment of MR-1 to mineral surfaces can potentially override abiotic kinetics. Our MC simulations provide a first glimpse into the complex interactions between water, microorganism, and mineral surface.