



Bacterially mediated dissolution – enhancement or inhibition?

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Microorganisms have been demonstrated to acquire essential nutrients from dissolving minerals at the Earth's surface and subsurface. There is evidence to suggest that mineral dissolution reactions are accelerated by the presence of heterotrophic bacteria [1, 2]. However, the actual mechanism of microbial accelerated mineral dissolution has yet to be determined.

Dissolution experiments on feldspar and apatite in the presence of *B. megaterium*, a Gram-positive bacterium, were performed to establish the importance of metal uptake by cells, the impact of bacterial exoproducts on dissolution and the significance of bacterial adhesion to the mineral surfaces. Exopolysaccharides (EPS) and bacterial cells accumulated both, Al and Si. Al was rapidly adsorbed on the cell surface while Si accumulation was a slow process which suggests a possible internal uptake or a strong complexation on the cell surface. Exometabolites and EPS were shown to substantially enhance feldspar dissolution especially in conditions of nutrient limitation. On the other hand, the presence of feldspar in the cultures stimulated EPS production in all the media studied. Early evidence suggests that stimulation was not due to Al or Si, but may have been a response to the presence of solid surfaces. Our results demonstrate that bacterial cells (and their metabolic products) play an important role in the dissolution of K-feldspar; the cells, their metabolites and EPS act as chelating agents for Al and Si and thus stimulating dissolution.

The number of cells attaching to feldspar surfaces varied with type of mineral and growth conditions. We found no convincing evidence of enhanced dissolution induced

by attached cells. In fact, a series of experiments performed with apatite, indicate that bacteria can accelerate mineral dissolution rates without their physical attachment to the mineral surfaces. The attachment of microbes on apatite crystals is found to actually limit microbial rate enhancement effects.

References

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