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An experimental study of calcite dissolution in the presence of Mg^{2+}

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Calcite is one of the most abundant minerals on the earth's surface and plays an important role in both inorganic and biological environments, both natural and anthropogenic. Calcite dissolution is fundamental in a wide range of processes including the weathering of rocks, the control of heavy metal mobilisation in the environment, the control on CO_2 sequestration, the deterioration of building stone and concrete, and industrial water treatment. Mg^{2+} is a major constituent of seawater and in pore waters, and is known to have an influence on calcite dissolution. Here we present investigations on the dissolution of calcite in the presence of Mg^{2+}. Both bulk (batch reactors) experiments and microscopic (*in situ* AFM) techniques are used to study the dissolution of calcite by a range of aqueous solutions containing Mg^{2+} ions. Previous work has indicated the role of magnesium as an inhibitor of calcite dissolution. Contrary to these results, (Arvidson et al. 2006 and references therein), our quantitative analyses of AFM observations, as well as solution analyses from batch reactor experiments using atomic absorption spectroscopy (AAS), show that although Mg^{2+}inhibits etch pit spreading, it enhances the dissolution in etch pit depth and subsequently the overall dissolution. AFM experiments have been carried out in a fluid cell using calcite cleavage surfaces in contact with solutions of $MgSO_4$, $MgCl_2$, Na_2SO_4 and NaCl to try to specify the role of Mg^{2+} during calcite dissolution.

References:

Arvidson, R. S.; Collier, M.; Davis, K. J.; Vinson, M. D.; Amonette, J. E.; Luttge, A. *Magnesium inhibition of calcite dissolution kinetics.* Geochimica et Cosmochimica Acta, **2006,** 70 (3) 583-594.