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# Understanding variation in dolomite dissolution rate at low pH

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Recent research on carbonate mineral surface reactivity has demonstrated fundamental variability of dissolution rates and the heterogeneous distribution of the reaction over the mineral surface. These findings have raised major concerns over the use of a 'mean rate' and the derived 'rate constant' for predicting the long term stability of minerals in natural and engineered settings. For instance, there has been substantial amount of literature reporting calcite ($CaCO_3$) surface variability and the associated heterogeneity of dissolution rates under a wide range of aqueous conditions[1]. In contrast, very little attention has been focused on the existence of surface heterogeneity and its effects on dissolution rates of dolomite ($CaMg(CO_3)_2$), which is a significant phase in the rock record and in the soil environment. Here, we investigate the effects of aqueous solutions of $NaCl/CaCl_2$ of variable concentrations (0.05 M-0.5 M), at acidic pH (pH 3.0), by the combined use of atomic force microscopy (AFM) and vertical scanning interferometry (VSI) with the aim of understanding the intrinsic rate variability of dolomite single crystal.

Direct surface measurement data obtained from VSI and AFM is analysed by material flux maps and rate spectra, permitting identification and quantification of dissolution rate contributors. To our knowledge, this is the first instance of the combined use of advanced surface analytical techniques (e.g. VSI) and rate spectral analyses to unravel the effects of aqueous conditions on dolomite surface rate heterogeneity and quantification of rate contributors. These results have implications for a variety of aqueous environments, where dolomite stability is governed by the solution cation composition and its concentration.

[1] C. Fischer, I. Kurganskaya, T. Schafer, & A. Lüttge, *Applied Geochemistry* **43**, (2014).