Modelling the reactivity of multi-mineral systems – Application to mine waste predictions

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Numerical predictions of long term mine water quality are commonly based on weathering/solute release rates derived from kinetic laboratory testwork, e.g. humidity cell tests. Scaling factors are typically applied to allow the application of laboratory data to approximate field conditions. These values are then fed into a numerical predictive calculator, such as the USGS PHREEQC [1], where single or multi step thermodynamic equilibrium chemistry is assumed. Results from these calculations are used to inform both project design and environmental impact of mine facilities. Thermodynamic equilibrium chemistry, the basis for these models, while having strong theoretical foundations has equally strong shortcomings [2].

This study builds on the foundation laid by the Carbfix Project [3] and applies its equations to the definition of a kinetic model of a mine waste rock facility. Through comparison of results and methodology of a kinetic and equilibrium approach to the same system, the use of kinetic models has been shown as equally valid as a prediction tool, and forms the basis for further developments: e.g. to inform the laboratory testwork that can best represent real world conditions within a numerical model.

[1] Parkhurst, & Appelo, 2013, : U.S. Geological Survey Techniques and Methods, book 6, chap. A43, 497 [2] Oelkers, Bénézeth, & Pokrovski, 2009. Reviews in Mineralogy and Geochemistry, 70 [3] Declercq & Oelkers, 2014. CarbFix WP5 Project no. 281348