Prediction and Calibration in the Kinetic Modelling of Mine Waste Facilities

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The long term prediction of water quality emmanating from from mine waste disposal facilities is an important aspect of the design and management of mining operations. Typically those predicitons are based on scaled up laboratory testwork data that produces results that whilst conservative and therefore useful in terms of preventing environmental impacts are generally not representative of the actual chemistries observed on site.

Using the recently publised kinetic database by Hermanska et al. (2021) water quality emmanating from mine waste storage facilities from several projects was predicted. These modelled water concentrations were based on mineralogical analysis and design information for a given waste facility and compared to the measured water quality emmanating, as runoff or seepage.

The main unknown parameters are the reactive surface area of the individual minerals composing the waste facilities as well as the estimated water to solid ratios in the facilities. To improve the modelling, the sites were selected for their detailed mineralogical analysis including mineral surface analysis such as QEMSCAN analysis to understand confounding factors such as armoring of the mineral surface areas.

These results were calibrated using water quality monitoring data and compared with the more classic thermodynamic equilibrium calculations.

Heřmanská, M., Voigt, M., Marieni, C., Declercq, J., & Oelkers, E. (2021). A comprehensive and consistent mineral dissolution rate database: Part I: Primary silicate minerals and glasses.