

Diavik Waste Rock Project: Scale-up of a reactive transport conceptual model for temperature and sulfide dependent geochemical evolution

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A primary goal of the Diavik Waste Rock Project (DWRP) was to investigate mechanistic techniques for scale-up of results from small scale laboratory experiments to assess the geochemical evolution of mine-waste rock at the field scale. The DWRP includes laboratory and field experiments developed to characterize weathering of sulfide waste rock at different scales. Medium-scale (2 m) active zone lysimeter (AZL) field experiments were conducted to characterize the geochemical weathering of waste rock under a relatively straightforward flow regime while being exposed to atmospheric temperature and infiltration conditions. The geochemical evolution of waste rock in the AZLs was simulated by scaling an integrated conceptual model developed for the DWRP small-scale experiments (humidity cells) and implemented via reactive-transport code MIN3P. Scaling of the integrated conceptual model involved only adjustment of S and C content. Water flow through the experiment was simulated using precipitation data and physical parameters measured at the site as part of the DWRP. The temperature dependence of the geochemical system was included using measured temperature to constrain mineral weathering rates on a daily basis. The simulations indicate that a conceptual model developed from humidity cell experiments can be mechanistically scaled to provide a reasonable assessment of geochemical evolution at the field scale using physical parameters that are consistent with the temperature and infiltration measured at the field experiment.