

How wrong can mining geochemical predictions be and still be useful?

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The use of geochemical predictive calculation codes is widespread in the mining industry as a tool to estimate potential contact water chemistry and potential impacts from the weathering of mine waste[1]. These codes are often used within elaborate models to explain the source, mixing and fate of such geochemical systems. However, there remain many unknowns that influence the ability of the users to provide realistic predictions. Foremost amongst these are the inherent limitations of the thermodynamic[2] databases and the lack of published kinetic databases that define the reactions. Is there really enough data on the complex behaviour of these minerals and secondary/amorphous phases that are encountered under field conditions to support the model predictions?

Another key limitation is how to develop a field sampling programme that can allow laboratory testing to be representative; to ensure that variations in mineralogy and geochemistry are accounted for. These gaps in knowledge and technique present challenges to fully reconcile laboratory tests and field conditions, and are significant hurdles to producing predictions that are fit for purpose.

In this work we will explore these common limitations and present our avenues to answers these question. Several research angles are considered, the correction and update of the thermodynamic data, the definition of a kinetic database and the use of multiple laboratory testwork to correlate our results.

[1] Nordstrom, DK 2012 *Applied Geochemistry*, 27, 1899-1918

[2] Oelkers, Bénézeth, & Pokrovski, 2009. *Reviews in Mineralogy and Geochemistry*, 70