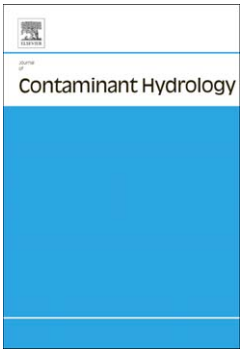

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Stochastic multicomponent reactive transport analysis of low quality drainage release from waste rock piles: controls of the spatial distribution of acid generating and neutralizing minerals

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Abstract

In mining environmental applications, it is important to assess water quality from waste rock piles (WRPs) and estimate the likelihood of acid rock drainage (ARD) over time. The mineralogical heterogeneity of WRPs is a source of uncertainty in this assessment, undermining the reliability of traditional bulk indicators used in the industry. We focused in this work on the bulk neutralizing potential ratio (NPR), which is defined as the ratio of the content of non-acid-generating minerals (typically reactive carbonates such as calcite) to the content of potentially acid-generating minerals (typically sulfides such as pyrite). We used a streamtube-based Monte-Carlo method to show why and to what extent bulk NPR can be a poor indicator of ARD occurrence. We simulated ensembles of WRPs identical in their geometry and bulk NPR, which only differed in their initial distribution of the acid generating and acid neutralizing minerals that control NPR. All models simulated the same principal acid-producing, acid-neutralizing and secondary mineral forming processes. We show that small differences