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Trace metal(loid) release and transport from gold mine tailings in Porgera, Papua New Guinea

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Arsenic (As) release due to gold mining activity can alter surface water and sediment chemistry. However, the form, concentration, and mobilization of As from mine waste depends on the geochemical conditions of the receiving environment. This study simulated As release from limed mine sediments under various redox and pH scenarios using sediment resuspension experiments. To characterize mineralogical controls on As release from tailings sediment, we analysed sediment characteristics using x-ray diffraction and sequential extraction methods. Varying the pH in liquid tailings from 4 to 10 caused the concentration of total dissolved As to decrease from 10 to 6 ppb, respectively. As was primarily present as the more mobile form, As(III), under neutral pH. Further, As was mobilized primarily as As(III) from oxidized tailings within the first 8 hours of rewetting. Given that carbonate-bound As comprised <1% of total As in the solid tailings, addition of lime likely affects the relative concentration of mobile As species due to the availability and surface charge of sorption sites. Although pH adjustment of wastewaters often reduces trace metal contamination, additional monitoring criteria should be implemented to mitigate As release.