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Assessing the Impact of Weathering on Arsenic Bioaccessibility in Mine Wastes at Empire Mine, California

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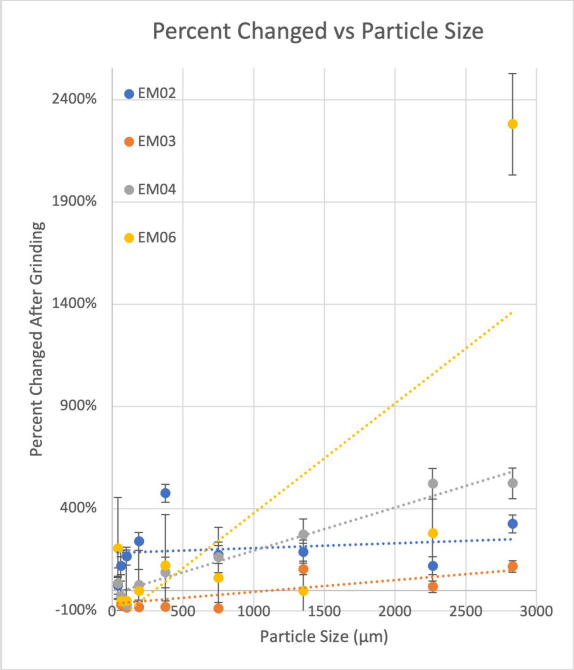

The mining industry has historically been an integral part of California's economy, but has also left an enduring environmental legacy in the form of inactive mine sites across the state containing processed mine tailings elevated in potentially toxic metal(loid)s. Arsenic (As), a naturally occurring metalloid commonly found in gold mine tailings, can pose health risks when ingested. However, these risks are highly variable due to the wide range of As bioaccessibility (proportion of soluble As) reported within tailings (ranging from ~1% to >25%). Developing more predictive methods of characterizing As bioaccessibility in tailings would improve exposure and risk estimates.

This study focuses on the Empire Mine, an abandoned gold mine located in Nevada County, California. Mine tailings were collected from several locations at Empire Mine as bulk grab samples and sieved through a series of stainless steel sieves into discrete size fractions as small as ≤20 µm. The reactive surface area of each size fraction was measured using a BET surface area analyzer and exposed to an *in vitro* simulated gastric fluid (SGF) extraction to simulate the ingestion pathway. After filtration through a 0.45 µm filter, supernatants were analyzed for dissolved As using an inductively coupled plasma-optical emission spectrometer (ICP-OES), and As bioaccessibility was calculated and expressed as a percentage of As in the sample.

The effects of weathering on bioaccessibility were evaluated by grinding selected size fractions in a ring mill, then repeating the SGF extraction process to compare As bioaccessibility pre- and post-grinding. Initial results show that ground samples generally release more As on both an absolute and surface area-normalized basis, suggesting that the chemical speciation and spatial distribution of As is more amenable towards increased As release with weathering. These findings have implications for the long-term risks posed by As in mine tailings and can guide remediation priorities and strategies for the numerous As-bearing mine waste locations across the state.