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Particle-Size Dependent Trends in Arsenic Bioaccessibility Through *In vitro* Extractions of Mine Wastes

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The mining and processing of gold and silver in the Mojave Desert, California has generated vast quantities of mine wastes containing elevated levels of several trace metal(oid)s, including inorganic arsenic (As). Although regulatory agencies often utilize bulk As concentrations to estimate exposure risk, simulated gastric fluid (SGF) extractions represent a more physiologically relevant metric to assess As bioaccessibility and potential exposure. Additionally, many physicochemical characteristics controlling As bioaccessibility are not often systematically considered when estimating exposure risk.

Processed mine tailings and unprocessed waste rock from six former mine sites in the Mojave Desert region were physically separated into 11 discrete size fractions (ranging from ≥ 2,730μm to ≤ 20μm) and analyzed for initial As concentration and reactive surface area before subsequent exposure to SGF and water leach extractions. Mine tailings and waste rock samples exhibited distinct trends across analyses, with As bioaccessibility between 2x-40x (avg. 15x) higher across all size fractions. Arsenic bioaccessibility, expressed as a percentage of As released in SGF, exhibited the strongest correlation with reactive surface area. When bioaccessibility was expressed as As concentration released in SGF, initial As solid concentration was most strongly correlated. Stepwise linear regressions showed that reactive surface area, initial As concentration, and water solubility, respectively and in order of importance, explained most of the variation of As bioaccessibility across sample types. Differences in arsenic speciation and physical encapsulation of As may explain the remaining unaccounted variability in As bioaccessibility.