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The impact of arsenic microspatial distribution and speciation on *in vitro* bioaccessibility in California mine tailings

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In California, the extraction and processing of mineral resources has resulted in an enduring environmental legacy of arsenic (As) contaminated mine wastes due to their co-occurrence in gold quartz vein deposits. Since As is a known human carcinogen, historic mine tailings with high As concentrations pose significant risks to human health and the environment. A critical factor in characterizing these potential health risks is the bioaccessibility, or the percent of solid-phase arsenic that can be mobilized and absorbed by the body, of the exposed mine tailings. Our previous work has demonstrated large variations in *in vitro* bioaccessibility (from <<1% to >30% bioaccessible As) among legacy mining sites in the Mojave Desert, Sierra Nevada, and Orange County, CA. To examine both the variation in As bioaccessibility and predict the long-term potential exposure and health risks of As-enriched mine wastes, we have used a multi-disciplinary approach utilizing a combination of simulated gastric fluid extractions, simulated accelerated weathering, multi-energy mapping (uXRF), and uXAS.

Through this research, we have categorized three distinct modes of As enrichment/depletion within soil particles: interior encapsulation, surface enrichment, and homogeneous distribution. Currently, we are investigating how As speciation and Fe co-location vary depending on the mode of As distribution, which provides important context to our understanding of As bioaccessibility. For example, encapsulated As is more likely to be found in reduced forms (-I, III), whereas we will observe oxidized As (V) on the particle surface. While particles with high surface-bound As present a short-term risk, mine tailings with encapsulated As represent long-term risks and should be considered in prioritizing remediation efforts.

Further comparison of arsenic bioaccessibility following simulated weathering/aging through repeated and controlled fluctuations in temperature and humidity will allow us to predict the long-term potential exposure and health risks of these mine wastes. We predict that natural weathering will facilitate surface dissolution and reprecipitation of As-bearing species at the particle surface and, therefore, enrichment of surface-bound As. Through our work integrating As microspatial distribution, speciation, and bioaccessibility, we aim to assist in characterizing the long-term effects of mineral weathering on contaminant mobility in mine tailings waste.