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Characterization of Mine Waste in Nevada, USA: Converting Waste Into Wealth

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The continual growth and development of society has led to an increasing demand for critical minerals, resulting in the assessment of alternative sources of these commodities. Mine waste is considered one of the most prospective secondary sources for future critical mineral and other metal supply. Modern technology requires nearly every element on the periodic table, however, many metals considered critical today were not required historically and were deposited as waste during mineral processing. This includes byproduct metals such as indium, tellurium, and selenium.

This study focuses on the characterization of two mine waste sites in Nevada, USA, a state with a significant mining history and >160,000 former mine sites. Lone Tree is a distal disseminated Au deposit that produced 4.2 Moz of Au between 1991 and 2006. We estimate that ~800,000 oz of Au remains in the tailings storage facility, which has an average Au grade of 1.55 ppm. The Caselton Mine and Mill is a historic processing facility for Zn-Pb-Ag ore from carbonate replacement deposits in the Pioche mining district, with approximately 7.5 Mt of tailings present at the site. Our geochemical analyses show that the tailings range from 1,000-12,750 ppm Zn and 2,370-38,100 ppm Pb and contain an average concentration of 67 ppm Ag. Based on these values, we estimate that 491 tons of Ag, 63 kt of Pb, and 56 kt of Zn are present in waste at the site, along with considerable amounts of As, Cu, Ga, In, and Mn. Both of these sites highlight the economic and critical metal potential of mine waste, and future work will focus on mineralogical characterization to identify the minerals hosting critical metals, which is crucial for determining the feasibility of metal recovery.