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# Critical metal endowment and environmental behaviour of the Elverdton tailings, Western Australia

**ROSIE BLANNIN**, KAMINI BHOWANY AND ANITA PARBHAKAR-FOX

The University of Queensland

The historic Elverdton mine site, located in Western Australia, was mined for copper, silver and gold intermittently between 1899 and 1971, followed by a period of treatment of gold ores from nearby Kundip (1988-1992). The tailings from the two periods were stored in adjacent uncontained stockpiles, with around 700,000 t of tailings. The stockpiles have eroded over time and tailings material extends several kilometres down the Steere River valley. The Elverdton site is listed as a Contaminated Site pending further investigation and may require rehabilitation, which could be aided by the recovery of residual metals in the tailings, including critical metals.

To investigate the environmental behaviour and critical metal endowment of the tailings, samples (n=71) were collected from the two TSFs and the eroded tailings, with additional samples of hardpan materials and efflorescent salts formed on the tailings and up to 2 km down the Steere River. Geochemical analysis has revealed that the tailings host multiple critical metals, including Te, Mo, Bi, As, W, Co, Sb, Ce and La, as well as Cu, Au and Ag. Gold is most concentrated in hardpan samples (1.5 ppm), while the highest Cu and Co values occur in an efflorescent salt sample (7,390 ppm and 970 ppm, respectively). This reveals that processes of metal remobilisation and precipitation of secondary phases are occurring and may have important implications for environmental contamination and critical metal distribution.

The mineralogy of selected samples was investigated using automated mineralogy and X-ray diffraction. The tailings mineralogy is dominated by quartz, chlorite, feldspars, micas, pyrite and jarosite. with minor abundances of ore minerals (chalcopyrite, tetrahedrite, molybdenite, galena, sphalerite, and monazite). Mineral chemistry measurements (LA-ICP-MS) have been performed to identify the mineralogical hosts of the critical metals. Furthermore, geoenvironmental tests (paste pH and net acid generation) will be performed to assess the potential for acid mine drainage and metal leaching from the tailings. By integrating the geochemical, mineralogical and mineral chemistry, recommendations for potential reprocessing routes will be provided, aiming to maximise critical metal recovery and reduce the environmental impacts of the tailings.