

### **Secondary prospectivity of mine wastes from the Thalanga, Highway-Reward and Balcooma volcanic-hosted massive sulphide deposits**

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Volcanic-hosted massive sulphide (VHMS) deposits are associated with high sulphide contents. Mine wastes resulting from mining and processing of VHMS deposits may present a high risk for acid and metalliferous drainage. VHMS deposits are associated with critical metals such as Co, In, Se, Bi, Te and Sb, which are not typically recovered and report to mine wastes. Reprocessing of VHMS-derived mine wastes to recover critical metals would likely provide the benefit of reducing environmental risks. The Thalanga Cu-Pb-Zn-Au-Ag VHMS deposit was mined intermittently from 1989-2022 for the recovery of Zn, Pb and Cu. Ores from the nearby Highway-Reward and Balcooma Cu-Au VHMS deposits were processed at the site from 1998-2008 to recover Cu and Au. Mine wastes from the Thalanga site were sampled and characterised, including tailings (n=210), waste rock (n=24), run-of-mine (n=14) and secondary efflorescent salts (n=8), to investigate critical metal endowment. The Thalanga mine wastes contain elevated contents of Au, Zn, Pb, Cu and the critical metals Te, Bi, Sb, Se, As, Mo, In, Sn and Co, relative to crustal abundance. The tailings from the different ore sources have distinct chemical signatures; Thalanga tailings are more enriched in Pb, Zn, Ag and Au, while Balcooma and Highway-Reward tailings have higher Te, Se, As, Bi and Co contents. Mine waste mineralogy is dominated by quartz, pyrite and mica, secondary phases such as jarosite, Fe-hydroxides and Fe-sulphates, and sulphides including sphalerite, chalcopyrite and galena. The critical metals are predominantly hosted by sulphide minerals and secondary phases. The efflorescent salt samples are enriched in Co, Cu and Zn relative to the tailings and predominantly comprise sulphate minerals such as jarosite, tamarugite and alunogen. This research will allow targeted processing tests to investigate metal recovery and reduction of potential environmental impacts from the high pyrite contents in the Thalanga mine wastes.