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The role of secondary prospectivity of mine waste for enhancing critical metals recovery in South Australia

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According to its Critical Minerals Strategy of 2022, Australia aims to turn into the "global critical minerals powerhouse" by 2030 by becoming an integral part of the international critical minerals supply chain (DISER, 2022). The Mine Waste Transormation through Characterization (MIWATCH) group is applying a set of integrated geometallurgical tools to assess the secondary prospectivity of mine waste across Australia to find new sources of critical metals.

The primary focus of these studies is to determine critical metal abundances and their modes of occurrence in tailings, stockpiles and waste dumps of operational and/or abandoned mine sites. This is achieved by a preliminary compilation of the relevant available information from public and confidential sources. A targeted mine waste sampling follows and uses a comprehensive set of analyses, including multi-element geochemical analysis (ICP-MS) and targeted mineralogical and geochemical characterization of selected representative samples (MLA; XRD; LA-ICP-MS).

MIWATCH in conjunction with the Geological Survey of South Australia (GSSA) has identified there is potential to explore for critical metals in mine waste materials across the state forming part of this new supply chain. The initial phase of this research focused on the identification of mine waste with potential to host economic accumulations of critical metals in South Australia. For this desktop study a ranking criteria was created using five key inputs based on data available from the Mines and mineral deposits (MinDep) database, accessed via the South Australian Resources Industry Gateway (SARIG). The criteria included, i) mine status; ii) known commodity; iii) associated commodity; iv) discovery year and, v) mine waste feature/s. The ranking was used to identify abandoned/historic mine sites with a high probability of containing critical metals in the mine waste.

The results of the desktop study indicate that South Australian mine waste is fertile in metals including Co, Cu, Ni, REEs and Au (particularly within the Adelaide Rift Complex, Gawler Craton, Nackara Arc, Kanmantoo Group and Willyama Supergroup). The second phase of this research involves integrated characterisation of the chemistry and mineralogy of mine waste from the sites identified in phase one, including Kanmantoo, a copper mine site (currently under manteinance) located southeast of Adelaide.

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