Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18999

Exploration for critical metals in Australia's mine waste to support the energy transition

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The complexity of mine waste management continues to be one of the greatest challenges the mining industry faces. Increasing global awareness of the negative impacts that incomplete, or inadequate, mine closure can have on the environment has caused increased demand on the mining industry to commit to improving environment management standards during and beyond the life-of-mine. However, successful mine closure is a challenge for several reasons, the most important of which is the poor understanding of the mine waste's (e.g., waste rock, tailings) chemical and physical properties. When considering improved management practices, which meet societal expectations, a new approach is required. One such approach is that adopting geometallurgical principles to characterise mine waste.

In Australia, much like the rest of the world, the circular economy is growing with a target set by the Australian Government for it to generate at least $26 billion AUD by 2025. Whilst industries like plastics, food and fashion are making significant changes to meet this target, the mining industry has been considerably slower to adapt. Further, there is an international drive for countries to transition to low-carbon economies. To manufacture these products, new resources of critical metals are required. Traditionally, these metals are by-products of base metal and precious metal mining operations, and therefore have been disposed of in waste dumps and tailings storage facilities. These sites can contain reactive wastes (for example, inducing acid and metalliferous drainage formation), and therefore require effective rehabilitation.

New geometallurgical research is being undertaken across Australia to identify new resources of critical metal in mine waste. Sites (n=30) in Queensland, New South Wales, South Australia, Tasmania and the Northern Territory have been sampled through integrated chemical and mineralogical programs. New resources of Co (Qld, Tas), REE (Qld), In (Qld), Mn (NSW, QLD, NT) and Sb (NSW, NT) have been identified with metallurgical pathways now being developed and tested to unlock the value.