geoconvention
Virtual Event September 21-23 2020
CSPG · CSEG · CWLS · GAC · MAC · IAH

Transition Metal Mobility and Partitioning in Weathered Tailings, Serpentinite and Skarn from the Lord Brassey mine, Tasmania, Australia

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Summary

Mineral resources are becoming scarcer so companies are resorting to exploring deeper underground and in more isolated areas for lower ore grades. However, current methods of mineral recovery are not 100% efficient and, in some cases, upwards of half of the desired resource fails to be extracted and is disposed of within tailings. Incorporating tailings storage facilities as part of the ore processing circuit can potentially extend the life of mines and save on exploration costs. Ultramafic and mafic mine tailings host heavier elements including first and second row transition metals and Platinum Group Elements (PGE's). Common transition metals in Canada's mafic-ultramafic rocks, such as nickel and cobalt, have high value and their recovery could serve as a motivator for mines to reprocess their tailings. Many of these target metals are initially hosted by olivine, repartitioned during serpentinization to form sulfides, oxides and alloys, and then remobilized during weathering into authigenic carbonates, sulfates and oxyhydroxides. Economic recovery of transition metals from tailings piles also has potential to reduce waste output while enhancing silicate weathering reactions to offset greenhouse gas emissions. Here we use powder X-ray Diffraction, Scanning Electron Microscopy and synchrotron X-ray Fluorescence Mapping to track the mobility and partitioning of first and second row transition metals in serpentinite, skarn and weathered tailings from the historical Lord Brassey nickel mine in Tasmania, Australia. By developing an understanding of the metal sinks within a weathered tailings pile we aim to develop an economically viable framework for tailings reprocessing that takes advantage of metal mobility during tailings weathering.