16TH BIENNIAL MEETING
SGA 2022

16th SGA BIENNIAL MEETING KEYNOTE SPEAKER

In concurrent session: ***Secondary prospectivity of mine waste: from metals to construction materials***

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Expanding the perspective on mine waste value with an emphasis on critical minerals and environmental mitigation

Meeting increased demand for critical minerals and reducing the waste footprint of mine waste can be compatible activities. Opportunities vary based on deposit type and whether a critical mineral is recovered as a primary, co-product, or by-product commodity. A suite of tailings samples is used to evaluate the potential for critical mineral, and base- and precious-metal recovery. For example, Te concentrations are highest in tailings from porphyry Cu deposits and Au deposits. Nickel and Co concentrations are highest in tailings from mafic magmatic deposits, although tailings from other deposit types are also elevated.

A mass-balance approach at a porphyry Cu mine describes the deportment of critical minerals and other commodities in concentrates and tailings during ore processing and enables targeting specific waste streams for additional recovery. Half the Au, Ag, Zn, PGMs, Se and Sb in the ore is lost to tailings. Two-thirds of the Te and most of the Co and REEs also reside in the tailings. The chalcophile nature of Au, Ag and other commodities suggests pyrite as their host.

Waste streams can have additional potential non-traditional value by reducing environmental costs and from carbon credits. For example, the importance of pyrite as a host of Au and other critical minerals commodities highlights the potential for recovering a pyrite concentrate to improve Au and critical mineral recovery while simultaneously enhancing long-term environmental management by concentrating acid-generating potential in a smaller, more manageable volume.

Critical minerals commonly associated with mafic host rocks include PGMs, Ni, and Co. The tailings and other mine wastes from these ores are dominated by olivine, pyroxene, and calcic plagioclase, which are prime targets for mineral carbonation – a potential source of carbon credits. Thus, the most tenable scenarios to enhance value of mine waste will likely combine resource recovery with improved environmental management.

Robert Seal

Bob is a senior research geologist with the US Geological Survey, where he has worked for over 30 years. He specializes in the environmental geochemistry of mining. He is currently leading a new scientific effort to investigate the resource potential of mine waste, particularly for critical minerals. He frequently serves as a technical advisor for the US Environmental Protection Agency and other government agencies on mining related issues. Bob is an associate editor for Applied Geochemistry. He has presented a number of workshops, short courses, and invited lectures internationally, including Afghanistan, Peru, New Zealand, Canada, and India.