Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.34858

Developing soil geochemistry and Pb isotope ratio baselines prior to commencement of mining operations at a major sulfide-hosted silver deposit in south-eastern Australia.

DAVID COHEN[1], IAN GRAHAM[1] AND HAMID ZEKRI[2]

[1]University of New South Wales

[2]University of New South Wales - MinEx CRC

Environmental monitoring and management of mining operations typically incorporate regulatory limits or benchmarks for metal concentrations in soils and waters. Some regulatory limits relate to total metal concentrations and others to the amount or rate of addition to soils compared with natural "background" levels. Geochemical background in soils can vary by orders of magnitude at different spatial scales depending on parent lithology, and regolith characteristics and evolution. Monitoring potential dispersion of metals from a mining operation therefore requires a comprehensive baseline geochemical mapping of the site and surrounding areas prior to mining, and a capacity to identify and quantify metal sources.

The Bowdens Ag-Pb-Zn deposit in NSW, Australia, is hosted in the Rylstone Volcanics. Base and precious metal mineralisation occurs in other parts of the Rylstone Volcanics and underlying Ordovician to Silurian units in the region. Previous exploration programs indicate a number of zones with highly elevated Pb, As, Cu and other metals in soils overlying the various mineral deposits, but variation in their multi-element associations.

Rock, regolith and water samples have been collected from Bowdens and surrounding locations representing different geological units in the area. Concentrations of key metals – Pb, Zn, As, Fe, Ag and Mn – display relatively consistent values with soil depth, size fraction and adjacent sites within a 10 m radius. Lead, Zn and Ag concentrations tend to be highest in the 180-2000 mm size fraction of soils, reflecting higher proportions of secondary Fe-oxyhydroxides. There is clear separation between the $^{208}Pb/^{204}Pb$ and $^{206}Pb/^{204}Pb$ isotope ratios for the ore and host rocks within the Bowdens deposit, versus unmineralised Rylstone Volcanics and other units and lithologies in the region (Fig. 1). Soil Pb isotopes closely reflect those of the parent rocks. Multi-element geochemical patterns and Pb isotopes allow for the characterisation of the source of the metals in the soils, and quantification of the amount of ore-related elements that might be contributed to soils on the site and surrounding areas once mining operations commence.

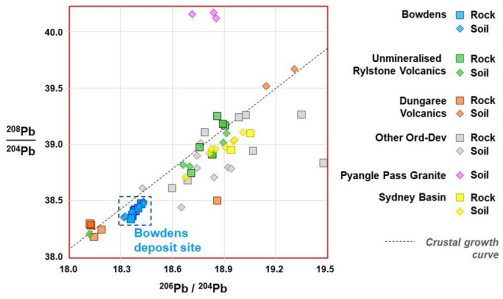

Fig. 1. ^{208}Pb / ^{204}Pb versus ^{206}Pb / ^{204}Pb for rock and sulfide samples from the Bowdens Ag-Pb-Zn deposit and host rocks, and other geological units and soils in the region.