SUBSURFACE LITHOLOGIES INFERRED FROM ISOTOPE ANALYSIS OF NEAR-SURFACE RESERVOIRS

(SOILS/WATERS/VEGETATION)

PHD PROJECT

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RESEARCH PROJECT

Understanding the cover and how to effectively explore through it is complicated by many factors that contribute to masking changes in subsurface lithologies (mafic, felsic, carbonates/shales) that may host ore deposits.

Apart from conventional element-concentration surveys of soils, which often provide inconclusive results, one potential tool to address these issues is via novel metal isotope tracers. There is evidence that the latter can be used to infer different lithologies and mineralised systems based on the isotope analysis of selected metals in cover. These isotope proxies (e.g. Ca, Mg, Sr, Cu, Zn, Cr) can be sampled in various Earth's surface reservoirs (soils, waters, vegetation, termite mounds) to better understand what may be preserved through weathering, and not greatly affected by local and/or regional biological/hydrological processes operating near surface.

This project aims to perform a regional study corresponding to NDI (National Drilling Initiative) areas of interest, by investigating how metal isotopes fractionate from key rock types during biogeochemical weathering. We expect that this will aid the identification of specific isotope indices and/or geochemical parameters that may be preserved through in-situ weathering and potentially transported into cover and its specific near-surface reservoirs (soils, groundwater, vegetation, termite mounds). In particular, the project will investigate (i) Cr, Cu, Zn isotopes from mafic/ultramafic terrains (Harris Greenstone Belt, South Australia), (ii) Li, Sr, U isotopes from weathered pegmatite/granite systems (Western Australia-based), and (iii) alkaline earth elements (Ca, Mg, Sr) and redox metal isotopes (Cr, Cu, Zn) from carbonate/shale lithologies (Cobar region). This project thus proposes a focused investigation on several key sites/areas where legacy cores of the key lithologies are available, and can be followed up by surface sampling. Overall, this project aims to identify main fractionation mechanisms for metal isotopes during weathering, transport and biological uptake, which in turn is critical for future application of these isotope tracers to identify subsurface lithologies and associated ore deposits in various host-rocks via the analysis of cover.