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Biogeochemical and Regolith expression of buried non-ferrous mineralisation in the Northern Middleback Ranges, Iron Knob North

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ABSTRACT

South Australia hosts some of the world's largest non-ferrous mineral deposits. Exploration for such mineralisation systems has so far been impeded by thick regolith that conceals much of the prospective regions throughout Australia. The project tenement studied here is on the Eyre Peninsula at the central northern edge of the Spencer Domain (Middleback Ranges) within the Gawler Craton. It considered highly prospective for mineralization, such as associated with Iron Ore Copper Gold (IOCG) mineralisation. This study provides a preliminary characterisation of the plant biogeochemistry in relation to potential mineralisation sources in the area, and evaluates the potential for plant biogeochemistry to provide an effective and efficient representation of the mineral prospectivity. Three different plant species (*Marianna sedifolia*, *Acacia papyrocarpa* and *Casuarina pauper*) were sampled along east-west transects. Regolith mapping was conducted from aerial imagery of the area and ground-proofing along transects. A landscape geochemical dispersion model was constructed to highlight material flow directions to further understand the regolith units, landform history and its relation to the biogeochemistry of the area. Multi-element plant biogeochemical results show elevated levels of the commodity elements (Cu, Au, U) over known fault structures, the western alluvial system, and surrounding the mineralised Hutchison Group. Three statistical methods were selected to analyse and interpret the data: 1) Normal distribution- two standard deviations; 2) Median absolute deviation; and 3) Normal probability plots & histograms. The median absolute deviation presented consistent parameters for isolating the natural (interpreted natural) uptake of the selected 19 elements. Threshold values displayed limits that were interpreted as showing minimal potential of inhibiting any interpretation of single points of interest or overshadowing any broad scale element trends. Thus this method was utilised in displaying the biogeochemical results. Proposed exploration models for the area include close spaced transect sampling of vegetation along fault structures. Results from this study have implications for the future of mineral exploration, both within this tenement and in other regions comprising similar species and regolith cover. Results demonstrate that biogeochemistry can assist in the exploration of mineral deposits at both the prospect and regional scale. The importance of regolith mapping and developing an understanding for the tenement and regional landscape are important components in identifying likely areas of mineralistion, the success of sampling and result analysis.

Key words: Middleback Ranges, non-ferrous, biogeochemistry, fault structure, mineral exploration, landscape regolith, geochemistry