Regolith evolution and hydrogeochemical analysis of the Capricorn Orogen Western Australia

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This study aims to combine hydrogeochemistry and the newly established regolith-landform evolution models across the Capricorn Orogen, Western Australia, to aid in understanding how geochemical anomalies are developed in this region. The Capricorn Orogen is a ~1000 by 500 km, variably deformed region of Western Australia located between the Pilbara and Yilgarn Cratons. Regional scale (N = 250 samples, covering 2500 km) regolith characterisation transects have resulted in the recognition of four major regolith-geomorphic provinces, each with different challenges and opportunities for mineral exploration. The west comprises predominantly exposed granitic crystalline basement. The south west is deeply weathered, with thick saprolite developed over both sediments and meta-volcanics. The north is dominated by mezoproterozoic basin sediments and can be split into two geomorphic provinces: the upland basin regions are highly dissected and possess several generations of ferruginous material, silcrete and calcrete developed in colluvium; the lowland basin regions are dominated by hardpan, calcrete and colluvial/alluvial plains below low hills on which the basin sediments are exposed. Different sample media are optimal for each province and mineral exploration is aided by an understanding of the landscape evolution and groundwater geochemistry.

Hydrogeochemistry can show broader signatures (e.g. alteration halos) than other sample media (drill core), as the chemistry is influenced by immediate contact with rocks that have previously influenced the groundwater. Samples have been taken from ~1000 stock bores across the Capricorn. The results are used to develop indices for mineral exploration as well as providing new pathfinder element suites to improve exploration. For example, the Abra base metal deposit is identified through elevated Pb concentrations close (<500 m) to the deposit. Whilst surface soil and regolith sampling methods have proven to be ineffective at this deposit. A model for the evolution of the surface environment allows links to be made between regolith and groundwater sampling leading to an increased potential for finding mineral systems halos in and under cover.

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