MINERAL HOSTS FOR GOLD AND PATHFINDER ELEMENTS AT THE MOUNT GIBSON AND LANCEFIELD GOLD DEPOSITS, W.A.

Rob Hough[1], Ravi Anand[1], Marc Norman[2] and Cajetan Phang[1]

[1] CRC LEME, CSIRO Exploration & Mining, 26 Dick Perry Avenue, Kensington, WA 6151, Australia [2] Research School of Earth Sciences, Australian National University, Canberra, ACT 0200, Australia

INTRODUCTION

Exploration geochemistry in the deeply weathered terrain of Australia in areas of transported cover requires a detailed understanding of anomaly formation processes and the mineralogical sites of elements at different scales. Building on an impressive history of bulk mineralogical and geochemical studies at the Mount Gibson and Lancefield gold deposits in Western Australia we have performed detailed in-situ microanalyses to determine the mineralogical-Au/pathfinder element associations within the regolith, more specifically, transported regolith at these sites.

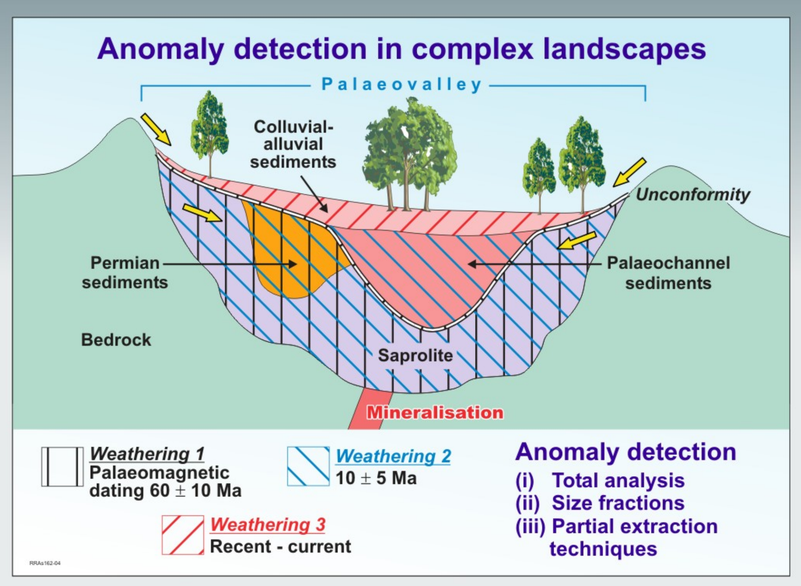


Figure 1 demonstrates the complex development and weathering of transported overburden that is widespread in the deeply weathered terrain of Western Australia. By analysing the individual mineralogies formed by post-depositional weathering of the sediments we can try to detect signatures of the underlying mineralisation.

Enterprise Pit, Mount Gibson

At the Enterprise pit (300 km NNE of Perth) gold is hosted by mixed sulphide-bearing sheared meta-basalts. These are overlain by 20 m of bleached saprolite. Saprolite is overlain by transported overburden principally consisting of two Tertiary and Quaternary sedimentary units. Slabby to pisolitic ferricrete is formed in Tertiary sediments. The uppermost Quaternary sandy-clay unit is 3-4 m thick and has been subjected to calcification and silicification to produce calcrete and hardpans.

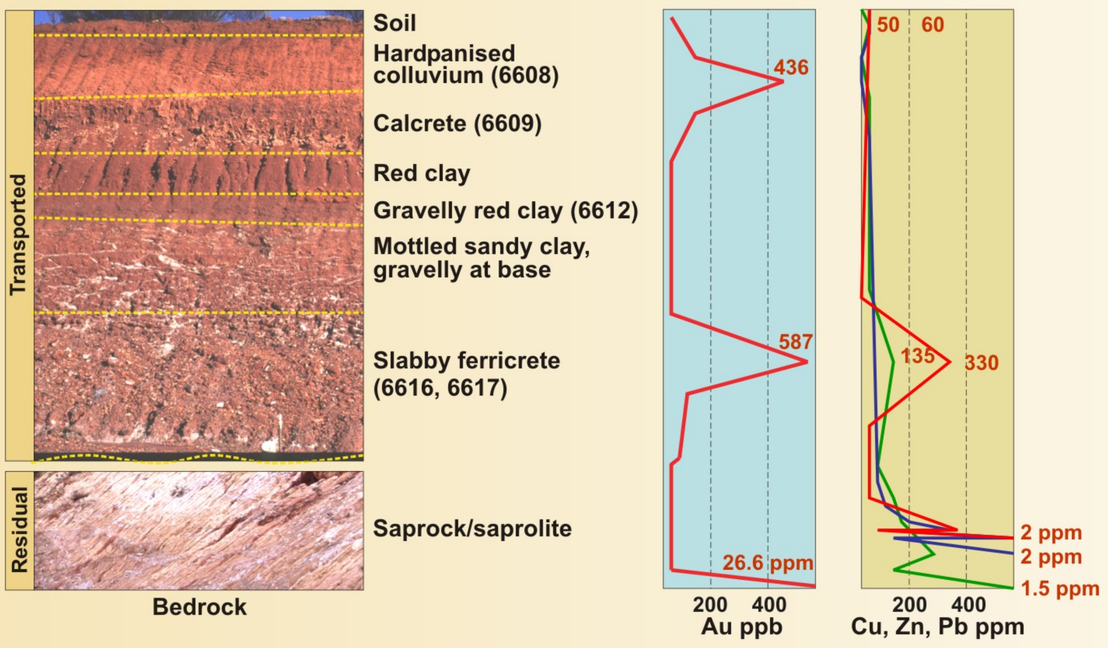
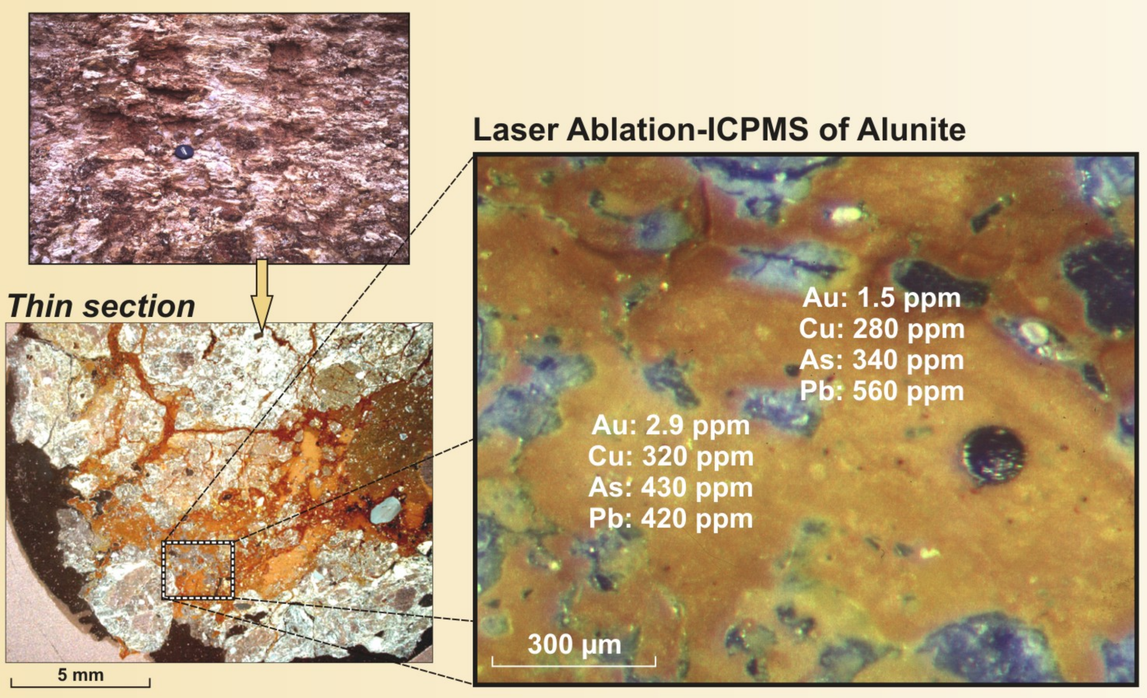


Figure 2. a,b: The slabby and indurated ferricrete contains 587 ppb Au, and a white clay in-between the slabby layer contains 112 ppb Au. Arsenic concentrations occur in areas of ferruginisation (20-50 ppm), even in the saprolite, and reach 85 ppm in slabby sediments. The silicified sediments and calcrete near the top of the profile yield little As but appreciable Au (128-436 ppb).

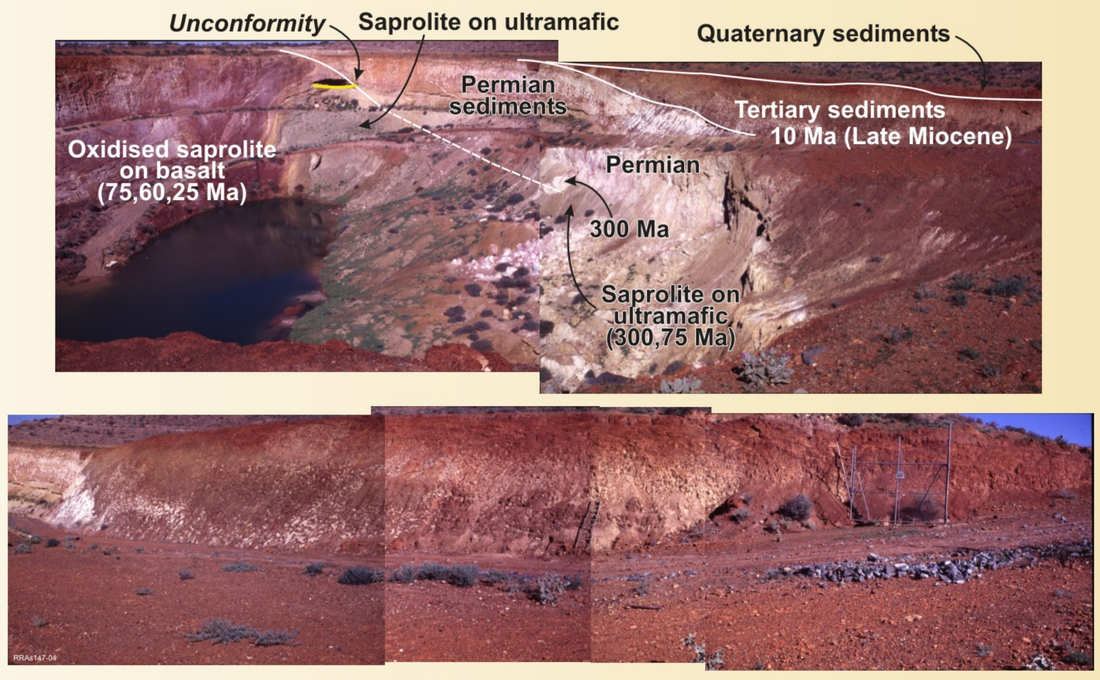


The in-situ analyses identify areas of element enrichment in the samples and in most the trend mirrors that of the bulk geochemistry with As, Cu and Zn all having a preference for Fe-rich areas. In the slabby ferricrete As, Cu and Zn are contained in the minor hematite rich clasts rather than a dominant matrix of quartz, goethite, kaolinite and hematite. LA-ICPMS identified fine grained alunite (K, Al sulphate) as a local host for Au in the white clay, the alunite also hosts Cu, As and Pb.

Lancefield Gold Deposit

This deposit, 8 km north of Laverton in Western Australia is situated in a sheet flow plain, it is again a mixed sulphide assemblage closely associated with chert within deformed ultramafics. The saprolite is overlain by three sediments types;

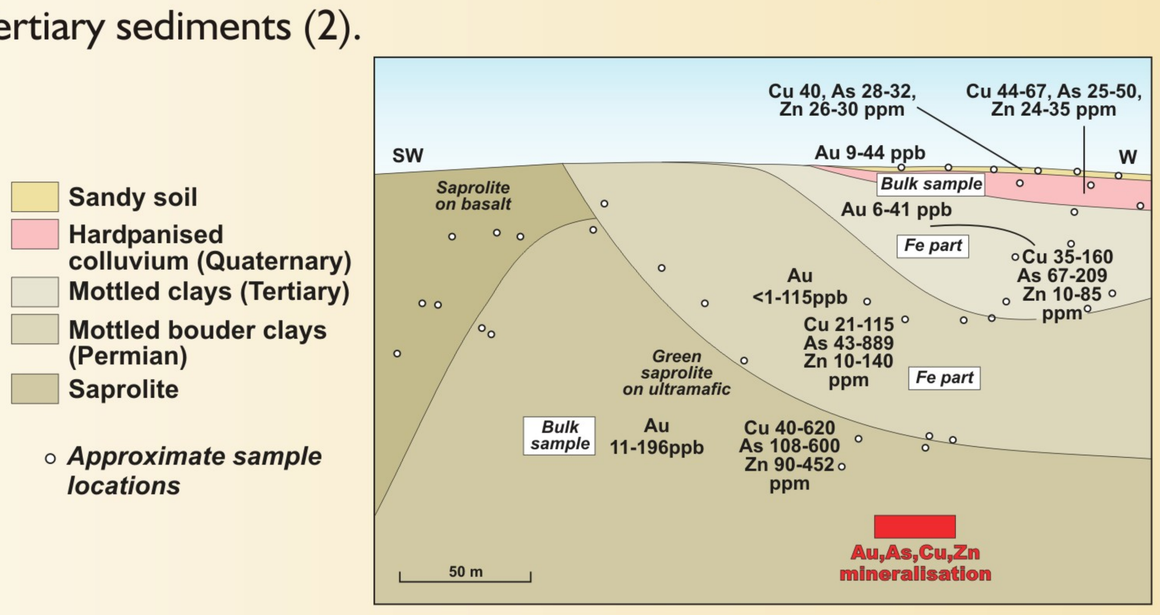
1. Basal Permian fluvioglacial deposits (10-20 m thick),
2. Mega-mottled Tertiary palaeochannel clays (3-8 m thick) and
3. Quaternary colluvium and alluvium (0-2 m thick), sometimes hardpanised.



Bulk samples of saprolite contain Au (11-196 ppb), As (14-908 ppm), Cu (11-472 ppm) and Zn (44-452 ppm).

Mottled Permian (1) and Tertiary (2) sediments were separated into Fe-rich and clay-rich components. Arsenic (66-899 ppm), Cu (21-128 ppm) and Zn (22-124 ppm) are enriched in the Fe-rich part of the Permian sediments (1).

The same elements are also enriched in the Fe-rich parts of the Tertiary sediments (2).



In-situ microanalyses of saprock and saprolite reveal that goethite after sulphides is enriched in As, Cu, Zn and Pb, and Cu is abundant in a chlorite-vermiculite interstratified mineral. Mottled Permian sediments contain anomalous As (up to 3,000 ppm), Cu (up to 630 ppm) and Pb (up to 145 ppm) in Fe-oxides, with hematite preferentially hosting As and Pb but Cu hosted by goethite. Iron oxides in the Tertiary clays are relatively depleted as are the minerals within hardpanised colluvium and alluvium.

Conclusions

- Minerals formed in the upper sediments of regolith profiles could provide an interesting sample medium to search for hydromorphic/biological dispersion from underlying, and deeply buried mineralisation.
- Alunite appears to be one such mineral occurring at the Enterprise pit, Mount Gibson that contains appreciable Au, Cu, Pb and As, similar sulphates occur at other sites and despite being of minor abundance they may be acting as important hosts for Au.
- At Lancefield, the dispersion of Au, As, Cu, Pb, and Zn can be related to three weathering events and hydromorphic/biological dispersion has played an important role in developing geochemical anomalies within Fe-oxides in the Permian and Tertiary sediments.
- Careful in-situ microanalyses[1] of mineralogy and geochemistry provide a powerful approach to detect dispersed element anomalies within transported overburden, particularly relevant for exploration in areas of deep cover.

1 LE GLEUHER M. 2003. Mineral hosts for gold and trace elements in the regolith, Boddington and Mt Percy Gold deposits, Western Australia. CRC LEME Restricted Report 196R, 95 pp.

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