BASELINE GEOCHEMISTRY OF SURFICIAL REGOLITH, BROKEN HILL REGION, AUSTRALIA

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The Callabonna Sub-basin in western New South Wales and northeastern South Australia (Figure 1) covers more than 90% of the Curnamona mineral Province. This province contains one supergiant and several smaller Ag-Pb-Zn ore deposits, as well as numerous other minor ore bodies (Cu, Au, W, Sn, U, etc), and the sediments locally host roll-front U deposits.

198 background samples of the 0-10 cm surface regolith were collected from the area (Figure 2). The < 2 mm fraction was analysed by XRF, XRD, PIMA (Portable Infrared Mineral Analyzer) and for pH and EC 1:5. The aim of the study was to determine whether the surface regolith material contained trace element concentrations reflecting mineralisation in the region, and, if so, to determine their mode of occurrence (physical vs hydromorphic dispersion).

Table 1 shows that the observed maximum concentration of some trace elements in the surface regolith exceeds the regional background value (Bg) used for mineral exploration based on saprolite and sediments. This is observed for Ni, Zn, Ba, Pb, Cu and As (in order of decreasing Max/Bg ratio). For Ba, even the median concentration in the surface regolith exceeds background. This is despite the fact that these are weathered and mostly transported materials that are often diluted by an allochthonous eolian component.

Some element associations suggest a primary host mineral for the elements. For instance, almost all rare earth elements (REE) have a correlation coefficient (r) > 0.90 (suggesting presence of REE-bearing minerals), Th-Ce 0.93 and Th-La 0.91 (monazite), Pb-Zn 0.85 (galena, sphalerite), Be-Al_2O_3 0.83 (beryl), As-V 0.69 and As-Sb 0.68 (sulphides), Sn-K_2O 0.57 (pegmatite minerals). These associations favour a physical (mechanical) mode of dispersion.

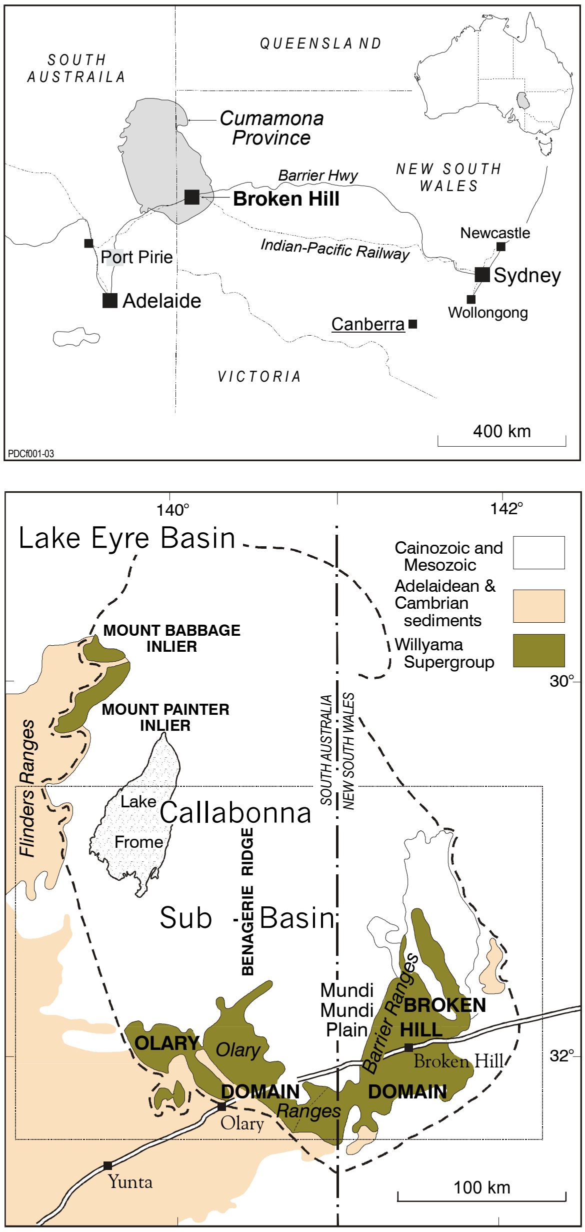

Figure 1: Location map of the study area

Other element associations suggest that secondary minerals (Fe-oxyhydroxides, clay minerals) or organic/amorphous matter may be the hosts for the elements. For instance, the V-LOI correlation coefficient (r) = 0.90, Cu-Fe_2O_3 0.85, Ni-LOI 0.83, Cr-LOI 0.81, Cu-LOI 0.76, V-Fe_2O_3 0.75, Zn-Fe_2O_3 0.74, Cu-Al_2O_3 0.61, Ni-Al_2O_3 and V-Al_2O_3 0.58. These associations support a complex process of dispersion that involves dissolution (or oxidation), aqueous transport and adsorption or ion exchange on Fe-oxyhydroxides and clay minerals.

It is likely that both physical and chemical transport processes have taken place, with their relative importance being a function of distance to bedrock outcrop (basin margins), thickness of sedimentary cover, time and hydrogeological and geochemical controls.

In: Roach I.C. ed. 2003. *Advances in Regolith*, pp. 53-54. CRC LEME.

Table 1: Minimum (Min), median (Med) and maximum (Max) concentrations of selected trace elements (in mg/kg) in the surface regolith samples (N=198), and comparison to background values (Bg) for saprolite and sediment used by local mineral explorers (from Tonui *et al*. 2003). Bold values are ratios > 1

	Min	Med	Max	Bg	Max/Bg	Med/Bg
As	<0.5	4	13.1	10	**1.31**	0.4
Ba	152	305.5	633	300	**2.11**	**1.018**
Bi	0.05	0.2	1.2	5	0.24	0.04
Cu	5	18	49	40	**1.225**	0.45
Mo	0.4	1.25	4.5	5	0.9	0.25
Ni	1	13	219	15	**14.6**	0.87
Pb	5	15.55	89.1	50	**1.782**	0.311
U	0.05	1.55	4.6	20	0.23	0.078
Zn	14.2	53.1	158	70	**2.257**	0.759

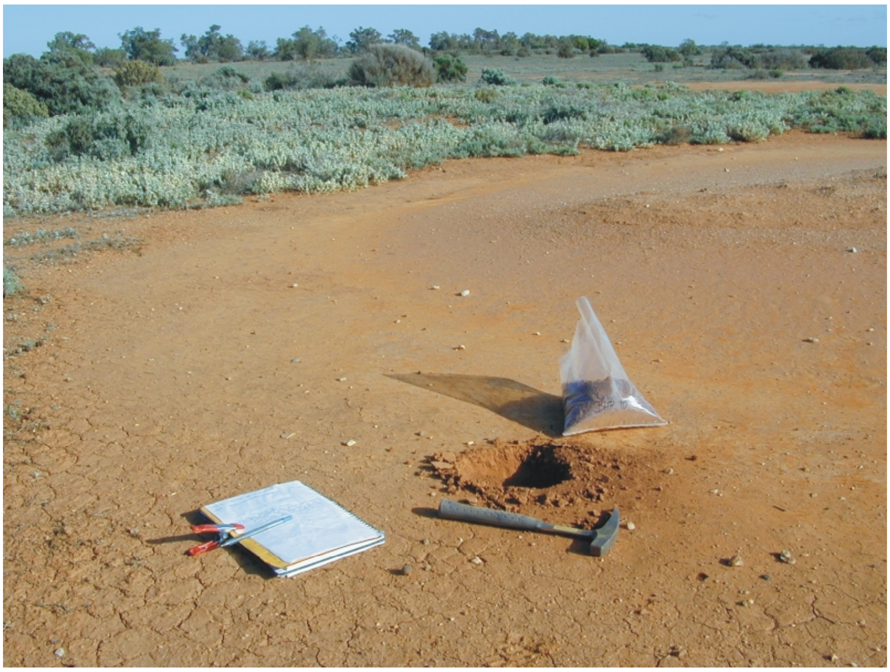

Figure 2: Surface regolith sampling in the Broken Hill region

REFERENCE

TONUI E., CARITAT P. DE & LEYH W. 2003. Geochemical signatures of mineralization in weathered sediments and bedrock, Thunderdome prospect, Broken Hill, western New South Wales, Australia: Implications for mineral exploration under cover. *Geochemistry: Exploration, Environment, Analysis* **3**, 263-280.