REGOLITH-LANDFORMS OF THE COBAR GOLD FIELD AND GEOCHEMICAL DISPERSION AT THE ILLEWONG PROSPECT

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INTRODUCTION

The township of Cobar is located in the northwest of NSW, approximately 700 km northwest of Canberra and sits approximately 243 m above sea level. The Cobar region is described geomorphologically as the Cobar Uplands, which create a drainage divide between the Murray catchment to the south and the Darling catchment to the north. The Cobar region has been exposed at the surface since at least the Mesozoic and a long and complex history of weathering and erosion has created regolith profiles from < 3m to > 100 m thick (McQueen 2004).

The Cobar Gold Field has produced in excess of 2.75 million ounces of Au and 200,000 tonnes of Cu since mining first began in 1870. Peak Gold Mines (PGM) currently produces 130,000 ounces of Au and 18,000 tonnes of Cu annually. Ore is extracted from two underground mining operations named Perseverance and New Occidental, projected at 650,000 tonnes in 2004 (PGM 2004). The deposits of the Cobar Gold Field are located in deformed turbidites of the eastern part of the Early Devonian Cobar Basin (Stegman & Pocock 1996). PGM geologists have been forced to continue the search for more ore under the regolith cover in order to sustain and continue the mining industry in the Cobar region.

JBS technologies agreed to loan a hand-held Niton X-Ray Fluorescence (XRF) spectrometer unit for use in the study in order to evaluate the unit in a field setting. As many meters of the drilling as possible were analysed with the unit to asses its capability as a quantitative, quick, cheap and reliable method for in-field whole-rock geochemical analysis.

This paper describes the results of regolith-landform mapping, hand-held XRF unit evaluation and regolith geochemistry over the Illewong Prospect, a potential new Au deposit to the southeast of The Peak mine.

REGOLITH-LANDFORM MAP OF THE COBAR GOLD FIELD

Two regolith-landform maps, covering 120 km^2, were created as part of the study. These cover the southern portion of the Cobar Gold field (Figure 1a, b). The maps adjoin a regolith-landform map created during a previous study of the Yarrawonga anomaly (McQueen & Munro 2003). The northern edge of the mapping area is located approximately 10 km south of Cobar and the Hillston Road cuts through the centre of the northern sheet and the western side of the southern sheet.

The main topographic features in the mapping area are the colluvial and erosional low hills that trend along strike of the Queen Bee Fault, and the Chesney-Nari anticline, the positive surface expression of which is the result of silicification and ferruginization which can be associated with mineralisation, e.g., The Peak, New Cobar and Queen Bee (Cairns *et al*. 2001). These features cover the northeastern part of the map striking in a NW-SE orientation. Colluvial sheetflow erosional plains and colluvial sheetflow erosional rises flank the low hills. Below these are colluvial depositional plains with little or no slope, which feed material into ephemeral colluvial channels and drainage depressions. On most of these regolith deposits there are alluvial erosional drainage depressions which drain into the alluvial plains and the ephemeral channels that cut their way through the bottom of the drainage depressions.

THE ILLEWONG PROSPECT

The Illewong prospect lies to the south of the historic Queen Bee mine site (Figure 2). The area has geophysical anomalies in a number of methods including Total Magnetic Intensity (TMI), Induced Polarisation (IP), Controlled Source Audio-frequency Magnetotellurics (CSAMT) and gravity. A previous RAB program (RAB98) showed a slight gold geochemical anomaly over the Prospect.

Peak Gold Mines agreed to fund an Aircore survey to the south of the RAB98 survey to define the extent of any possible geochemical anomaly over the areas of geophysical anomalism identified. The drill hole sampling program included: a sample from the *in situ*-transported regolith interface; bottom of the hole; meters with distinct colouration as a result of hematite or goethite alteration caused by a current or palaeo-redox front; holes with abundant quartz veining; and, meters with abundant Fe or Mn veining and box works.

Approximately every tenth hole, or holes of particular interest according to the existing geochemical and geophysical information, were sampled every meter and sent for further geochemical analysis. This was done to get a full down-hole geochemical data set for the regolith profile.

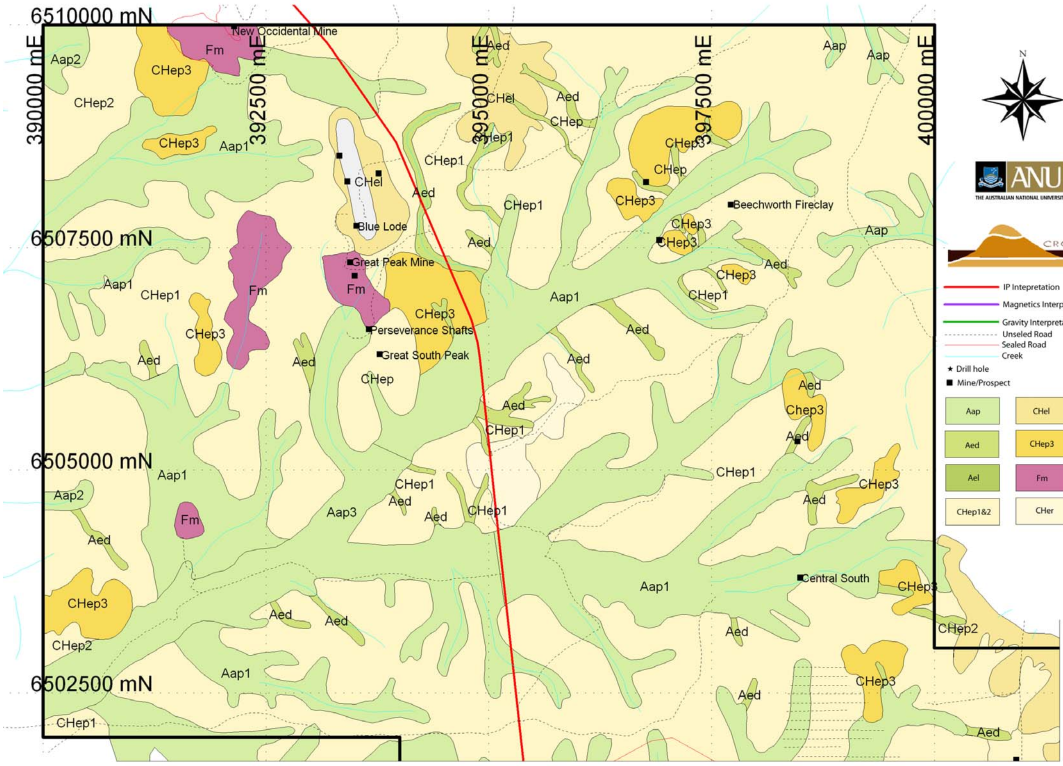

Figure 1a: Regolith-landform map of the Cobar Gold Field, north sheet.

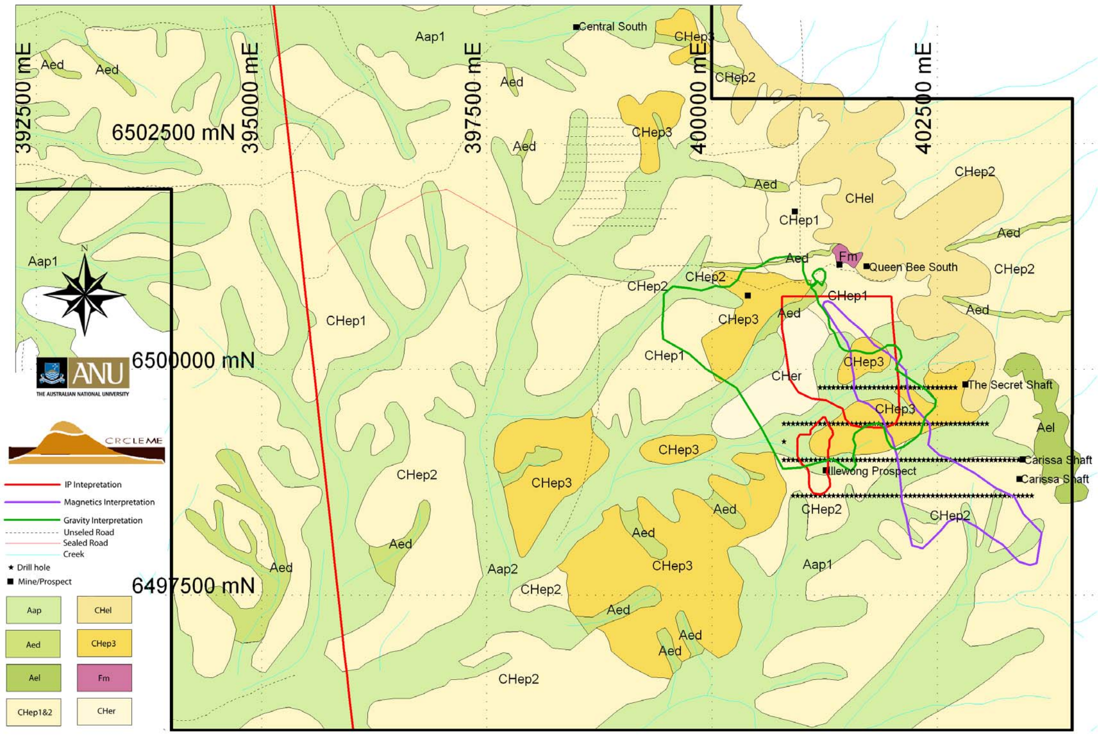

Figure 1b: Regolith-landform map of the Cobar Gold Field, south sheet, with the Illewong prospect shown in the red polygon to the south of Queen Bee South.

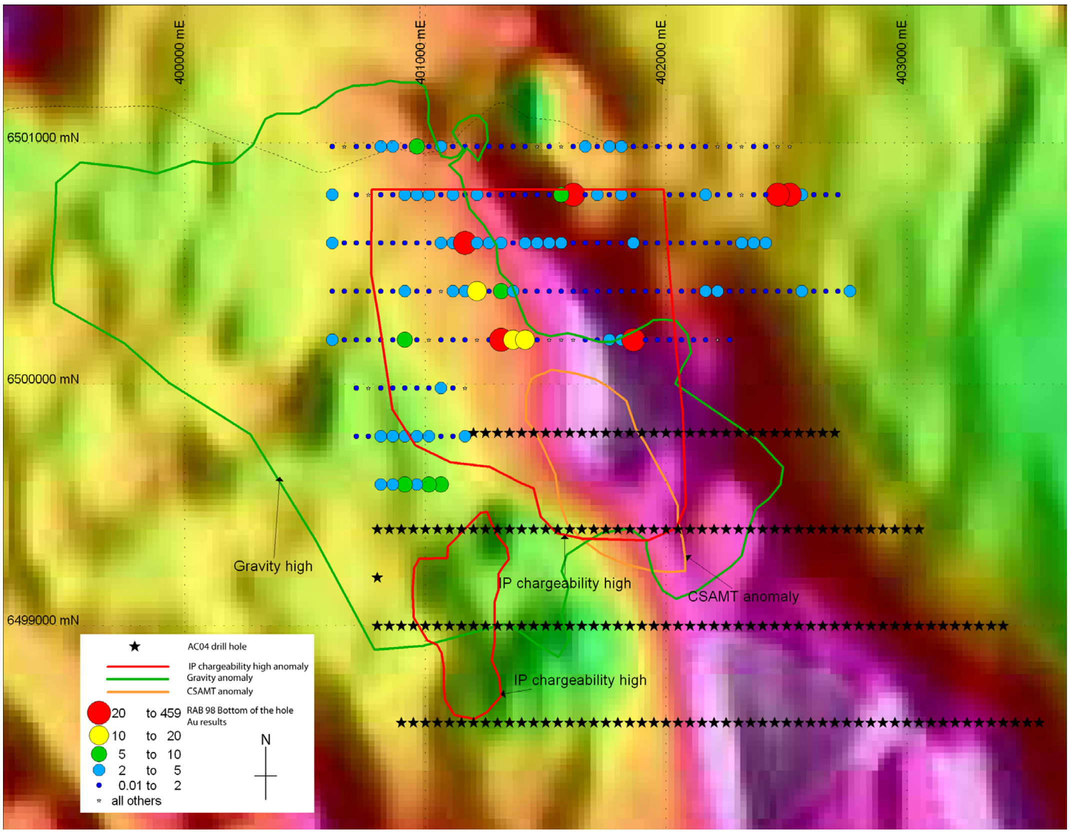

Figure 2. Map of the Illewong prospect with interpreted CSAMT, gravity and IP anomalies overlying a coloured total magnetic intensity image. The RAB98 drilling survey results are shown as ppb Au. The collar locations of the AC04 survey conducted for this study are shown as stars.

RESULTS

The hand-held XRF unit produced good correlations for Fe, especially considering the sample size (n = 355), but only average results for Pb (Figure 3) when the return was above detection. Other elements were detected, but returned poor correlation with the laboratory data (including Cu, Zn, As, Co, and Mo).

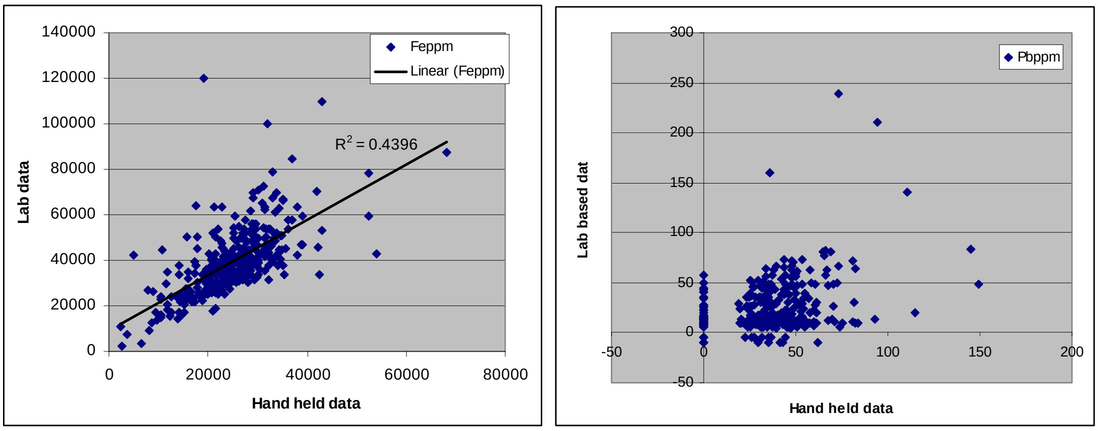

Figure 3: Scatter plots for hand-held XRF versus laboratory ICP OES data for Fe (left) and Pb (right).

Table 1 displays the Spearman Rank Order correlation matrix for the laboratory XRF data from the AC04 drilling program. Good correlations were returned for Pb and Zn, Sb and Pb, Sb and Zn, Fe and Zn, and Co and Mn.

Table 1: Spearman Rank Order correlation matrix for laboratory XRF data from the AC04 drilling program samples (n = 485, r > 0.522 in **bold**).

	Cu	Au	Pb	Zn	Ag	As	Bi	Sb	Fe	Mn	Co	Mo	Ca
Cu	1												
Au	0.138	1											
Pb	0.215	0.046	1										
Zn	0.455	0.084	**0.647**	1									
Ag	-0.024	0.02	-0.386	-0.332	1								
As	0.172	0.187	-0.128	0.079	0.138	1							
Bi	0.075	-0.017	0.358	0.369	-0.94	-0.044	1						
Sb	0.189	-0.064	**0.522**	**0.555**	-0.296	0.043	0.316	1					
Fe	0.429	0.079	0.374	**0.536**	0.023	0.226	0.095	0.451	1				
Mn	0.187	0.188	0.454	0.359	-0.127	-0.132	0.111	0.188	0.308	1			
Co	0.237	0.122	0.318	0.291	-0.18	-0.104	0.164	0.181	0.305	**0.524**	1		
Mo	0.075	-0.017	0.358	0.369	-0.94	-0.044	**1**	0.316	0.095	0.111	0.164	1	
Ca	-0.122	-0.117	-0.229	-0.292	0.178	-0.271	-0.213	-0.126	-0.172	0.044	-0.124	-0.213	1

Figure 4 and Figure 5 display the downhole geochemistry of holes AC04IL0014 and AC04IL0019, which both returned high Au results and elevated Cu, Pb, Zn and As. Hole AC04IL0019 also returned an increase in Fe content (expressed as % in the figures). Both holes have distinct goethitic colouration (bright yellow). Data for AC04IL0019 showed that the hole contained primarily quartz with muscovite, kaolinite, ± dolomite ± goethite.

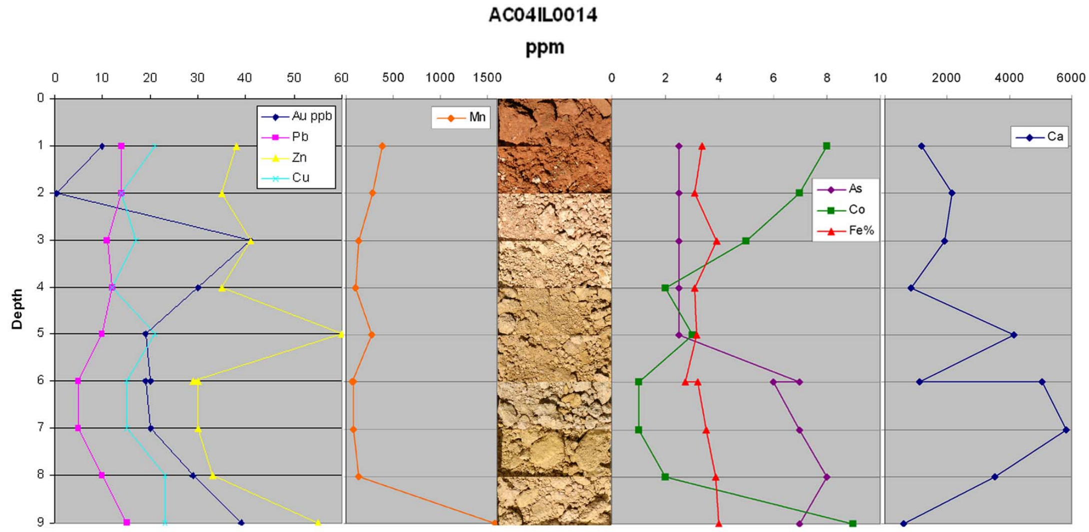

Figure 4: AC04IL0014, downhole geochemistry with photos of the dry samples.

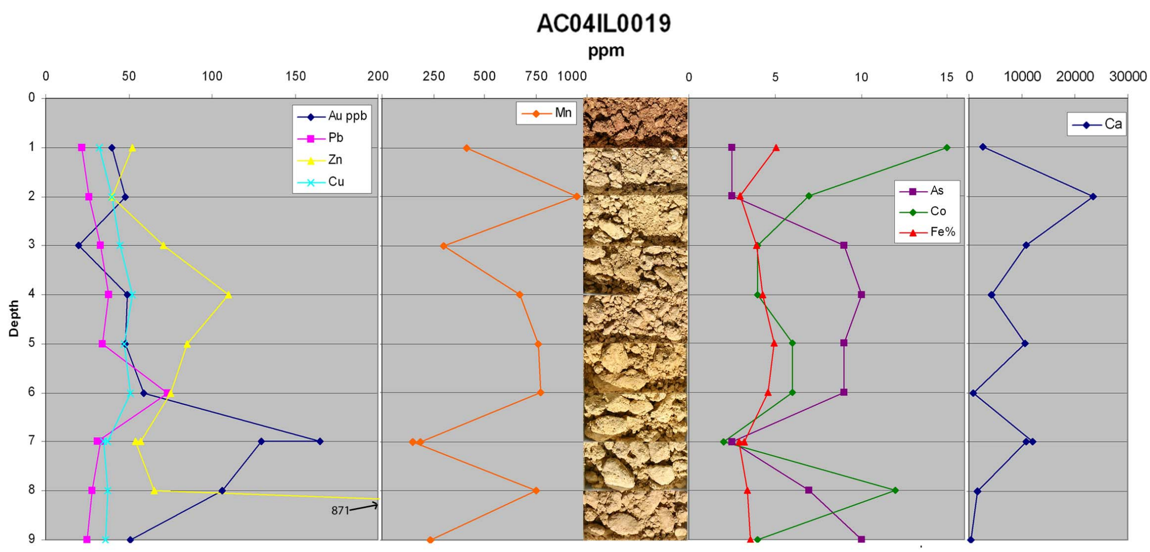

Figure 5: AC04IL0019, down hole geochemistry with photos of the dry samples.

Figure 6 displays the Inverse-Distance Weighted (IDW) distribution pattern for Au, based on the highest Au value (in ppb) from each hole. The figure defines an anomalous zone through the centre of the grid, in a NNW-SSE orientation.

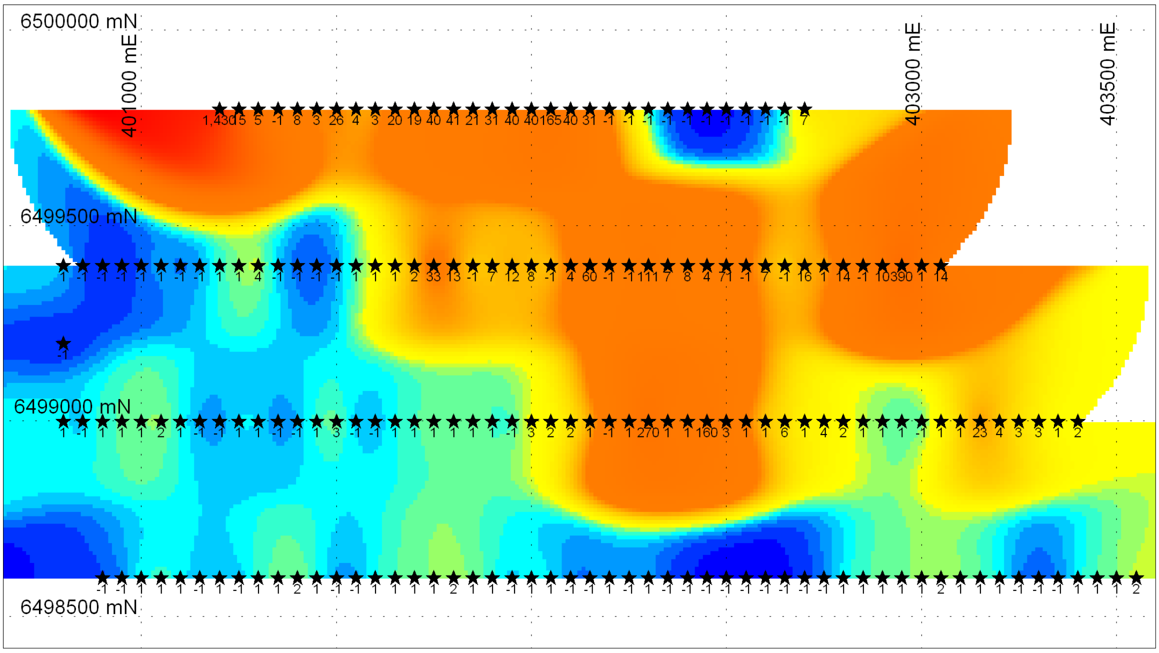

Figure 6: IDW grid for Au ppb, split in two zones with a 10 m cell size, 500 m search and display radius and a high exponential rate of decay (8).

CONCLUSIONS

The good correlation with Fe for the hand-held XRF and laboratory data is particularly interesting because of the role hematite and goethite play in fixing important trace elements such as Pb, As, Sb, Bi, Ba, Cr and Th in the upper part of the regolith at Cobar (McQueen & Munro 2003). The hand-held XRF unit could prove useful in soil and lag surveys if used in conjunction with sampling for laboratory analysis because of its usefulness in locating anomalous Fe. The unit could also be used in drilling surveys to test every meter whilst sampling selected meters for laboratory analysis. The drilling survey revealed a well defined Au anomaly which coincides well with the CSAMT, IP, gravity and magnetic geophysical anomalies. The highest Au value encountered was 1,430 ppb Au from the first hole, AC04IL0001, in the 5th meter. The Au anomaly correlates well with the RAB98 survey, and follows-on in a NNW-SSE orientation along strike with the Queen Bee Fault. The anomaly occurs in a deeply weathered alluvial plain with a transported zone of around 3 m depth. The transported material contained values elevated slightly above background for most elements tested. A lag survey conducted over the entire Cobar Gold field in 1997 showed Au anomalism in the exact same area; the highest return was 42 ppb Au. Arsenic was also extremely elevated in this sample (1,400 ppm). Infill surface drilling and deeper RC or diamond drilling would be highly recommended to further investigate the anomaly.

The regolith-landform unit (RLU) map produced will assist in selecting the best exploration methods, particularly for future soil & lag sampling. Sampling media can be selected on the basis of the RLU they lie in. In the alluvial plains the sample must be treated as transported if it is collected within the top 3 m; on sheetflow plains the sample must be treated as *in situ* with potential for limited transportation; and, on rises and low hills the sample can be considered as *in situ*. When drilling it is no longer sufficient to simply consider a bottom of the hole sample as the best sampling media. Oxide minerals fix trace elements at current and palaeo-redox fronts and this zone is also closely related to water table depths (both present and past) and as such lateral dispersion by groundwater can occur (Rutherford 2004). By sampling oxide material a broader anomalous geochemical footprint can be discovered, then used to vector in on the mineralisation before further work usually drilling can occur.

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