GEOCHEMICAL DISPERSION AND UNDER-COVER EXPRESSION OF GOLD MINERALIZATION AT THE WYOMING GOLD DEPOSIT, TOMINGLEY, NSW

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INTRODUCTION

A large proportion of the Australian continent is dominated by regolith cover that hides the bedrock and contained mineral deposits. It is therefore necessary to develop new techniques to explore for minerals through this cover. This study examines the physical nature of the cover overlying the Wyoming gold deposit, and its influence on the geochemical signature of underlying mineralization.

REGIONAL SETTING

The Wyoming gold deposit is situated between Tomingley and Peak Hill in central western New South Wales (Figure 1) and is being firmed up as a resource by Alkane Exploration Ltd. The deposit lies under approximately 30-50 m of transported alluvial cover and 30-40 m of *in situ* saprolite (Figure 2). It was noted (Scott *et al.* 2003) that there is an unconformity in the cover that marks the boundary between an argillaceous cover type and an overlying arenaceous cover type. Scott *et al.*, (2003), have used dates obtained on nearby cover types (Pillans *et al.* 1999) to speculate that the mottled, argillaceous alluvium is Tertiary and the overlying arenaceous cover is Late Tertiary. This suggests that they would have different provenances. Anomalous gold values were recorded in the argillaceous cover (Cruikshank *et al.*, 1999b), thus giving reason to investigate which components of the cover are hosting this gold.

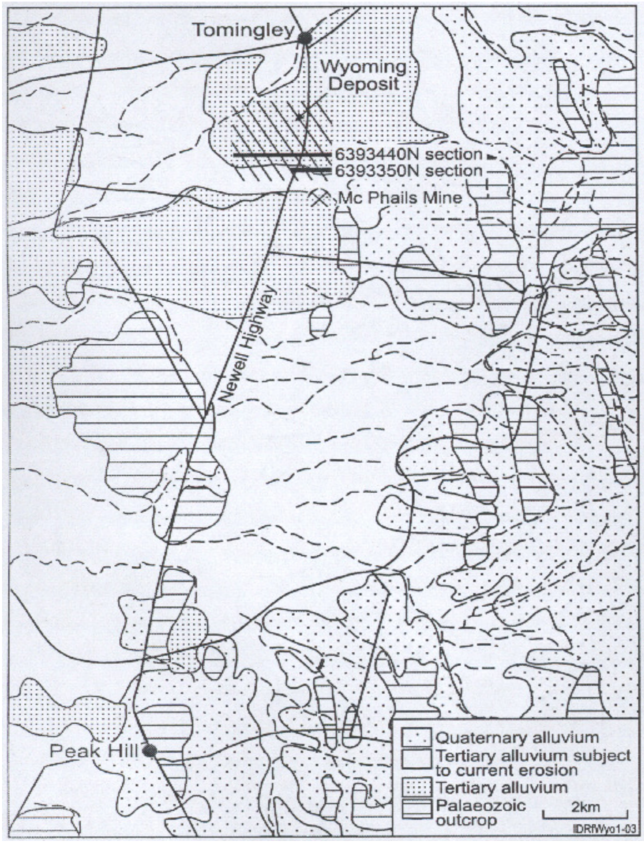

Figure 1: Location of the Wyoming gold deposit in the Tomingley region of central NSW, after Scott *et al.* (2003).

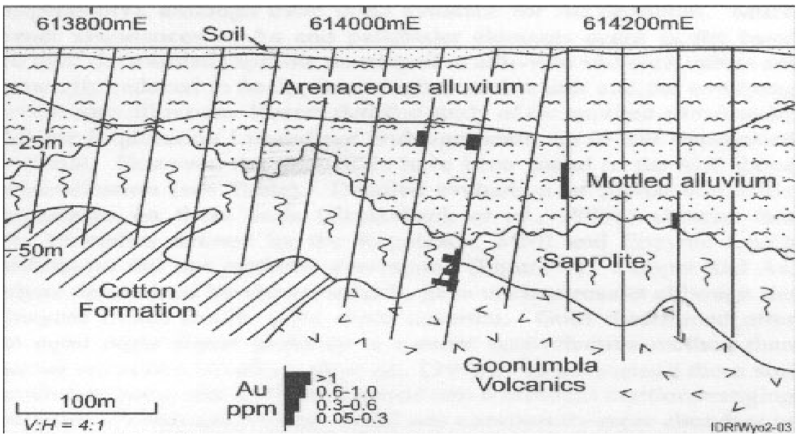

Figure 2: Cover types over the Wyoming gold deposit, after Cruikshank *et al*. (1999)

LOCAL GEOLOGY

The geology of the Tomingley region consists of steeply dipping Late Ordovician Goonumbla Volcanics to the east, which have been overlain by the sediments of the Cotton Formation in the west (Sherwin 1996;

Figure 1). Drilling and core/chip logging by Alkane Exploration Ltd. indicates that the volcanics are andesitic lavas and flow breccias with pyroclastic- and volcaniclastic-rich units. These have been intruded by feldspar porphyry bodies which are yet to be dated. Mineralization occurs in quartz veins that are present in the highly cleaved and altered feldspar porphyrys. These appear to be filling brittle fractures, suggesting that the deposit is structurally and rheologically controlled. The deposit is open at depth, with the only significant sulfide minerals present being arsenopyrite and pyrite.

AIMS AND METHODS

This study focuses on the geochemical dispersion of elements related to mineralization in a region of deep regolith cover. A major aim of the study was to determine what component or components of the regolith carry a geochemical signature related to the mineralization and how far this extends from the mineralisation. This was achieved by carrying out detailed logging of the cover, thus determining what physical regolith components are present. After the physical nature of the cover was determined and the different components identified, each component was submitted for geochemical analysis by Inductively Couple Plasma Optical Emission Spectrometry (ICP-OES) following a multi-acid digest. ALS Chemex in Orange, NSW, performed the geochemical analysis. Selected samples were also submitted for quantitative X-Ray Diffraction (XRD) analysis to quantify the mineral constituents.

SIROQUANT RESULTS AND DISCUSSION

Siroquant XRD results highlight the differences between the various materials in the profile. Quartz content gradually decreases until reaching the bedrock where it suddenly increases again. Each of the regolith units can be distinguished on its quartz content. The arenaceous unit is characterises by lower kaolin content.

The presence of hematite in the argillaceous unit is an indication of the increased mottling that occurs with depth (Figure 2). Another notable change in the profile is the presence of montmorillonite in the arenaceous cover. Montmorillonite is a shrink-swell clay and can be responsible for the formation of gilgai, which have been identified by preliminary regolith mapping to the south of the deposit. The argillaceous cover can be distinguished from the underlying saprolite by high kaolin and lower muscovite content.

Anatase (a weathering product of rutile) is present in the argillaceous cover, with rutile being present in the saprolite. This suggests that there has been some incorporation of *in situ* materials into the transported materials of the argillaceous cover. This is significant as it suggests that minerals have been mechanically transported from the underlying *in situ* saprolite to the transported cover.

Table 1: Siroquant XRD results from Hole WYGT02

Arenaceous Cover (10.3m)		
Mineral	*Weight %*	*Error*
Quartz	43.50%	0.41
Muscovite	9.70%	0.52
Kaolin	41.40%	0.48
Montmorillonite	5.50%	0.12
Argillaceous cover (39.6m)		
Mineral	*Weight %*	*Error*
Quartz	22.40%	0.24
Muscovite	8.10%	0.54
Hematite	0.90%	0.15
Anatase	0.50%	0.12
Kaolin	68.10%	0.49
Saprolite (43.2m)		
Mineral	*Weight %*	*Error*
Kaolin	45.30%	0.58
Muscovite	48.10%	0.57
Quartz	5.10%	0.19
Rutile	1.60%	0.19
Bedrock (48.5m)		
Mineral	*Weight %*	*Error*
Chlorite	1.40%	0.21
Dolomite	19.40%	0.21
Muscovite	24.30%	0.36
Quartz	23.30%	0.19
Siderite/magnesite	5.90%	0.24
Albite	25.60%	0.28

GEOCHEMICAL RESULTS AND DISCUSSION

Preliminary geochemical results for hole WYGT01 are presented in Table 2. These results show that elements such as Cu, As and Au are only significant in the *in situ* regolith, thus suggesting that the dispersions of these elements related to mineralization do not extend into the transported cover to any great extent. It is possible that the particular component of the profile sampled did not carry a signature and that there may still have been some dispersion, which is detectable in other parts of the regolith. Elements such as Fe and Mn increase in the argillaceous cover. This trend is occurring due to the increase in oxidation and thus the increase in mottling. Increased K levels occur in the arenaceous cover with anomalous Ca levels occurring in the first meter of the profile. Increased Ca levels suggest that there is a possibility that Regolith Carbonate Accumulations (RCAs, or calcrete) have formed in the soil profile. It has been noted that RCAs can be used as a sampling media for Au (Hill and Hill, 2003). This is being followed up by on-going work.

The majority of geochemical features obtained in the data to date correlate with the different units identified during logging. However, results for some, such as Al, Fe, Mn, Bi and Ni, suggest that the boundary between the argillaceous cover and the saprolite may not be as obvious as previously thought. These results display obvious changes between sample numbers 5 and 6, thus suggesting that there is some uncertainty as to the position of the boundary between the argillaceous cover and the saprolite. This could suggest that there has been some intermingling of both transported and *in situ* materials, as suggested by the mineralogical feature described previously. This could occur with the erosion of materials from topographic highs in the palaeolandscape and deposition in topographic lows, such as palaeochannels.

Table 2: Geochemical results from hole: WYGT01.

		Analytical Method	*Au-TL42*	*ME-ICP61s*	*ME-ICP61s*	*ME-ICP61s*	*ME-MS62s*	*ME-ICP61s*	*ME-ICP61s*	*ME-ICP61s*	*ME-ICP61s*	*ME-ICP61s*
No.	**Depth**	**Cover type**	**Au ppm**	**Cu ppm**	**Mn ppm**	**Ni ppm**	**Bi ppm**	**Al %**	**As ppm**	**Ca %**	**Fe %**	**K %**
1	0.75	Arenaceous	0.004	25	210	25	0.30	5.94	14	0.16	3.22	1.35
2	5.30	Arenaceous	0.001	10	48	4	0.35	5.35	<5	0.04	1.37	2.78
3	6.80	Argilliceous	0.003	37	738	20	0.24	5.00	28	0.01	7.26	0.71
4	9.45	Argilliceous	0.002	52	1100	22	0.32	7.37	20	0.01	5.74	0.95
5	11.70	Argilliceous	0.004	58	5120	23	0.24	5.32	25	0.01	7.21	0.70
6	19.20	Argilliceous	0.003	59	207	74	0.11	11.10	10	0.02	15.25	0.05
7	28.50	Saprolite	0.018	192	295	77	0.04	12.50	24	0.01	10.80	0.08
8	45.00	Saprolite	0.017	136	321	75	0.19	9.51	370	0.04	3.83	3.41

Geophysical surveys undertaken by Alkane Exploration Ltd. suggest that there are magnetic palaeochannels over the deposit, and detailed logging of the cover has shown that the base of the argillaceous unit is dominated by maghemite sands and pisoliths. It would appear that the palaeolandscape consisted of a small braided channel system, with maghemite sands and pisoliths being transported and deposited in the channels. It is this process that could have caused the intermixing of transported and *in situ* materials, for if the channels were incised enough they would have been exposing the *in situ* saprolite, and would have subsequently had the transported materials being reworked within the active channel.

FUTURE WORK

The study is not yet complete and future work will focus in much more detail on the interface between the saprolite and the argillaceous cover with a number of samples being taken from within the 5 m below and above the unconformity. This will help to establish the nature of the unconformity and better determine the degree of geochemical dispersion into the transported material. This is important as the exploration geologists need to understand what materials they are sampling and if it is transported or *in situ*. Further research will also focus on the geochemistry of particular components of the transported regolith. Effort will be made to separate and analyse the sandy and pisolithic maghemite, as well as analyse the non-magnetic pisoliths within the profile. A closer examination of the first meter of the arenaceous cover will also be completed so as to determine the extent of RCAs within that region of the profile and their possible use as sample media for indications of mineralization.

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