THE WILDWOOD AND KEWELL Au PROSPECTS, WESTERN VICTORIA

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LOCATION

The Wildwood and Kewell deposits are 30 and 100 km NE of Stawell, Victoria, respectively. Wildwood is located at 36º52’S, 142º40’E; St Arnaud 1:250 000 map sheet (SJ54-4). Kewell is located at 36º25’S, 142º19’E; Horsham 1:250 000 map sheet (SJ54-3).

DISCOVERY HISTORY

Since the late 1990s, Stawell Gold Mines has used a simplified geological model for exploring the basalt domes, typified by that at the Magdala mine, occurring along the concealed Stawell Belt NW of Stawell (Figure 1). Magnetic targets, reflecting possible mafic volcanic host rocks, have been explored through a cover of up to 200 m of Murray Basin sediments with significant success *e.g.,* 6 m at 1.67 g/t Au under 100 m of cover at Kewell. Wildwood and other prospects and targets in the Stawell belt (Figure 1) have also been discovered using this method. Localized targeting of mineralization has been improved by fluid flow and 3D deformation modelling of the basalt domes (Schaubs *et al*., 2006), along with down-hole geochemistry (Noble, 2007) and alteration mineralogy (Dugdale *et al.,* 2006). Regolith geochemistry has not been a major part of this model, but understanding the geochemical dispersion into the cover may enhance current exploration strategies in this region.

PHYSICAL FEATURES AND ENVIRONMENT

The deposits occur in generally flat terrain, the Wimmera Plains, which has some minor ephemeral drainages and local depressions of a few metres. Slight topographical rises have a discontinuous ferruginous and/or siliceous duricrust at the surface (Williams and Radojkovic, 2004). The climate is temperate with warm to hot summers and cool to cold winters. Mean minimum and maximum temperatures at Stawell are 13-28ºC in February and 4-12ºC in July, and the mean annual rainfall is 576 mm. (Bureau of Meteorology, 2006). Vegetation is dominated by crops interspersed with mixed woodlands of *Eucalyptus* with minor *Acacia*.

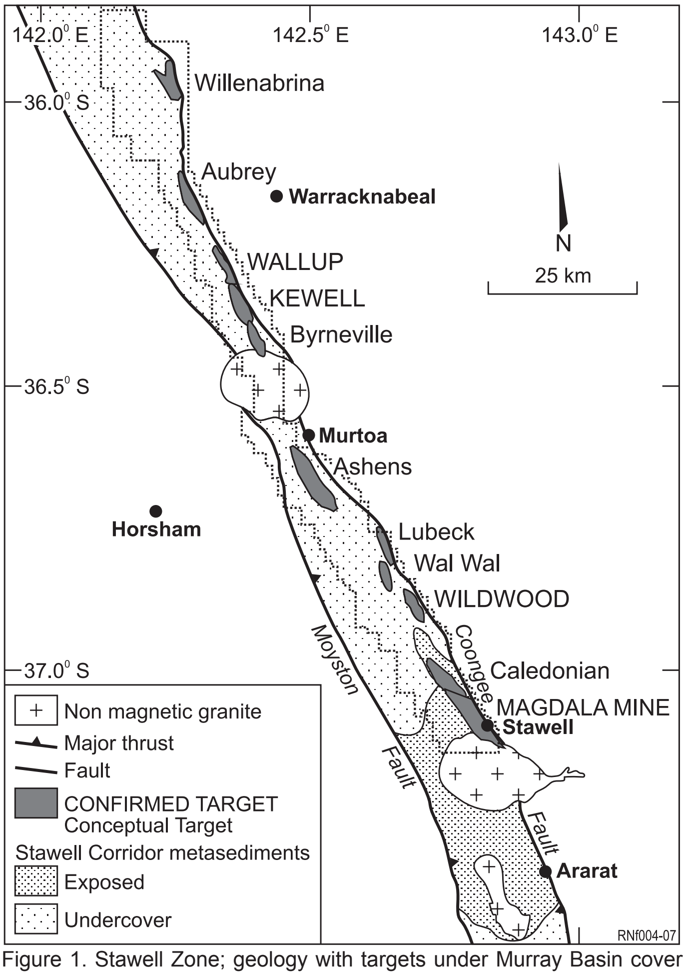

Figure 1. Stawell Zone; geology with targets under Murray Basin cover (modified from Leviathan Resources).

GEOLOGICAL SETTING

The Wildwood and Kewell prospects lie within the Stawell zone of the Lachlan Fold Belt in strongly deformed early Palaeozoic turbidites of the St Arnaud Group which contain fault-bounded Cambrian volcanic and volcaniclastic rocks (Miller *et* al., 2006; Schaubs *et al*., 2006). These rocks are intruded and contact metamorphosed by the large Devonian I-type Stawell Granite (Miller *et al*., 2001). The basalt domes occur within a 15 km wide belt bounded by the east dipping Moyston Fault on the west and the west dipping Coongee Fault to the east (Schaubs *et al*., 2006). The Palaeozoic bedrock is overlain by the Geera Clays and Loxton-Parilla Sands of the Tertiary Murray Basin sequence and later Quaternary sediments. The whole sedimentary cover is herein included as part of the regolith.

REGOLITH

The Palaeozoic bedrock is commonly weathered, with a variable thickness (0-30 m) of saprolite and saprock, preserved beneath the Murray Basin sediments (Brown and Stephenson, 1989) (Figure 2). The late-Oligocene to middle-Miocene Geera Clay consists of black, olive grey, dark grey or dark green silt and clay, deposited in a shallow to marginal marine environment. The silt and clay are glauconitic, pyritic, calcareous (marls) and carbonaceous. The major clays are smectite, kaolinite and illite, with pyrite, hematite, siderite, natrojarosite and dolomite. At Kewell, there are distinctive bands (1-5 m thick) of highly

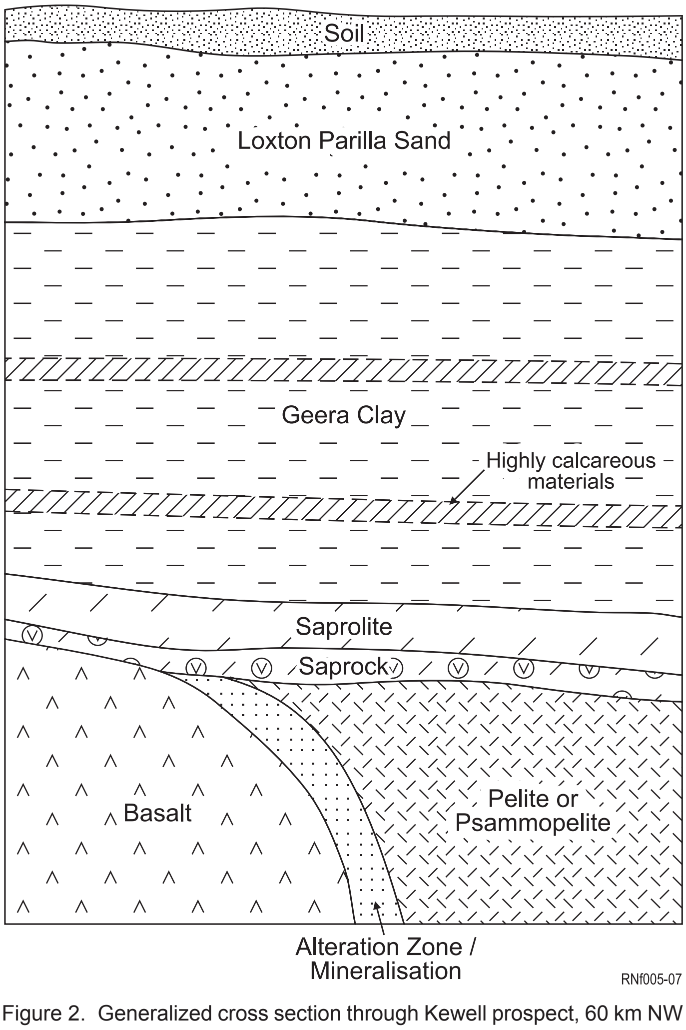

Figure 2. Generalized cross section through Kewell prospect, 60 km NW of Stawell. Depth to basalt is approximately 100m

calcareous material, composed predominately of shells (Figure 2). The Geera Clay is approximately 20–40 m thick at Wildwood and 70 m thick at Kewell and does not outcrop.

The late Miocene- Pliocene Loxton-Parilla Sands consist of coarse to fine grained, well sorted quartz sands deposited in marginal to shallow marine, estuarine and fluvial environments (Brown and Stephenson, 1989). Poorly sorted quartz sand and micaceous gravels occur locally, with some marine fossils. The unit is generally friable to unconsolidated with <15% clay, with the clay content typically increasing with depth. Upper sections of the unit are pale yellow to reddish-brown, whilst the lowest sections can be grey and pyritic. The Loxton-Parilla Sands have an average thickness of 60 m in Victoria, and are approximately 10 and 30 m for the Wildwood and Kewell prospects, respectively. The unit rarely outcrops, being overlain by a thin cover of more recent Quaternary sediments and aeolian material, and soil

MINERALIZATION

Mineralization at Wildwood and Kewell is hosted by the Stawell Facies (Dugdale *et al.,* 2006), which are deformed and chlorite-sericite altered mudstones (previously termed 'volcanogenic'). The sulphide- and Fe-enriched Stawell Facies occurs adjacent to barren basalt domes, referred to as Magdala-style mineralization. The Wildwood basalt dome is approximately 3 km long, with the mineralized Stawell Facies along the eastern flank. Two shallow zones of oxide mineralization have been identified on the northwest and northeast flanks of the buried basalt. Kewell has a similar sized 3 km long basalt dome with mineralization recognized on both flanks (Leviathan Resources, 2004). Drilling at Kewell has intersected ore-grade mineralization of the Magdala style on the southwest flank of the dome (Leviathan Resources, 2004). Gold is hosted within sulphide minerals including pyrite, pyrrhotite and arsenopyrite. No reserve estimates are available.

REGOLITH EXPRESSION

The unconformity between the Geera Clay and saprolitic bedrock is a favourable zone for element dispersion. Arsenic, in particular, has been dispersed across this interface and presents a broader target at low

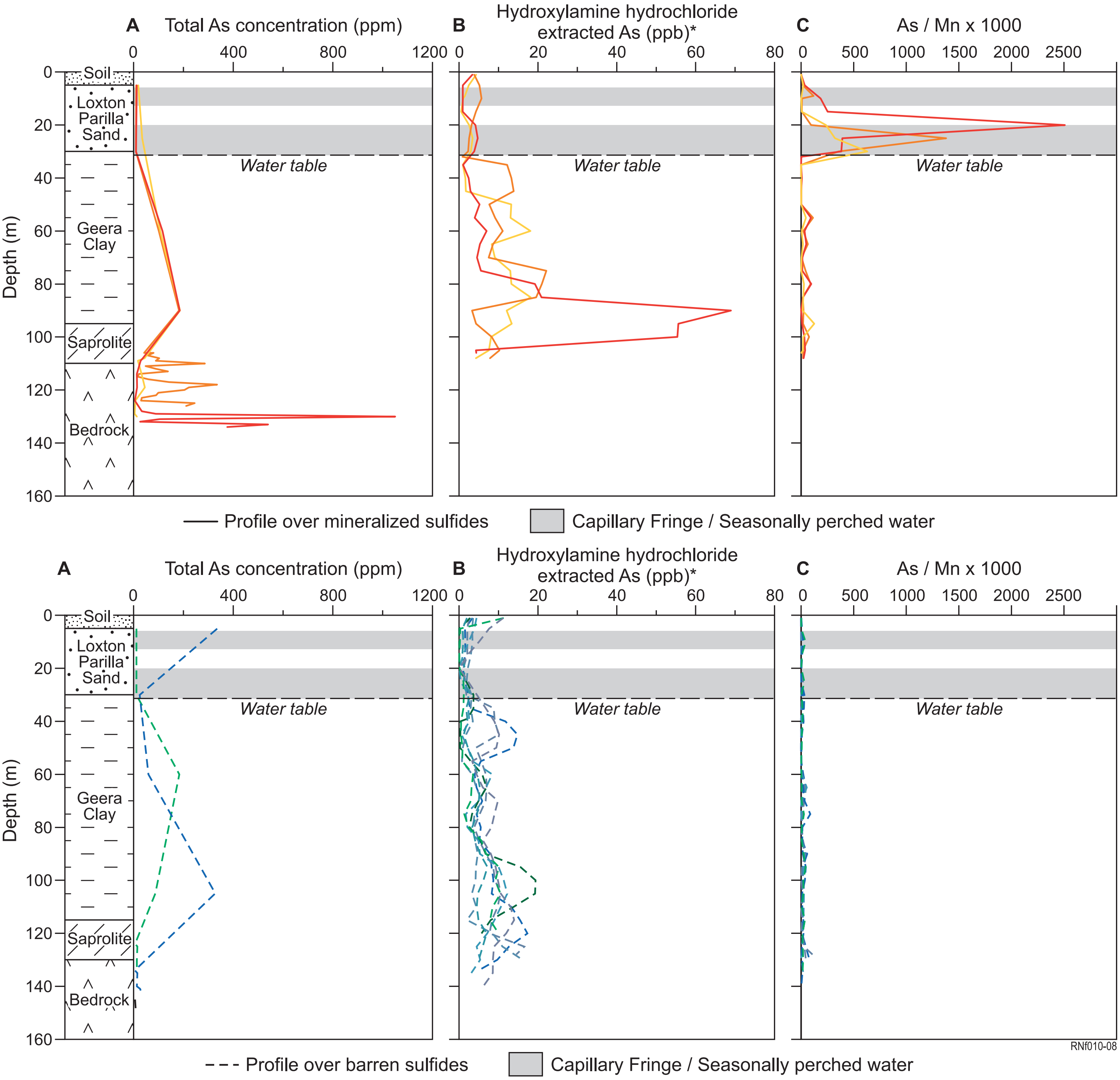

Figure 3. Arsenic distributions in the regolith: A, total As; B, partially extracted As using hydroxylamine hydrochloride (HA); C, As/Mn ratio in partial extraction analyses based on the HA extraction targeting amorphous Mn oxide and associated elements. The upper plots are profiles above mineralization and the lower plots are profiles above barren sulphides. * Indicates the data have been smoothed as an average of the nearest neighbouring concentrations to improve pattern recognition.

levels (>50 ppm) than the primary Au-As mineralized source. Soil As concentrations show no evident link to the high-As concentrations in the mineralization at Kewell. Both the hydrofluoric-nitric-perchloric acid 'total' and hydroxylamine hydrochloride (HA) extractable As had similar vertical dispersion patterns. The Geera Clay has higher total As concentrations over mineralization, particularly at between 80 and 100 m (just above saprolite), indicating there to be some dispersion of As into the transported cover, but that that this does not extend to the surface (Figure 3A). Similarly, the selective HA extraction showed the greatest As concentrations in the saprolite, also with a decrease towards the surface (Figure 4B). This indicates that some As is released into the transported cover, but at a depth of tens of metres below the surface and, as such, is not useful for exploration.

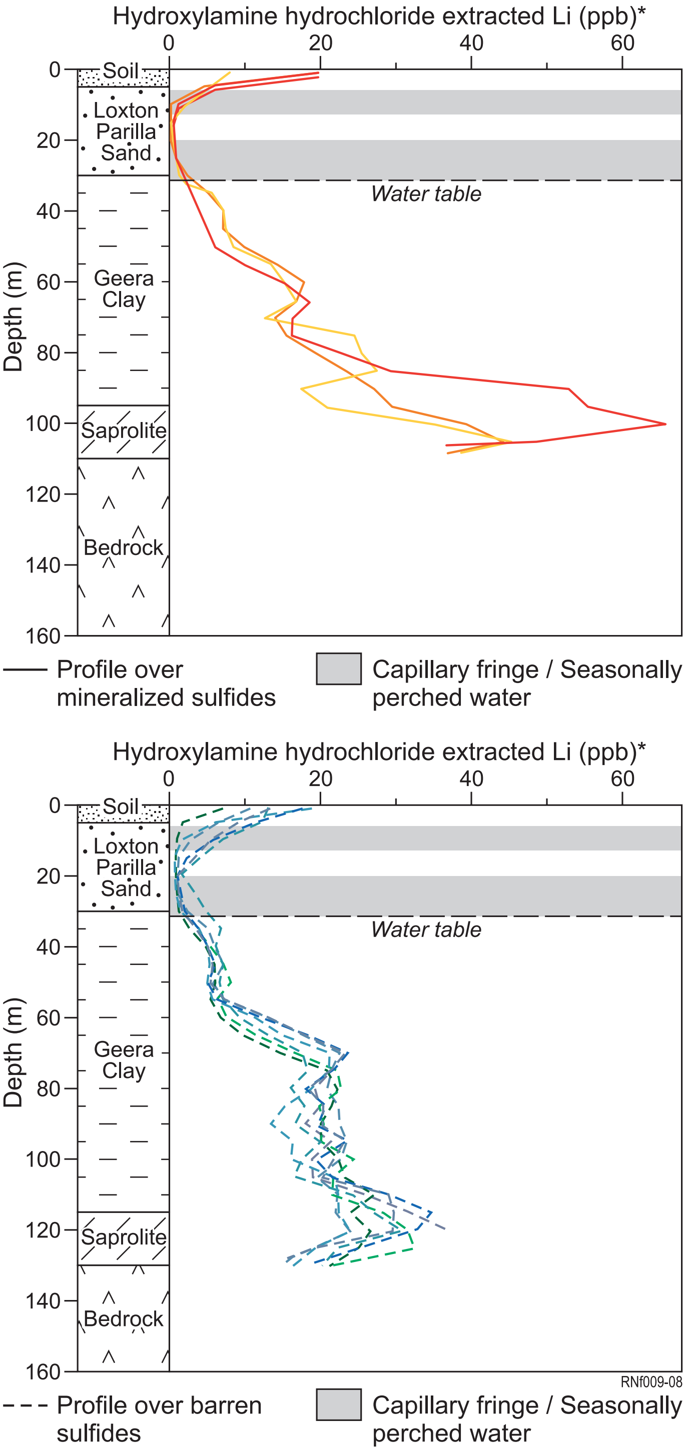

Figure 4. Lithium distribution in the regolith, showing concentrations extracted by the hydroxylamine hydrochloride. The upper plot shows profiles above mineralization and the lower plots show profiles above barren sulphides.* Indicates the data have been smoothed as an average of the nearest neighbouring concentrations to improve pattern recognition.

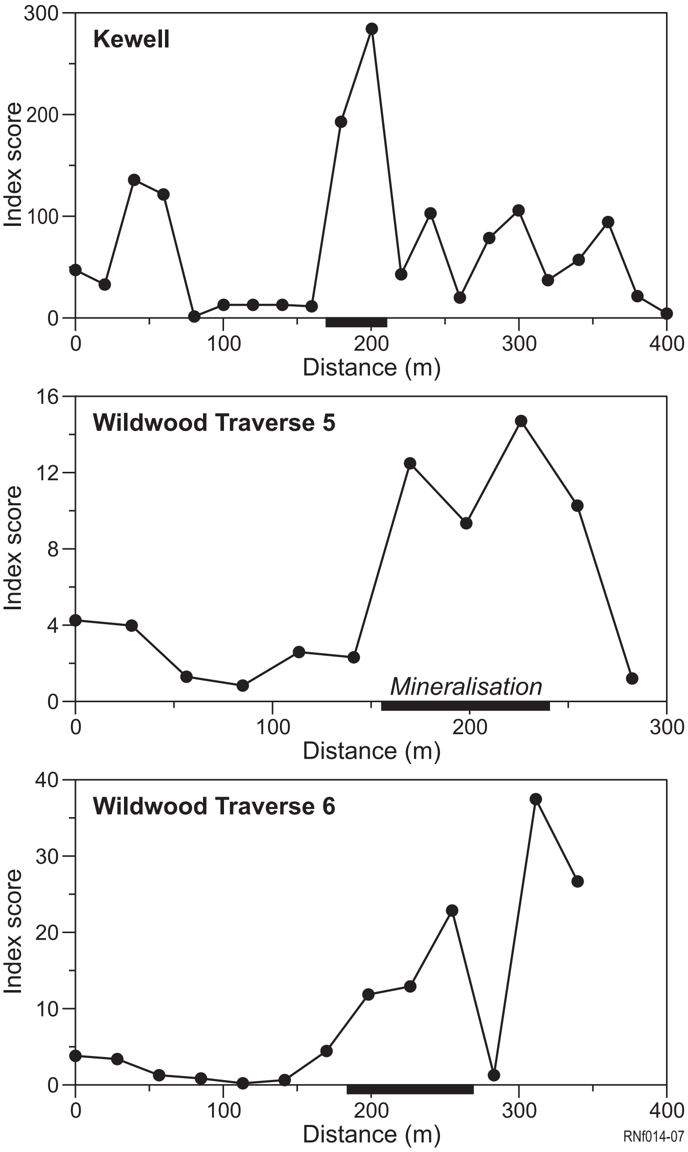

Figure 5. Near surface (B-horizon) soil traverses at Kewell and Wildwood using a bacterial leach partial digest and the geochemical index [(Ni * Cu * Ga * Ge * Se * W * Bi) / 1x10^{7}]. Underlying mineralization is indicated by the solid bar.

The HA extraction commonly liberates metals bound to Mn oxides, so the vertical geochemical variation has been normalized against Mn concentration. Arsenic distribution for the mineralized profiles was greatly increased just below the surface in the seasonally saturated zone and in the capillary fringe above the water-table at 20-30 m (Figure 3C). The As/Mn ratio data were also greater in the Geera Clay between 55 and100 m for regolith above mineralization compared to that above barren sulphides, although this is less obvious and not as consistent as the contrasting results near the water-table (Figure 3C). The implication is not that drilling to 20-30 m for regolith sampling should be used in exploration, as this has little advantage over drilling to saprock, but that regional groundwater sampling from existing wells and bores could be a cost-effective method for regional targeting; this has not been tested. Concentrations of other elements, such as Pb, Te, Zn and Co, are also higher in the seasonally saturated/capillary fringe zone in the profile over mineralization than over the barren rocks and could be used as pathfinders in samples from this zone (Noble, 2007). Lithium is the only element that showed any consistent vertical variation towards the surface, using the HA extraction, but there is no distinction between Li concentrations at the surface over mineralization compared to barren sulphides (Figure 4).

Arsenic, clearly associated with mineralization at depth, did not show any vectoring capability near surface, and also showed significant variation in field duplicates, making it a poor pathfinder for surface geochemistry. Arsenic in the soils at Kewell and Wildwood was primarily apportioned to the easily exchangeable and the amorphous/

SAMPLE MEDIA - SUMMARY TABLE

Sample medium	*Indicator elements*	*Analytical methods**	*Detection limits (ppm)*	*Background (ppm)*	*Maximum anomaly (ppm)*	*Dispersion distance(m)*
Primary mineralization	Au As	Fire Assay Acid & ICPMS	0.001 0.1	0.005 30	48 1050	
Saprolite/saprock	As	HA & ICPMS	0.0001	0.025	0.150	10
Interface/unconformity (metal/Mn ratio)	As Pb Zn	HA & ICPMS HA & ICPMS HA & ICPMS	0.0001 0.0001 0.0001	30 100 1000	2500 4500 20000	5 5 5
Transported overburden (total)	As (at depth)	Acid & ICPMS	0. 1	10	160	20
Transported overburden (partial))	As (at depth)	HA & ICPMS	0.0001	0.0010	0.0070	20

* Acid: concentrated HF-HNO_3-$HClO_4$ acid digestion, residue leached in HCl; HA: 0.1M hydroxylamine hydrochloride.

poorly crystalline Fe oxides fractions. Clay, Fe and organic C content can all influence the chemical composition of soil (Noble, 2007), as can the significant disturbance due to agriculture, including contamination by fertilisers and may explain the lack of a detectable near surface signature.

A comprehensive comparison by Noble (2007) of partial and total digests on a single orientation traverse at Kewell and six traverses at Wildwood revealed there were no consistent pathfinder elements. The argillic clay-rich B-horizon was sampled (300–800 mm depth), using the <250 µm fraction for analysis. A bacterial partial digestion (LocatOre®) with a combination element index of (Ni * Cu * Ga * Ge * Se * W * Bi) / 10^7 successfully predicted mineralization on the single Kewell traverse and two of five evaluated traverses at Wildwood using hypergeometric statistics and a vertical element migration model. However, it is not consistent enough to provide a viable exploration method and there is no evidence to link this combination of elements to the mineralization style (Figure 5). The index was developed at Kewell and then applied without modification at Wildwood. The two traverses successfully predicted at Wildwood related to the shallowest transported cover (approximately 30 m; Noble, 2007).

Pedogenic carbonate was also sampled regionally as an exploration medium. However, the area receives too much rainfall for the consistent development of carbonate, but where it is present it has a quite uniform elemental composition (Noble, 2007). There are some isolated anomalies of Au and some pathfinder elements (As and W), but these are in regions with no known or conceptual mineralization and have not been followed up. The use of regolith carbonate sampling in the study area was not successful for locating known mineralization and is unlikely to be successful in other regions of Victoria, except in semi-arid regions of thin cover or residual soil (southern WA, central SA). Since there are few regions in Victoria with such a favourable exploration environment, pedogenic carbonate sampling is unlikely to be useful.

There is probably no surface expression of the mineralization at either Kewell or Wildwood. Generally, the cover at Kewell and Wildwood was too thick for interpretable dispersion to the surface, but other exploration techniques may succeed, particularly hydrogeochemical analysis and interface/vadose zone regolith sampling. The use of As concentrations in near-miss RAB or RC drilling is also useful in targeting mineralization at both Kewell and Wildwood. Thick cover is a consistent problem for geochemical exploration and the Wildwood-Kewell region is no exception.

DISPERSION MODEL

B**[3]

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