# **White Dam** — detailed regolith–landform mapping as a tool for refining the interpretation of surface geochemical results

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## Introduction

Detailed regolith–landform mapping at 1:2000 scale over the White Dam Au–Cu deposit, 30 km northeast of Olary (Fig. 1), provides a framework for improved interpretation and ranking of geochemical 'anomalies'. By characterising and mapping surface regolith units and associated landforms, local dispersion pathways were identified that help to discriminate transported soil geochemical anomalies (i.e. displaced from mineralisation sources) from those close to the mineralised source rock. This approach may be applicable in equivalent areas of subdued outcrop and widespread, thin (<2 m) transported cover, which account for large parts of South Australia.

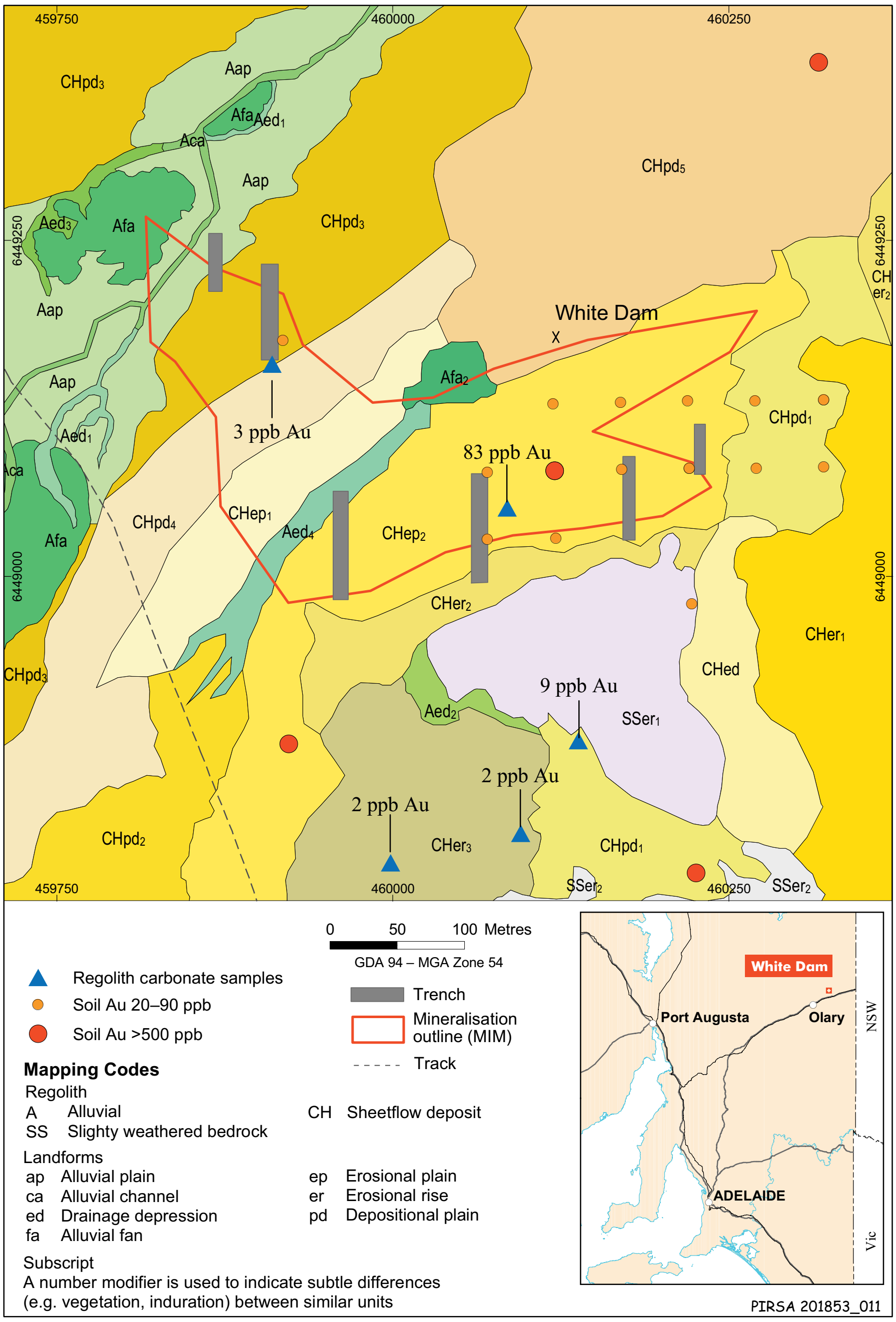


*Fig. 1 Regolith–landform map of the White Dam prospect, with soil and carbonate gold assay results, outline of known mineralisation and trench locations.*

## Background

In 1995, MIM Exploration used soil geochemistry and drilling to follow up anomalous gold and copper reported earlier by Aberfoyle Resources. MIM identified Au–Cu mineralisation at White Dam (McGeough and Anderson, 1998), outlining a resource estimated at 7 Mt at 1 g/t Au (Busuttil and Bargman, 2003). The deposit was acquired in 2002 from MIM by Polymetals and is being evaluated by joint venture partner EXCO Resources. In June 2003, EXCO excavated six trenches over the main zone of mineralisation and collected a 25 t bulk sample to test amenability of the gold to extraction by cyanide column leach.

The mineralisation is hosted in biotite–quartzofeldspathic gneiss of the Wiperaminga Subgroup of the Palaeoproterozoic Willyama Supergroup. Gold is concentrated in biotite-rich selvages to leucocratic bands and veins within the gneiss (Cordon, 1998). Compared to other Au–Cu prospects in the district, White Dam has a relatively low iron content and does not show elevated levels of As, Ag, Ni, Cd, Sb or Pb (Cordon, 1998).

## Regolith mapping

MIM Exploration's data show that soil geochemistry was only partially successful in delineating the orebody, with the main geochemical 'anomaly' defining the weakly mineralised subcropping eastern margin of the mineralised zone (Fig. 1). Anomalous soil geochemical results to the northeast of the prospect failed to show any underlying bedrock mineralisation when tested by drilling. Regolith and landforms have since been characterised and mapped as part of an assessment of the effectiveness of geochemical techniques for exploration in this regolith-dominated landscape. Maps were produced at two scales: a regional 1:25 000 map centred on the White Dam mineralisation, and a detailed 1:2000 map of the main prospect area (Fig. 1). The regional map provides the broad regolith–landform context, while the 1:2000 map was required to give the detail necessary to place individual soil geochemical sample sites in their regolith–landform context.

The 1:25 000 mapping was done largely by interpretation of ortho-imagery supplied by PIRSA, followed by field description. This approach is relatively rapid and provides a good regional perspective for the White Dam deposit and adjoining areas. The result is of limited use, however, when attempting to interpret closely spaced geochemical sample points (100x100 m), particularly in areas of transported cover, as most mapping polygons are >75 m wide. The 1:2000 map required field mapping to delineate subtle yet significant changes in the regolith and landforms over the known mineralisation and adjacent areas. Although more time consuming, the level of detail (>6 m wide polygons) gives improved confidence in defining the landscape context for existing geochemical data and the reinterpretation and subsequent ranking of surface geochemistry 'anomalies'.

The RTMAP scheme was adopted for mapping (Pain et al., 2000), and provides a framework for presenting regolith–landform units by upper and lower case descriptors. The upper case letters refer to the dominant regolith material and the lower case refers to the landform; e.g. CHpd, where CH is the code for sheetflow deposits, and pd is the code for a depositional plain, thus CHpd signifies sheet flow deposits on a depositional plain. In the case of similar units with more subtle differences (e.g. surface lag variation, vegetation, induration), a number modifier is used, e.g. $CHpd_1$. A regolith–landform map includes detailed non-genetic descriptions of each unit, with information on the dominant regolith materials, surface lag, minor features and vegetation, e.g. Aed — red-brown unconsolidated silt and clay, with angular to subangular quartzose and lithic sand to small pebbles, and occasional granitic cobbles, occurring within depressions displaying minor channelling on moderately steep slopes; surface lag is predominately sand-sized quartz and granitic lithic fragments; sparsely vegetated chenopod shrubland dominated by Sida spp.

These descriptions have been omitted in Figure 1, with only brief descriptions of each mapping code being included.

## Regolith–landform setting

The White Dam mineralisation area is dominated by shallow overland flow (sheetflow) deposits. These occur over erosional rises and within depositional plains directly over mineralisation. The sheetflow deposits have a distinctive 'contour band' surface pattern consisting of irregular sandy bands vegetated by bladder saltbush (*Atriplex vesicaria*) between bands of pebbly surface lag. Erosional rises with slightly weathered bedrock occur to the east of the known mineralisation and shed some detritus across the prospect (Fig. 1). Alluvial channels and associated plains occur to the west and north. Calcrete is irregularly distributed across the surface as fragmented hardpan and nodules.

Limited surface calcrete samples show gold contents ranging up to 86 ppb (1 ppb detection limit). These results are lower than, but comparable to, the existing MIM soil geochemistry, and show relatively high gold over the weakly mineralised subcropping orebody corresponding to an erosional landform (Fig. 1). Very low gold-in-calcrete values were recorded in areas of depositional landforms, and on adjacent erosional landforms not associated with mineralisation.

## Surface dispersion vector mapping

Recognition of depositional landforms and the source of deposits are critical for the interpretation of the associated surficial geochemical data. The identification and use of centimetre-scale surficial bands of organic fragments (known as 'stick dams') as a means of mapping subtle, surface dispersion patterns due to shallow overland flow

*Linear 'stick dam' of fine twigs, leaves and macropod droppings, perpendicular to flow. Arrow indicates flow direction.* (Photo 049411)

*Curved 'stick dam' of fine twigs, leaves and macropod droppings. Arrow indicates flow direction.* (Photo 049410) (sheetflow) was developed during this study. By recording the flow directions as indicated by the stick dams, surface dispersion vectors can be determined and represented on the regolith–landform maps (Fig. 2) either as individual symbols or the dominant flow direction shown using rose diagrams.

'Stick dams' usually consist of sticks, leaves, twigs and other plant debris and macropod droppings, and can be observed mostly with an orientation perpendicular to surface flow direction, but when forming on the lee-side of bushes and other obstacles ('shadow deposits') they may align parallel to flow. Flow directions are measured by taking a bearing through the central axis of the curve, or perpendicular to the feature for more linear dams. In the case of linear arrangements formed parallel to flow, a bearing is taken of the long axis of the feature.

## Discussion

Soil geochemistry results previously obtained over the White Dam deposit show a number of sites with elevated gold values. When these are considered in the context of the regolith–landforms and surface dis-persion vectors, it can be seen that surface dispersion processes have displaced some soil geochemistry 'anomalies' relative to mineralised bedrock delineated by drilling. By ranking anomalous values based on their regolith–landform setting, priority should be given to erosional sites and areas upslope of sediment-hosted 'anomalies'. Detailed mapping demonstrates that much of the White Dam mineralisation is overlain by depositional landforms and is poorly expressed with traditional soil geochemistry (Fig. 1). In this area, even 2 m of transported sediment cover over mineralised bedrock is sufficient to mask or dilute chemical signals indicative of mineralisation. Ongoing work at White Dam will examine the dispersion of gold and other elements in the regolith, with the objective of recommending the most appropriate geochemical sampling strategies for detecting mineralisation below shallow transported cover in the region.

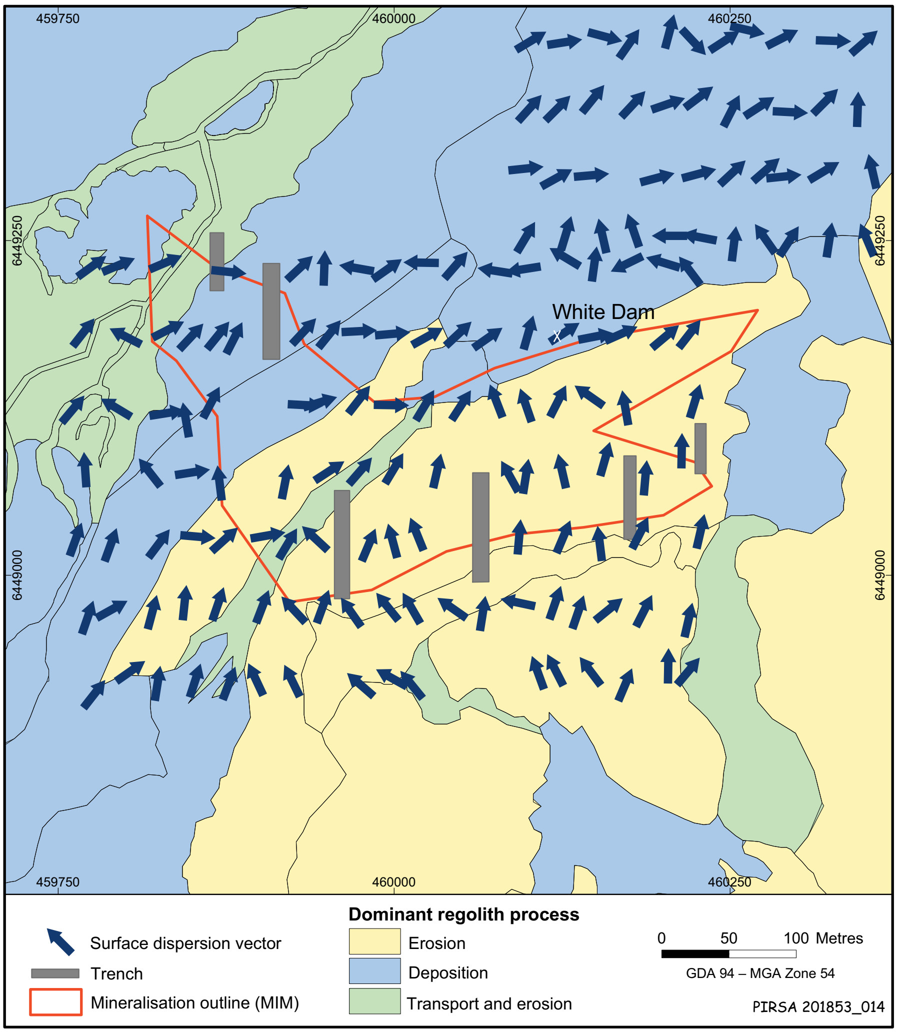


*Fig. 2 Derivative map produced from the regolith–landform map, with surface dispersion vectors shown over erosional and depositional landforms. Surface dispersion vectors show strong northeast movement from areas overlying known mineralisation to a large depositional plain in the northeastern corner.*

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