Tunkillia Modelling: Preliminary Results and some Predictive Targeting Outcomes

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Central Gawler Gold Province Modelling Project Update
Poster #3

pmd*CRC

Predictive Targeting Outcomes:

- ***To the south of Area 223, the footwall region of the western Yarbrinda Shear Zone (YSZ) immediately north of the major NE cross fault, has significant potential for focussed dilation coincident with high shear strain, ideal conditions for focussing ore fluids. Similar structural positions along the YSZ, associated with other NE cross faults, are also potential targets.***
- ***The mafic units just to the east of the greater YSZ and Tunkillia deposit, and immediately below the Gawler Range Volcanics (GRV) contact, may be the most prospective green-fields gold target in the Tunkillia region. Mechanical, fluid-flow, thermal and geochemical modelling methods all highlight these units, and this particular structural position, as highly prospective:***

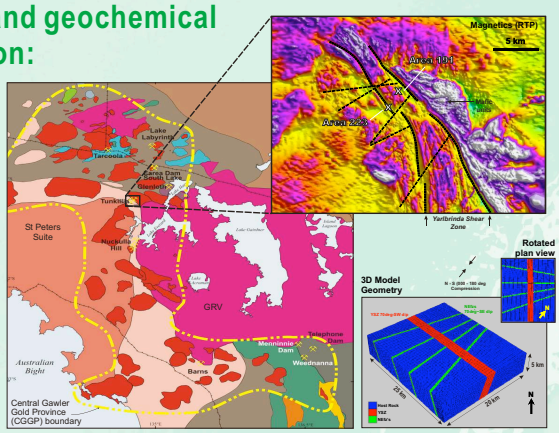
  - Mafic units are identified by geochemical modelling to be the "best trap" lithology in the region (3 times more reactive than the Tunkillia Suite felsic rocks).

  - The regional flow field predicted by the thermal-fluid-flow modelling (Update #2) indicates that lateral fluid flow beneath the GRV will be highly focussed proximal to the base of the GRV, particularly where this horizon nears the YSZ.

  - The localised dilation driven fluid flow, described in this report, highlights the potential role of the NE trending cross faults in locally channelling fluids proximal to the YSZ. If these structures extend to the East of the YSZ into the mafic units, there is the potential for significant competency contrasts, associated damage zones and fluid focussing and mixing within a highly geochemically reactive sequence.

Aim of deformation-fluid-flow and geochemical modelling of the Tunkillia Region:

- To numerically reverse engineer the observed distribution of ore host structures at Tunkillia (area 223) in order to confirm and quantify the interpreted far-field stress regime responsible for generating these structures.
- To ascertain the geochemical reactivity of local rock types and potential source fluids, in order to define the best geochemical/lithological trap rocks for Au mineralisation.
- To compare the Tunkillia reverse engineering results to those for Tarcoola and see if there are similarities in far-field stress orientation and geochemical attributes. If a consistent regional far-field stress regime and geochemical attributes can be identified, they can then be applied to subsequent regional scale predictive modelling.



Deposit-scale reverse engineering outcomes

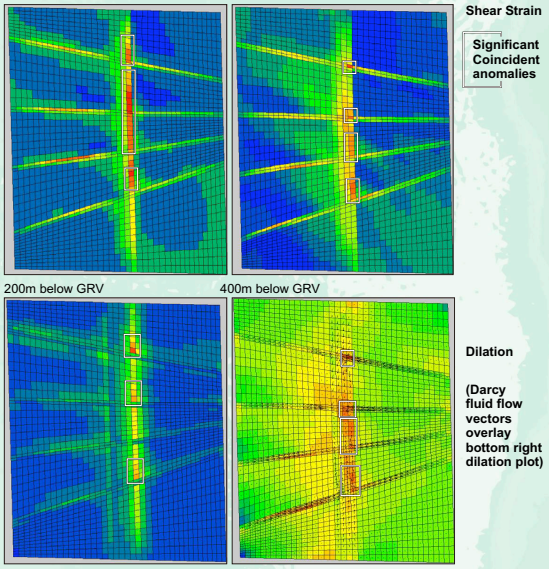
N-S to NW-SE compression is required to reproduce the observed structural trends of the ore zones, with N-S compression yielding the best fit (similar to Tarcoola).

Unlike Tarcoola, wrenching or transpression is not an important component of the regional far field stress regime. It is the compression component of the deformation that drives coincident ore zone dilation and high shear strain in the Yarlbrinda Shear Zone (YSZ).

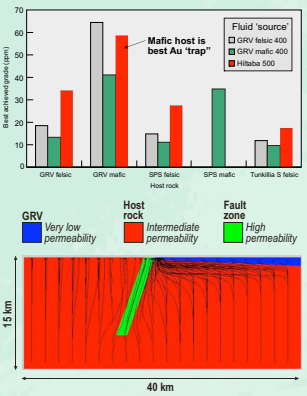
In the N-S compression model, both high shear strain and dilation are focussed near the footwall contact of the Western YSZ structure, indicating that one might expect mineralisation and alteration to intensify towards the footwall. A sharp transition into unmineralised and undeformed rocks below the footwall contact is also predicted by the modelling.

The NE-SW trending cross faults play an important role in partitioning strain within the YSZ, and may be responsible for along-strike variations in gold grade and tonnages. The N-S compression model predicts that both dilation and shear strain in the YSZ should increase as you progress southward towards each NE cross fault and reach a peak within the YSZ immediately North of the cross fault near the footwall of the YSZ high strain zone.

N - S Compression Model

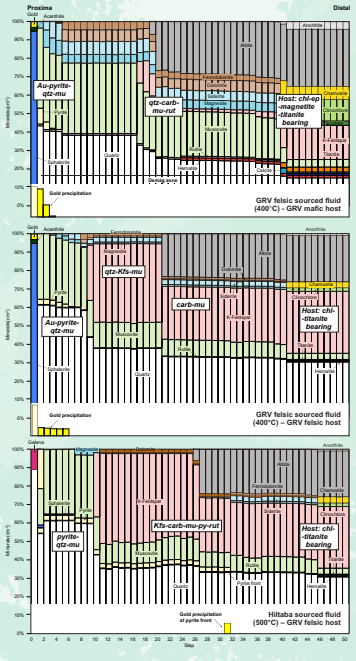


The N-S compression model also highlighted that the NE-SW cross faults may be important secondary fluid conduits channelling regional fluids into the YSZ.



Geochemical simulations indicate that mafic host rocks would be the "best trap" for wall-rock sulphidation-related gold mineralisation near Tunkillia, while the felsic rocks of the Tunkillia Suite are least favoured for gold precipitation through these types of reactions. This may explain why ore zones and associated alteration are particularly narrow at Tunkillia, and confined to the immediate proximity of the veins.

Thermal-fluid-flow modelling (Update #2) indicates that the regional fluids (distal to the YSZ) most probably have a very different geochemical and thermal history to those channelled through the YSZ from depth. If the NE cross faults are able to tap and focus these regional fluids (particularly fluids sourced from East of the YSZ under the GRV) there is good potential for the formation of mixing zones, where two fluids with very different geochemistries and temperatures combine, at the intersection of these two structural trends.



Rock 'trap'	Inner/late	Outer/early	Fresh host
Felsic (SPS, GRV)	Quartz sericite pyrite (rutile)	K. feldspar sericite carbonate rutile	Chlorite (titanium) (hematite)
Mafic SPS	Carbonate quartz sericite/ paragonite anhydrite	Chlorite epidote sericite/ paragonite titanium	Amphibolite biotite magnetite ilmenite
Mafic GRV	Sericite quartz pyrite rutile	Sericite quartz carbonate rutile hematite	Chlorite epidote titanium magnetite hematite

Geochemical modelling has also predicted the alteration assemblages expected to be associated with the interaction of gold fluids with different host rock "traps", and highlights that demagnetised zones should be expected to be much wider than the associated intense visible alteration zones. Modelling also predicts that gold associated with pyrite may occur distal to the source vein at the pyrite reaction front for some fluids

More information:
https:/pmd-twiki.arrc.csiro.au/twiki/bin/view/PIRSA/WebHome

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