New Light Shed on Structure at Wallaby

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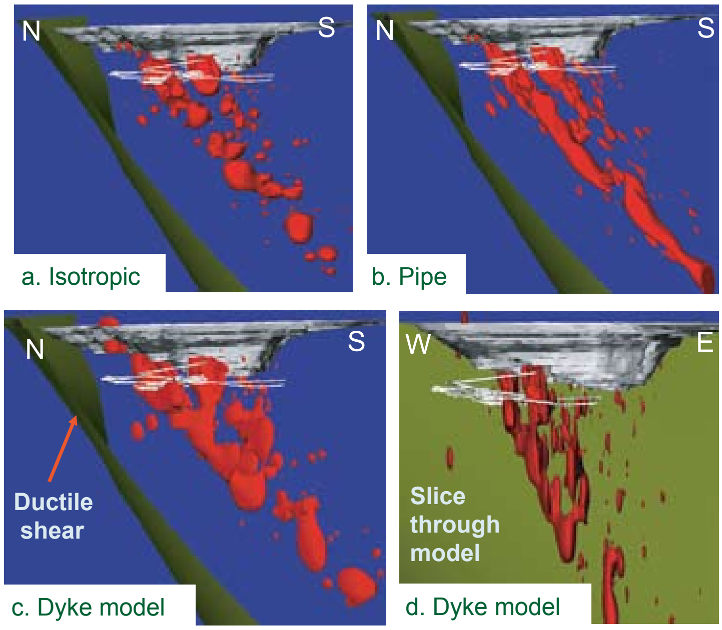
Structural evolution of the Wallaby deposit

A new report on the structural evolution of the Wallaby gold deposit has some important implications for explorers.

Some of the key findings are:

- *A major change in the structural evolution of the Wallaby system, with two major distinct phases of gold mineralisation now identified (hematite-associated and sinistral-slip associated).*
- *The identification of a series of palaeostress switches linked to changes in the observed alteration assemblages.*
- *All generations of veining are associated with gold. This includes a series of magmatic calcite veins that have previously been linked to oxidised fluids associated with the intrusions.*
- *Emplacement of alkaline intrusive rocks marks a stress switch from E-W shortening (D2 folding event) to radial extension. The syenite dykes and magmatic calcite veins have variable strikes, but intersect at a point plunging 60° S that matches the plunge of the larger intrusive bodies.*



Leapfrog models of intrusive rocks (combines all intrusive rocks except for lamprophyres), ductile footwall shear, pit shell and development also shown (ductile shear produced by Placer Dome Asia Pacific staff and is termed the wedge shear). Viewed in FracSIS. Note: two intrusive bodies were delineated in the models. (a) Isotropic fit. (b) Pipe geometry (fitted for a plunge of 60 degrees to the S with Leapfrog anisotropy of 211). (c & d) Two views of the dyke model. Follows dominant dyke trend in the open pit (NNE), Leapfrog anisotropy of 441.

- The shape of the intrusive bodies was a control on where gold lodes propagated. Faults focus at the top of the intrusive rocks and within thinner regions the intrusive bodies. These faults “horse-tail” once they enter the surrounding conglomerates and die out within 100m of the intrusive contact.
- A N-directed shearing event occurred at the end-stage of magmatism, and marks a stress switch from extension to compression. This folds the syenite dykes with substantial flattening of conglomerate clasts, and chlorite alteration that overprints magnetite-actinolite alteration related to the magmatism. Many of the N-directed ductile shears have preferentially localised along SE-dipping bedding surfaces within the Wallaby conglomerate.
- Ductile shears and foliation have a major control on the formation of the gold lodes - these shears are inferred to both chemically and mechanically prepare the rocks making them more susceptible to developing ore-related alteration.
- The first major phase of gold mineralisation is linked to hematite-associated alteration (quartz, Fe-rich dolomite, pyrite, hematite) within predominantly brittle structures that formed during N-S and NW-SE compression.
- A switch to extension marks the end of hematite-associated deformation.
- A phase of sinistral-slip faulting (transport direction of top-to-NW and –N) is related to major gold mineralisation (and are termed sinistral-slip lodes). These overprint the hematite-associated lodes, and are associated with quartz-calcite-dolomite-pyrite-sericite (+/- fuchsite, no hematite). The lodes formed when σ_1 was flat-lying and oriented NW-SE and σ_2 plunging 30 to 40° NE.

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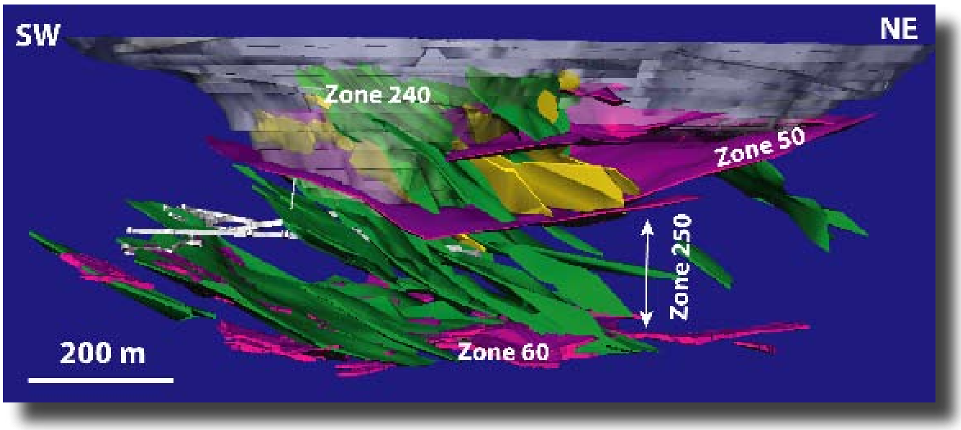
Implications for regional targeting

- *Two phases of gold mineralisation are linked to NW-SE oriented σ_1, but with different orientations of σ_2 and σ_3 (producing compressional and sinistral-slip structures). Changes in strike on regional faults that would be dilatant in these stress regimes could be targeted. This is distinct to some other gold models that propose an E-W or ENE-WSW orientation for gold-related σ_1.*
- *There is a close link between the hematite-associated lodes, ductile shearing and the syenite intrusives, and suggest hematite-associated lodes will form close to a syenite body where a N-S compressional overprint occurred – ductile structures within the basin (such as Thet's Fault) may be a key feature that needs to be close to syenite intrusions for a Wallaby-style deposit to form.*
- *Irrespective of the gold model used, the intrusive rocks acted as rheology contrasts with the surrounding conglomerates allowing faults to localise within and on top of the intrusive body.*

More information

- *The full text of the report and accompanying 3 A0-sized plates are available for download from the secure website on the Y4 Project page (link below):*

https://pmd-twiki.arrc.csiro.au/twiki/bin/view/Pmdcrc/ProjectYNew#Wallaby_Structure_Report



Snapshot of the Wallaby deposit (pit shell as at November 2004; Grade shells produced by Placer Dome Asia Pacific staff). N-dipping lodes are coded yellow (e.g., Zone 241), NE-dipping lodes are coded green (e.g., Zone 240, 250), low angle hematite-associated lodes are coded purple (e.g., Zone 50, 60). Some lodes have been excluded. Viewed in FracSIS looking NW, highlighting lodes beneath open cut.

- The sinistral-slip lodes are subdivided into fracture-mesh controlled gold lodes and ductile shear controlled gold lodes. The fracture-meshes developed via multiple phases of fluid over pressure. The ductile shear associated lodes occur where brittle structures have intersected the earlier ductile shears and cleavages associated with the N-directed shearing event.

- Stress switches are inferred to have allowed the system to access different fluid reservoirs (producing the sudden changes in alteration). The field relations could support a scenario where a stress switch from extension to compression during the end-stage of syenite emplacement produced fluid-mixing. In this model the compressional ductile shears may have tapped reduced fluids in the surrounding basin (outside the magnetite-actinolite alteration halo around the intrusive body), and provided a fluid conduit that brought these fluids into contact with oxidised fluids from around the intrusion producing the first high grade hematite-associated gold lodes. The key issue for the validity of a fluid-mixing model is the length of time between the initiation of N-directed shearing and cooling of the intrusive rocks.

- The change from ductile shearing to brittle failure may be related to the syenite body cooling with resulting changes in deformation mode.

- A consistent transport direction associated with the sinistral-slip gold lodes exists irrespective of structural position and spatial association with the intrusive rocks. With the exception of the magmatic calcite veins, the gold lodes do not have geometries linked to the stress field associated with magmatism. All major gold lodes are linked to a distinct structural overprint within a stress field unrelated to the emplacement of the intrusive rocks.

- The stress switch to a sinistral regime is associated with a change in alteration assemblage. The fault-fracture intersections associated with the sinistral-slip lodes have steeper plunges and compared to the horizontal intersections for previous stages of gold mineralisation, this geometry would have allowed the system to more readily access deeper-level fluid reservoirs.

- Field relations are not consistent with linking the sinistral-slip lodes to the intrusive rocks. These lodes have timing relationships and mineral assemblages consistent with being labeled orogenic gold lodes with no direct link to the Wallaby syenite (apart from the rheological controls). The sinistral-slip lodes clearly offset, and overprint the hematite-associated lodes, which indicates a time break not only between the hematite-associated lodes and the sinistral-slip gold lodes, but also the magmatism. This is supported by the existing geochronology (Salier et al., 2004).