January-March 2006

Y4 Project Quarterly Report

predictive mineral discovery CRC

Highlights:

- New Magneto-Telluric survey for the Eastern Yilgarn
- New numerical modelling of extension and fluid flow
- New Sunrise Dam structural analysis
- Y4 at the Sharp End
- Successful and 3D map making meeting held in Canberra (February)
- Student news
- News from Embedded Researchers

Magneto-Telluric survey: what do the big systems look like electrically?

The 91EGF01 seismic reflection line acquired across the Kalgoorlie Terrane created a paradgim shift in the understanding of the Yilgarn architecture (Fig 1a). One of the surprises of this survey was the mapping of a diffuse zone of reflectivity that was interpreted as a large alteration system in the lower and mid crust (blue coloured zone).

To test this large-scale alteration hypothesis, the Y4 project has comissioned the University of Adelaide to acquire magneto-telluric (MT) data over the same line. Figure 1b is a topographical map of the proposed stations for this survey. The project team will be in the field for 2 weeks following the *pmd**CRC conference in late April. For more information on this MT survey contact Richard.Blewett@ga.gov.au

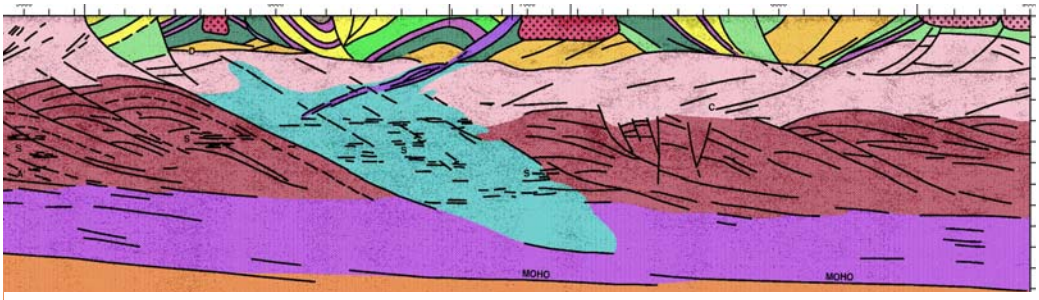


Figure 1a: Interpreted EGF01 seismic line (Drummond et al., 2000)

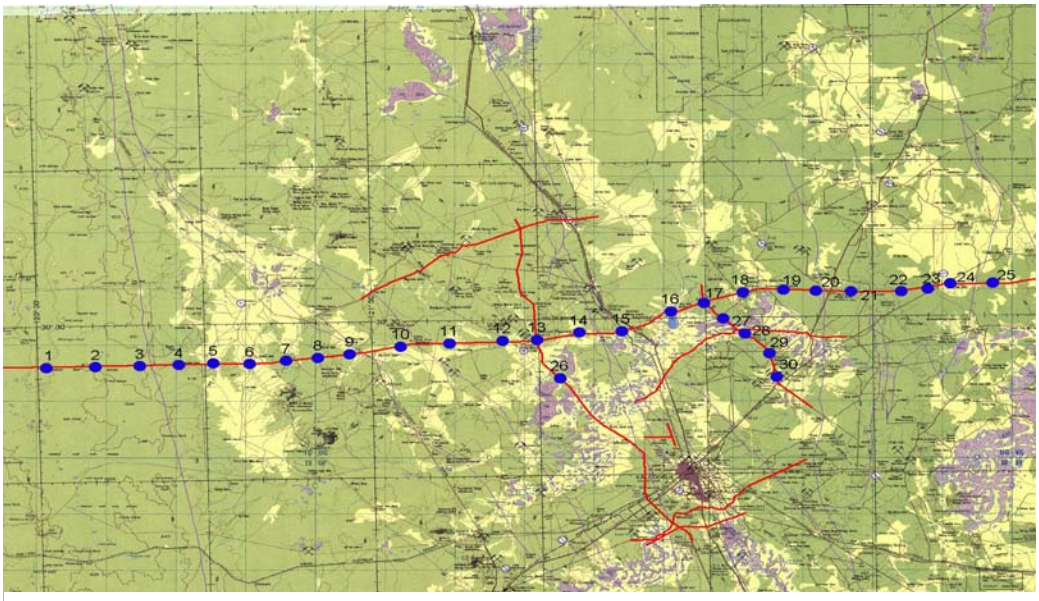
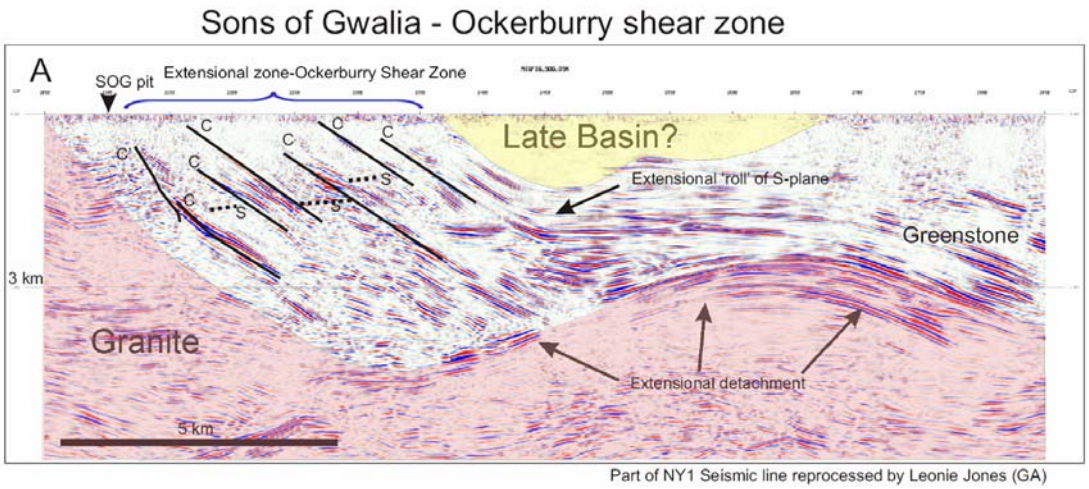
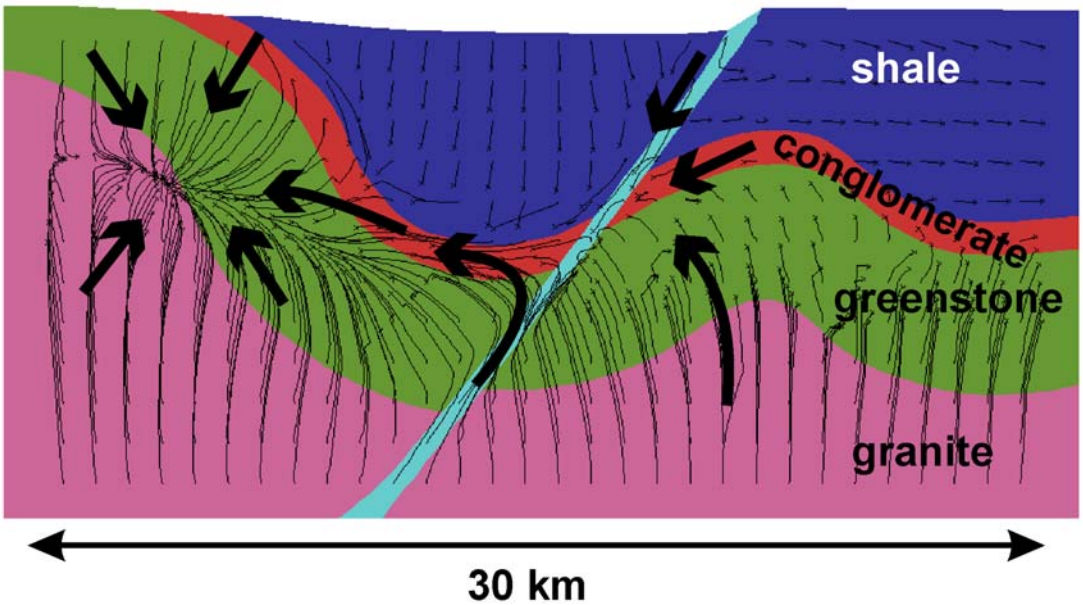


Figure 1b: Proposed MT survey stations, red lines existing seismic surveys

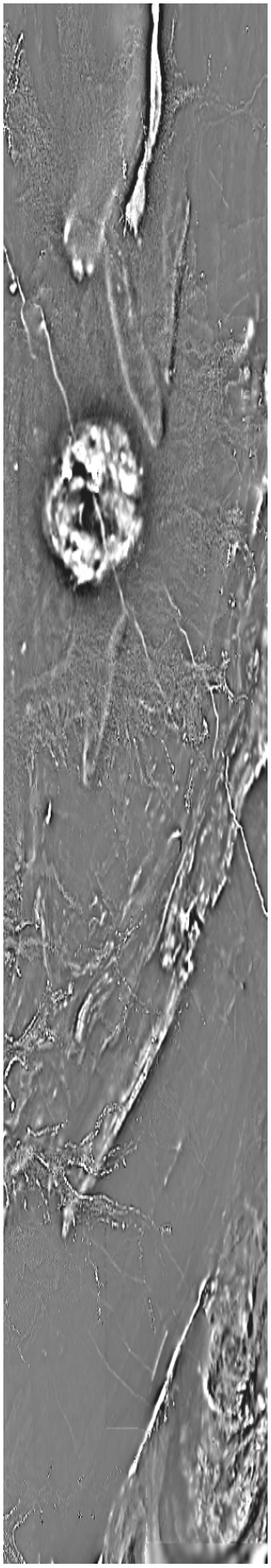
Modelling extension and role of domes and Late-Stage Basins





Numerical models are being used to explore patterns of fluid flow in and around the Late-Stage Basins and the effects of extension on generic geometries akin to those observed in seismic profiles. Extensional deformation results in mixing of deep-sourced fluids (e.g. from devolatilisation) with basinal fluids (see figure; arrows and lines indicate flow paths). Mixing typically takes place within the greenstones, close to the unconformity with overlying late basins. When compared to the seismic section the location of fluid focusing is roughly equivalent to the location of the Sons of Gwalia group of deposits.

We are exploring the effects of various extensional regimes on a simple geometry comprising a weak greenstone layer overlying a circular granite dome. Extension in one horizontal direction (plane strain) creates shear zones that are broadly perpendicular to the extension direction, with minimal wrapping around the dome. Radial extension creates concentric shear zones around the dome, consistent with field observations. Further work will explore the effect of different dome geometries and extensional regimes. For more information contact Heather.Sheldon@csiro.au



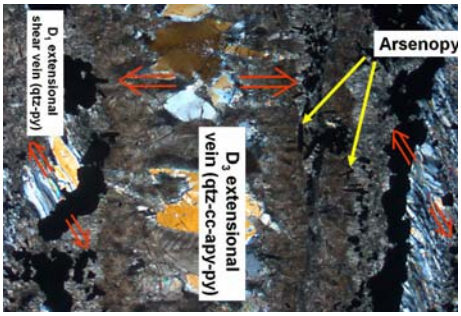
Sunrise Dam: new structural insights

John Miller has recently completed a structural synthesis of the Sunrise Dam gold deposit in the Laverton district. The work is part of the project's desire to link the geodynamics and architecture with the fluid (alteration-mineralisation) evolution.

Sunrise Dam (like Wallaby) has stress switches, with a major change in alteration when the system changes to strike-slip (from thrusting). The steeply dipping high-grade (Au) faults at Sunrise Dam are linked to strike changes of the controlling structures and the petrographic data indicates they formed during D1 and were reactivated during D3.

A new report will be posted in the next quarter. For more information contact John Miller jmmiller@cyllene.uwa.edu.au

Two phases of opening: D1 extension shear veins and D3 veins with arsenopyrite



Plans for next quarter

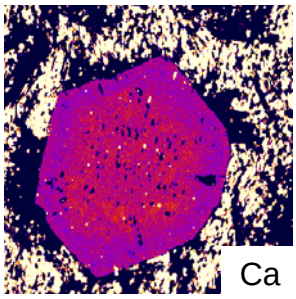
- Complete the Kalgoorlie-Kambalda 3D map solid volumes
- Complete Laverton region 3D map
- Build Laverton architecture surfaces ready for meshing at CSIRO
- *pmd**CRC Conference in April
- Continue to write up results from A1, Y3 and Y2 projects
- Complete Magneto-Telluric survey and other field work
- Inversions of Perservence (Leinster)

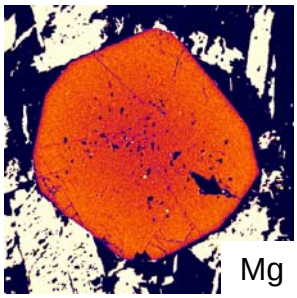
Workshops

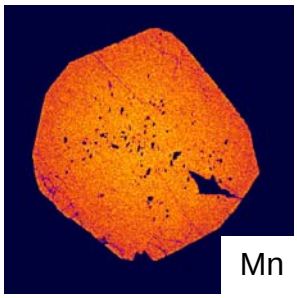
The project was the main driving force behind the "How to make a 3D map" workshop held at Geoscience Australia on 15^{tth} February. The meeting was attended by around 45 sponsors, students and researchers. Topics included philosophy and pit falls of various aspects of the 3D world, included worms, seismic, gocad, inverse and forward modelling. A live demonstration of 3D Geomodeller was successful, as was a demonstration of Malcolm Nicoll's 'portable' 3D visualisation system.

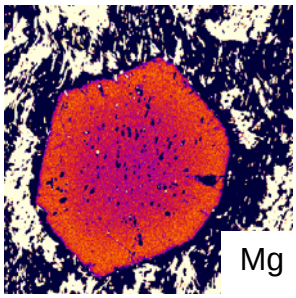
Copies of the talks are on: https://pmd-twiki.arrc.csiro.au/twiki/bin/view/Pmdcrc/3DMappingWorkshopFeb06

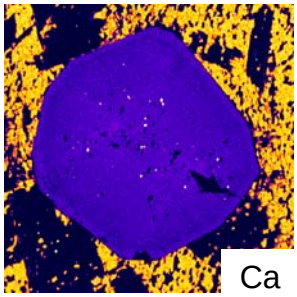
The project held a meeting at GA in Canberra (16-17th February), and focussed on finalising the integrated project presentations for the *pmd**CRC conference in April (Perth), as well as the science of Sunrise Dam. Mike Nugus from Sunrise Dam attended and presented AngloGoldAshanti's ideas on the evolution of this exciting system.

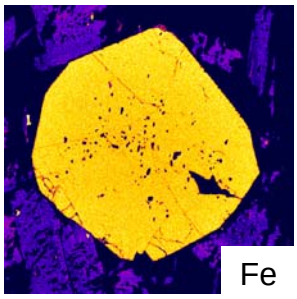












Garnet maps from
Ben Goscombe

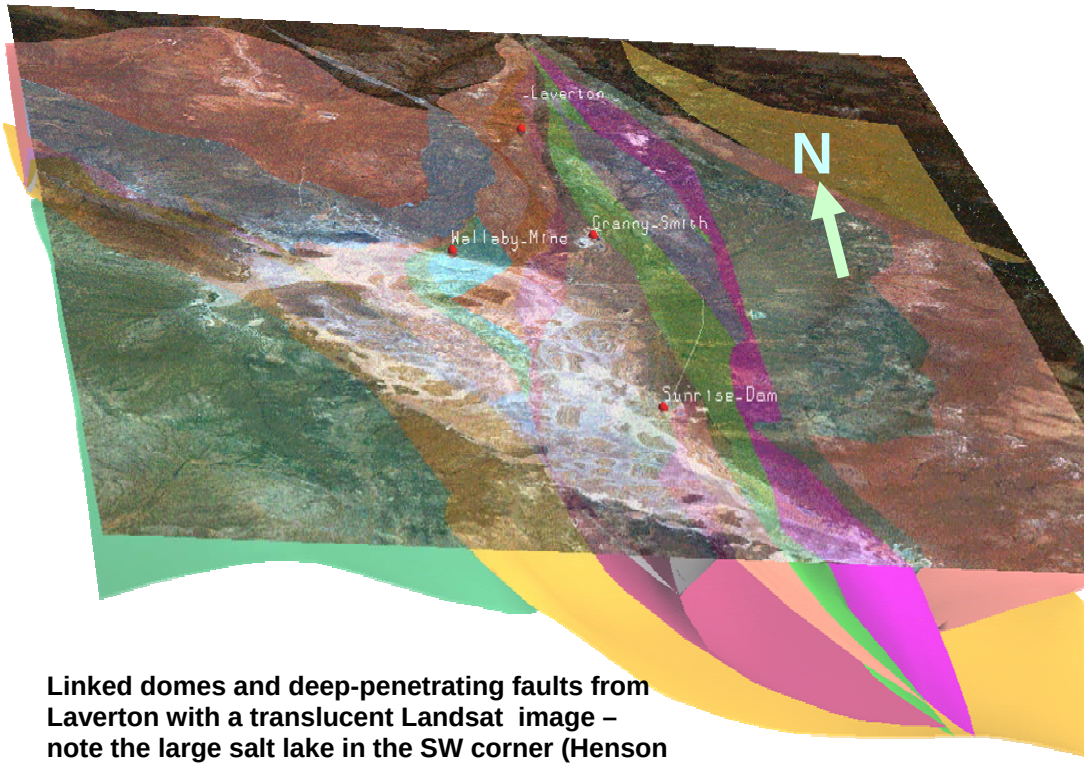
Y4 @ the Sharp End: 19th-20th April conference

The Y4 team is making a major contribution to the April 19-20 conference in Perth. We have eight oral papers from the team (including one on seismic from Richard Chopping of the A3 project). The team are also presenting 12 poster papers on a range of topics.

The presentations focus on the integration of the Five Questions across the scales and use this integrated understanding to be predictive in terms of targets at a range scales.

- Goleby et al. sets the scene and considers the big picture system including mantle tomography and major crustal differences.
- Henson et al. describe the architecture of the Laverton region and note the similarity in geometry and style of structure between Sunrise Dam and Wallaby.
- Sheldon et al. have tested some of the concepts of the Y4 team and consider the role of Late-Stage Basins, granites, domes and metamorphic devolatolisation for the region's orogenic gold mineral system.
- Chopping maps fluid pathways and alteration at the largest scale in the seismic reflection data and builds on the architecture of the Henson 3D map.
- Miller describes the commonality in structural history between Sunrise Dam and Wallaby, and confirms the regional architecture of Henson in these deposits.
- Cleverley et al. describe the fluids of Sunrise Dam and note the similarity between this deposit and the better understood Kanowna Belle gold deposit in the Kalgoorlie Terrane.
- Blewett et al. integrate the above papers and further develop the concepts raised previously and predicts a number of targets at a range of scales.

If you are not fortunate to be joining us at the conference, then please obtain a copy of the abstracts and talks/posters.



Linked domes and deep-penetrating faults from Laverton with a translucent Landsat image – note the large salt lake in the SW corner (Henson et al.). Image ~50 km x 50 km.

pmd*CRC

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www.pmdcrc.com.au

Embedded Researcher (ER) News

Following consultations with Leviathan U/G and Exploration at St Ives, two new sampling campaigns have commenced to spatially map the reduced and oxidised end-member fluids in around 100km of drill core. The Hychipper programme (to complete 6/4/06) will provide indications on alteration and the reduced assemblages in particular. A longer-term magnetic susceptibility programme will map the oxidised assemblages. Tony Roache reports that the goal at St Ives is to assist the sponsors in near-mine scale and camp-scale targeting in the short term.

With the completion of the Gordons-Reidy generative campaign, the focus will return to the alteration and architecture work at Kanowna Belle over the next quarter. This work will follow up on the results of the Leapfrog alteration modelling and lithology re-modelling. Carl Young reports that these results included the definition of new structural orientations that co-incided witht contrasting alteration styles and chemistry.

Student News

Louis:

- Completed his PhD and wis currently working with our sponsor Barrick.

Joanna:

- University of Leeds (UK) LA-ICP-MS analysis on New Celebration fluid inclusions (January)
- Compiling and interpreting LA data
- Compiling and interpreting S isotope data collected in December
- Finalising New Celebration paper

Anthony:

- Compiled new SEM and LA-ICP-MS data of Bardoc Tectonic Zone sulphides to study the bimodal gold distribution. Results to be presented at the April conference
- Prepared samples for Re-Os dating
- Completed two major thesis chapters

Nick:

- Compiling physical properties from last quarter's field work
- Preparing 'regional' removal for the inversions of the Perserverence area
- Running magnetic and gravity inversions
- Met with MIRA Geoscience to determine how to use physical property measurements on small samples as constraints for large-cell size geological models

Gerard:

- Cut thin sections for prelim SEM scanning, for monazite dating of regional fabric
- Compilation and write up mapping results from Spargoville Formation structural study
- Continued microstructural analysis of Spargoville Formation samples
- Commenced field mapping of key Kurrawang Formation exposures for basin margin kinematics
- Provided White Flag Formation samples to Rick Squire for zircon
- geochronology: Late Basins project

List of project events/acitivities/interactions

As usual the team travelled to various sites for liaison with sponsors. Visits were made to Sunrise Dam, Granny-Smith, St Ives, and Kanowna Belle.

Vancouver Mineral Exploration 2006 Roundup NW presents (Jan 2006)

3D Modelling workshop, PN, IR, PH, RB presents (15/2/06)

Y4 project meeting at GA including Mike Nugus Anglo (16-17/2/06)

JM JW PN, KP visited St Ives 10th March

MDRU-GIF Annual Sponsors Meeting in Toronto (during PDAC), NW presents (March 2006)

Presentation to MEGWA on the CRC approach by Paul Roberts and PN (March)