July – September 2005

Y4 Project Quarterly Report

predictive mineral discovery CRC

Highlights:

- Wallaby structural report delivered
- Updated Kalgoorlie 3D map delivered
- Fracsis copy of Y2 3D map and database delivered
- Identification of reduced end-member fluids at St Ives

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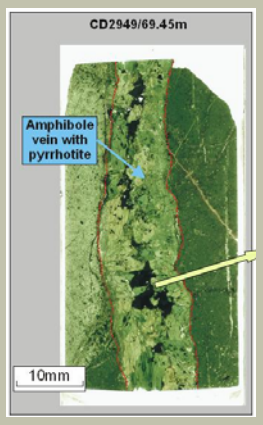
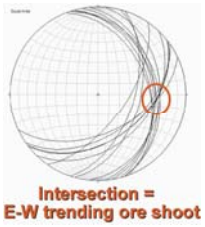


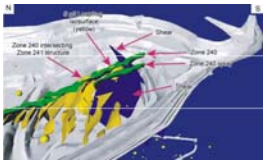
Chasing the Wallaby's secrets

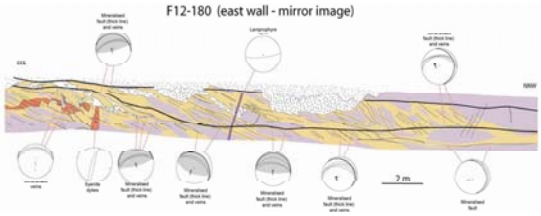
John Miller (Uni Melbourne) delivered a comprehensive report on the structural evolution of the Wallaby deposit. Links to the pdf report and accompanying A0 plates (maps) are at https://pmd-twiki.arrc.csiro.au/twiki/bin/view/Pmdcrc/ProjectYNew#Wallaby_Structure_Report

Highlights include:

- Two phases of gold mineralisation are linked to NW-SE oriented σ1, but with different orientations of σ2 and σ3 (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 σ1.
- 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.



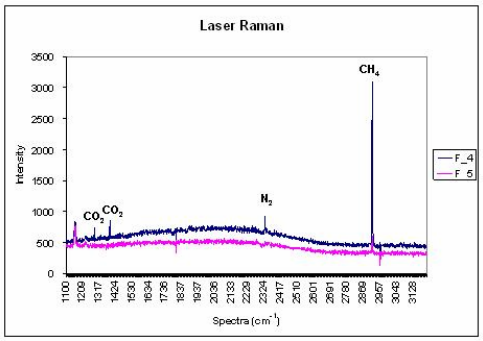




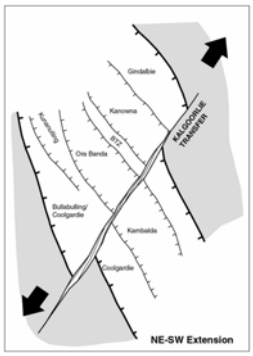
Conquering the enigmatic reduced fluids

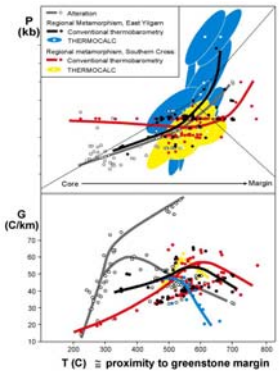
Klaus Peterson at UWA has had a breakthrough in successfully identifying the reduced end member fluid in the Conqueror area at St. Ives. This is because fluid inclusion preservation of the reduced fluid system is extremely poor. The fluid inclusions were discovered in quartz inclusions in pyrrhotite in a gently SW dipping reduced fluid conduit, distal to the Conqueror ore system.

Microthermometry and laser Raman analyses (the latter in collaboration with Terry Mernagh, Geoscience Australia) revealed that the reduced fluids are composed of CH4, CO2, and N2. Water, if present, is a subordinate component.



Fluid inclusions from shielded quartz inclusions in pyrrhotite





Upper Basalt stratigraphy changes and the early extensional architecture

Gerard Tripp (Placer, JCU Phd student) has been mapping around Mt Pleasant in the Kalgoorlie Terrane. New results include:

- Stratigraphic thickness changes in the upper basalt are modelled across major breaks
- Packages of consistent thickness occur in NW-SE trending elongate belts, suggesting that NW-SE trending domain faults are potential boundary markers, and possible extensional breaks at "upper basalt time"
- Major thickness changes also occur across NE trending gravity features in the central Kalgoorlie district
- Possible interpretations include NE and NW extensional vectors, with the central Kalgoorlie gravity feature acting as a rift segment, or a basement transfer zone

Plans for next quarter

The projects PDT meeting will be held in Perth at the ARRC building (Kensington) on the 22-23rd November. The meeting will be held in a workshop style, rather than formal delivery presentations. Engagement and involvement of industry sponsors will be very much encouraged. The topics for the workshop are:

- From mineralogy/lithology to rock properties in 4D
- Domes and the role of regional extension, granite magmatism and basin formation
- Towards a unified structural 'stratigraphy'
- Thermal history of the crust
- Towards a unified stratigraphy (Time–Space plots) for the Eastern Yilgarn
- Relating seismic architecture to geological 'reality'
- Understanding PIMA (Hylogger) in Yilgarn gold systems
- Timing of gold & alteration
- Mapping end–member fluid pathways: chemistry and architecture beyond the deposit–camp
- Regional fluid flow drivers

Major deliverables next quarter are the revised Kalgoorlie 3D map with stratigraphic infill, and the new Laverton detailed 3D map.

Access to GSWA metamorphic study

The project has been fortunate in obtaining the comprehensive compilation of legacy metamorphic maps, PT estimates, and chemical data from Dr Ben Goscombe (NTGS, formerly GSWA). In addition to the legacy data, GSWA have re-collected material and probed these samples for PT estimates. A temperature map has been generated, and field gradients determined. The highlight of the work is the recognition that with steadily increasing temperature, pressure increases dramatically towards the granitoid domes. This field gradient is consistent with extensional exhumation of granite domes as proposed by previous workers. Y4 will work with GSWA and Ben in furthering this work.

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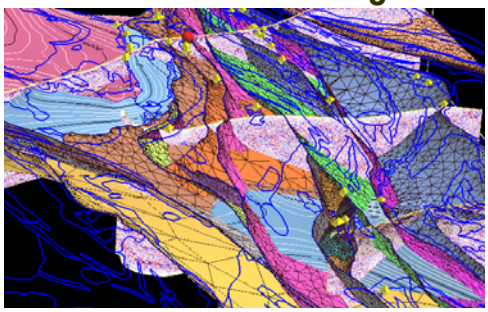
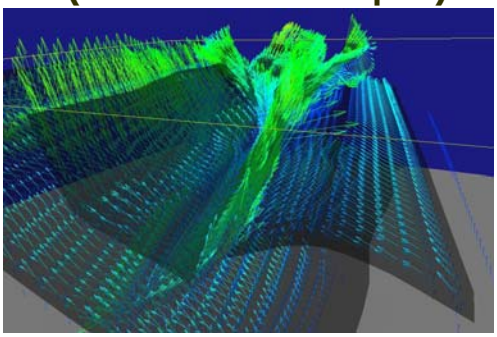
A taste of other interesting activities.....(see TWiki for full report)



Significant progress with GIS of Laverton and fault architecture pinned by seismic data



Numerical modelling the Y2 architecture – towards "painting the faults"

Publications and workshops

SGA Beijing 18-21 August 2005

- Mapping of hydrothermal alteration and geochemical gradients as a tool for conceptual targeting: St. Ives gold camp, Western Australia, by Neumayr et al.
- Palaeohydrological evolution of the St. Ives gold camp, by Petersen et al.
- Mineral systems, hydridic fluids, the Earth's core, mass extinction events and related phenomena, by Walshe et al.
- Five questions for fun and profit: A mineral systems perspective on metallogenic epochs, provinces and magmatic hydrothermal Cu and Au deposits, by Walshe et al.
- Characteristics and evolution of hydrothermal fluids from the Archaean orogenic New Celebration gold deposits, Western Australia, by Hodge et al.

Papers posted on Twiki

- Testing the Fools Clock: 40Ar/39Ar dating of pyrite, Miller and Phillips

STOMP Townsville abstracts29 August – 2 September 2005

- Structural and geochemical architecture of intrusion-associated lode-gold deposits, Eastern Goldfields, Yilgarn Craton, by Neumayr, P., et al.
- Integrated structural and spectroscopic identification of foliation zones and alteration related to Au mineralization at St Ives, Kambalda, Western Australia, by Roache, T. & Yang, K.
- Palaeohydrological evolution of the St. Ives gold camp, by Petersen, K., et al.
- Two boxes we don't need: orogenic and intrusion-related gold systems, by Walshe, J., et al.
- Domes: a characteristic architecture of world–class gold deposits, by Henson, P. et al.
- Testing the Fools Clock: 40Ar/39Ar dating of pyrite, Miller and Phillips

List of project events for the quarter

1. Project meetings

Name	*Date*	*Venue*	*Number of Researchers*	*Number of sponsors*
Fieldwork: John Walshe, Peter Neumayr, Klaus Petersen, Carl Young to sample across albite breccias and hangingwall structures of Fitzroy Fault	18.-22.07.	KB	4	
Fieldwork and Targeting workshops: John Walshe, Peter Neumayr, Klaus Petersen, Tony Roache to present targeting concepts and workshop current targets	01.-05.08.	St. Ives	4	30
Fieldwork: John Walshe, Tony Roache, Carl Young	12.-16.09.	St. Ives, KB	3	

2. Workshops

Name	Date	Venue	Number of researchers	Number of industry/sponsors
3D map workflow	10-08	ARRC building Perth	2	6 (BHPB)
Laverton solid geology and 3D map	11-08	Granny Smith mine	2	6 (Placer, AngloGold Ashanti)

3. Conferences/Symposia

Name	Date	Venue	Number of researchers	Number of industry/sponsors
SGA Beijing	18-21-08		5	

4. Shortcourses

Name	Date	Venue	Number of researchers	Number of sponsors
Peter Neumayr, Klaus Petersen and John Walshe continue to provide on-site training and development for sponsors		On site: St Ives, KB,	variable	variable