Structural architecture, hydrothermal alteration and fluid characteristics in the Kalgoorlie-Kambalda area, Western Australia

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OVERVIEW
In the Eastern Goldfields Province of Western Australia the tectonometamorphic framework is well constrained (Hinchley et al., 1977; Gei, 1974; Genik and Lofthouse, 1981; Campbell and Hill, 1986; Senior, 1987; Weiberg et al., 2003). However, the characteristic hydrothermal and metamorphic alteration assemblages and related fluids are less well understood. It is critically important to gain a far better understanding of the structural-hydrothermal alteration-fluid relationships in order to develop new exploration models which will allow exploration under cover.

The Kalgoorlie-Kambalda area of the Eastern Goldfields Province is an ideal location to undertake this research on the characteristic hydrothermal alteration and metamorphic mineral assemblages in a tectonically complex, metamorphosed, and overprinted terrane. The hydrothermal alteration is associated with and controlled by the thrusting and deformation associated with the Central and Eastern Goldfields. The area has been actively mined for more than a century, and there is a wealth of information both historic and recent on mining activities in the area. Outcrops are easily accessible and drill core is readily available.

AIMS
i. Evaluate and identify hydrothermal alteration assemblages and fluid characteristics during deformation, metamorphism, magmatism and gold mineralisation associated with De to D4 deformation events.
ii. Identify and characterise end-member hydrothermal fluids and alteration assemblages in space and time.
iii. Compare and contrast Au-endowed and barren alteration systems.
iv. Identify and characterise end-member hydrothermal fluids and alteration assemblages in space and time.

FOCUSES
i. Kalgoorlie Terrane between Kalgoorlie and Kambalda.
ii. Detailed petrography of alteration and metamorphic minerals within and adjacent to the major fault systems and granitoid bodies in the study area to identify characteristic hydrothermal and metamorphic mineral assemblages associated with different tectonic, igneous and metamorphic events, and to identify characteristic syn-depositional, pre-deformation alteration.

NEW CELEBRATION (3)
CRITICAL QUESTIONS:
• What is the nature of the hydrothermal fluid as it relates to the D2-D3 Boulder-Lefroy Fault?
• How do the hydrothermal alteration assemblages relate to the mineralizing events and depositonal, predating D1 (De)?
• What is the spatial distribution of the hydrothermal alteration and metamorphic characteristics of epidote-magnetite and magnetite-hematite associations?

SUMMARY
Preliminary investigations have resulted in the identification of five key areas in which to characterise alteration assemblages associated with De to D4 tectonic events.

GOLDEN MILE (1)
CRITICAL QUESTIONS:
What is the nature of the subaerial alteration?
Can supergene alteration be identified?

HANNAN SOUTH (2)
CRITICAL QUESTIONS:
• What are the characteristics of the D2 granite-related alteration assemblages? Are they stains?
• What is the paragenetic sequence and how does the hydrothermal alteration relate to magmatism and gold mineralisation?

NEW CELEBRATION (3)
CRITICAL QUESTIONS:
• What is the paragenetic characteristic (as defined by characteristic mineral and chemical assemblages) of the alteration associated with D3 thrusting?
• How do the mineral populations compare within the hydrothermal alteration?

REFERENCES:

REFERENCES CONTINUED: