Deformation and fluid flow associated with late basins and domes - Implications for mineralisation in the Yilgarn

Introduction

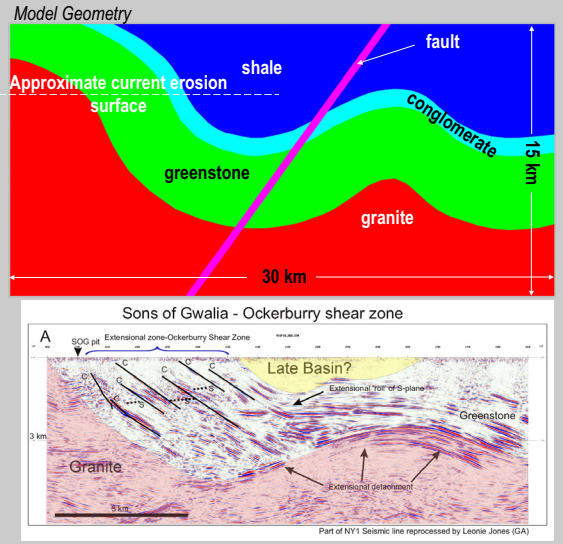
Late basins may have played an important role in Au mineralisation in the Yilgarn. Numerical models have been used to explore the effects of extension and compression in a generic dome-and-basin geometry, including a deep fault which acts as a pathway for transport of deep fluids.

Key Questions

1. Why is mineralisation commonly located close to the unconformity between greenstones and the "late basins"?
2. What are the roles of deep faults and granite domes in the system?
3. Can basin fluids migrate downward or laterally into the greenstones?

The model

A generic architecture for the late basin models is used, comprising four stratigraphic units (shale, conglomerate, greenstone and granite) and one deep fault. Aspects of this architecture are consistent with those inferred from the Sons of Gwalia seismic section (see below).



Key model implications

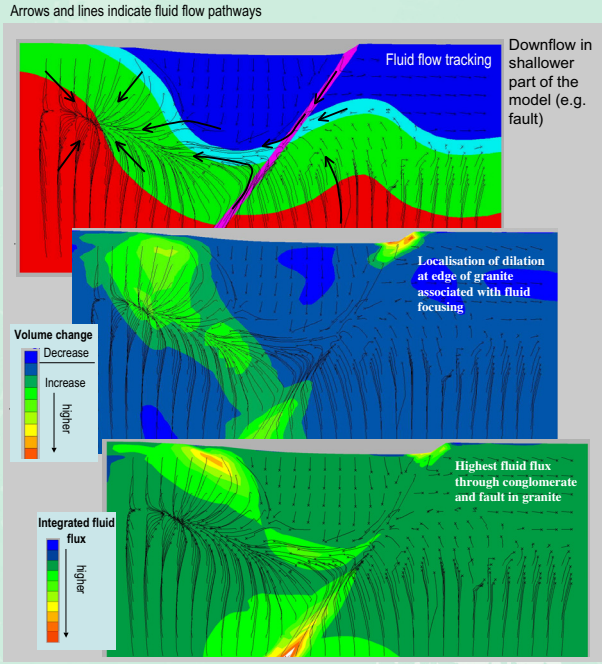
- Extension may be a key driver for downward fluid flow from the late basins into the greenstone, either directly across the unconformity or along permeable faults, allowing basinal fluids to mix with deep fluids.
- Strain rate is important; fast extension promotes downward flow.
- Basin inversion (compression following extension) is dominated by fluid up-flow, particularly along faults. Fluids that accumulated at a certain depth during extension can be driven up to shallower levels during inversion.
- Steeper limb of granitic domes seems to be the favourable site for dilation and fluid mixing, the approximate location of sons of Gwalia group of deposits.

Future work

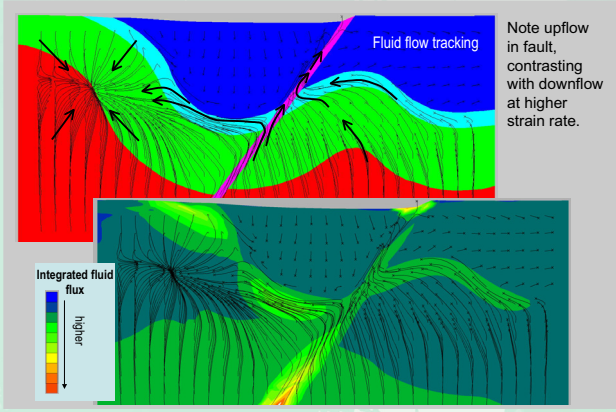
- Modelling of metamorphic dehydration has been carried out, and future late basin models need to consider regional fluid flux contribution from dehydration.
- Reactive transport models will be used to explore the chemical effects of moving fluids from basins into the greenstones (and back again, during inversion)

Faster extension (strain rate = ~8 x 10^{-14} s^{-1})

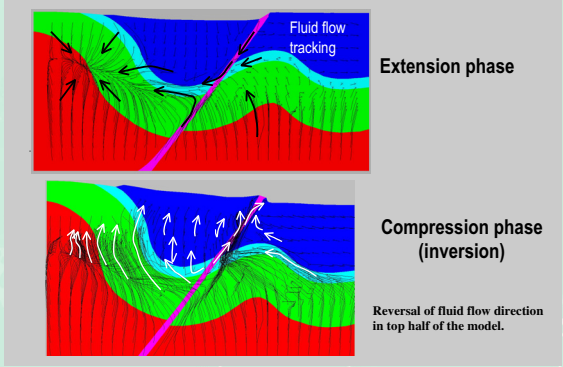
Arrows and lines indicate fluid flow pathways



Slower extension (strain rate = ~3.2 x 10^{-14} s^{-1})



Switch from extension to compression



Yanhua Zhang[1], Heather A. Sheldon[1], Richard Blewett[2], Alison Ord[1], Andy Barnicoat[2] and Karol Czarnota[2]

[1] CSIRO Exploration & Mining, PO Box 1130, Bentley WA 6102

[2] Geoscience Australia, GPO Box 378, Canberra 2601

Phone: 08 6436 8626 **Email**:yanhua.zhang@csiro.au

www.pmdcrc.com.au

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