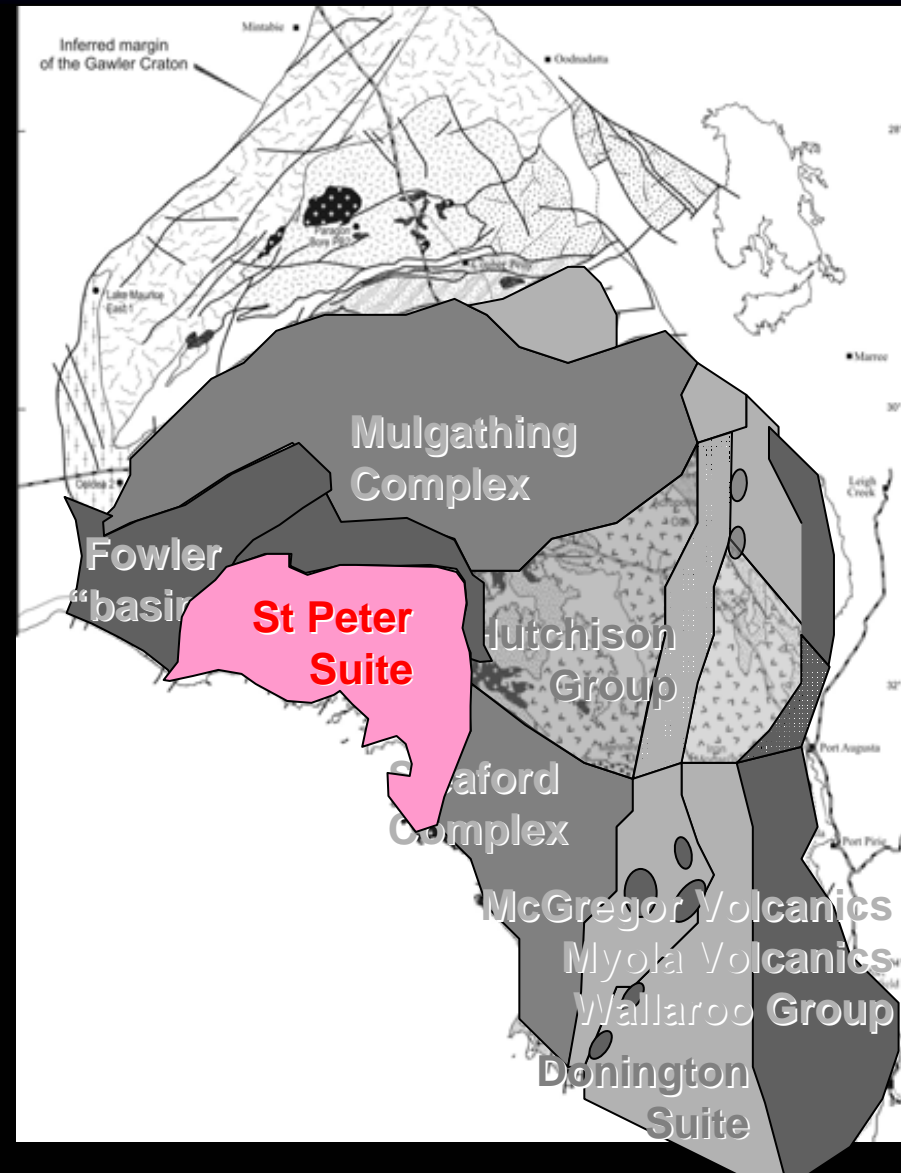


# Towards a tectonic framework for the Gawler Craton

## Megacycle 2

1.65-1.62 Ga

- Localised rift basin development (Tarcoola Fm).
- Regional high-T metamorphism in NW Gawler.
- Development of St Peter Magmatic Suite (1620-1608 Ma): felsic and mafic syn-deformational system.
- Apparent arc related geochemistry of the St Peters Suite suggests the development of a convergent margin system.

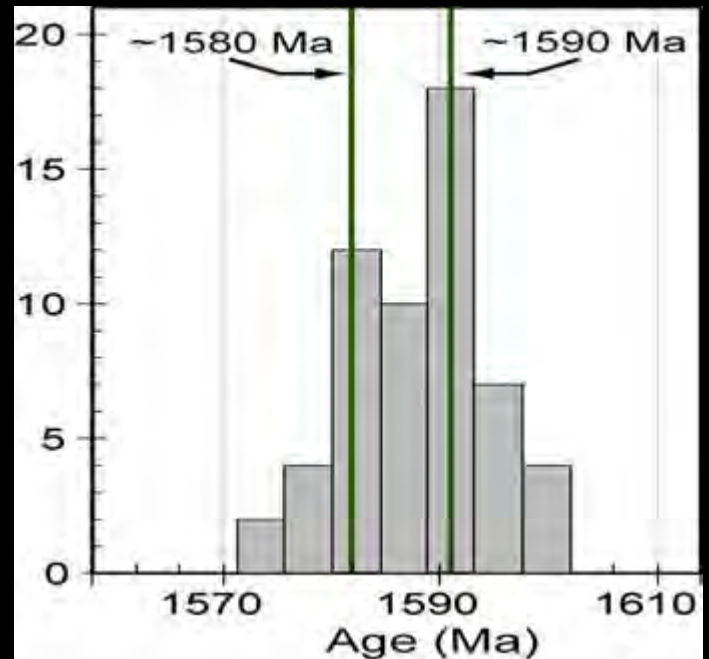
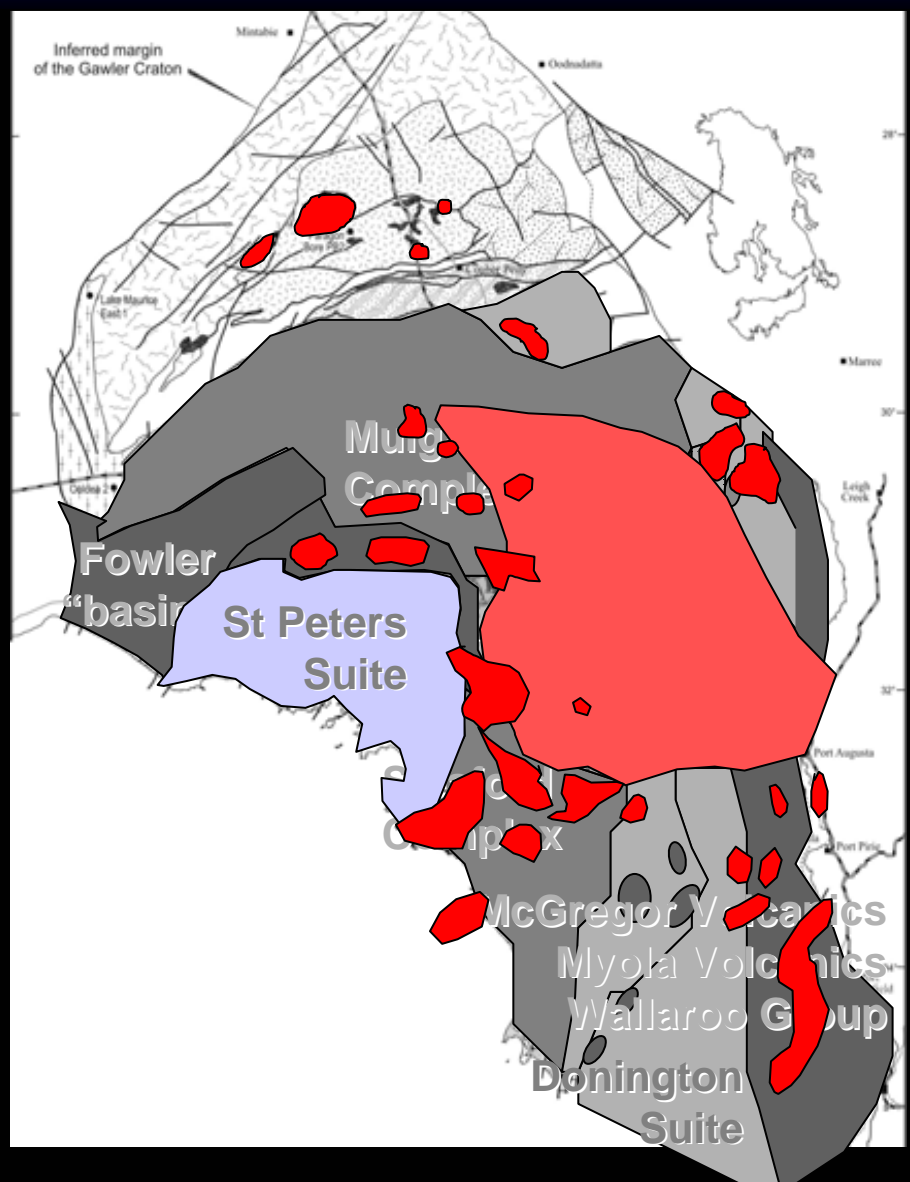


# Towards a tectonic framework for the Gawler Craton

## Megacycle 2

### 1.595-1.57 Ga: Hiltaba

- Localised rift basin development and voluminous felsic magmatism (1.59 Ga).
- Terrain-scale I-type felsic magmatism with a significant crustal component and mafic subordinates.

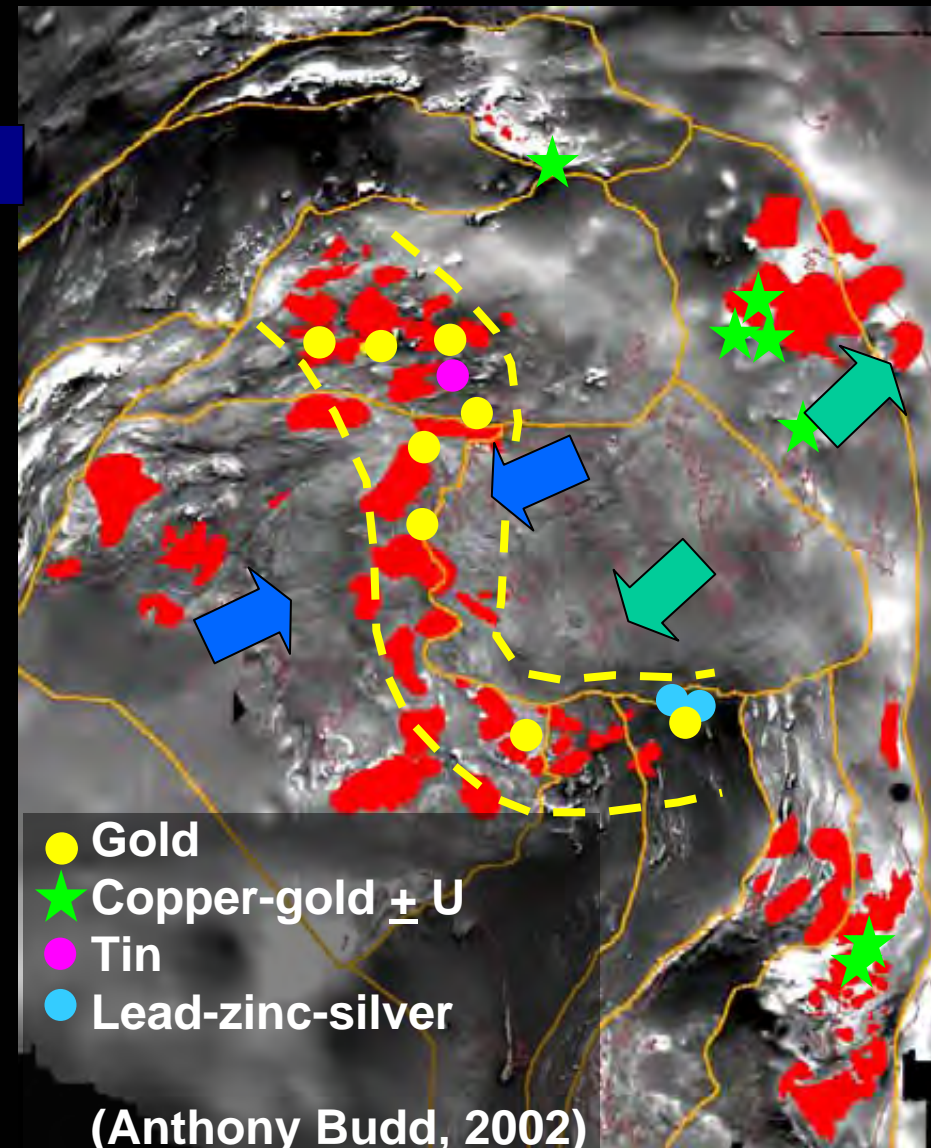


# Towards a tectonic framework for the Gawler Craton

## Megacycle 2

### 1.59-1.57 Ga: Hiltaba

- Localised rift basin development and voluminous felsic magmatism (1.59 Ga).
- Terrain-scale I-type felsic magmatism with a significant crustal component and mafic subordinates.
- Development of IOCG systems in rift related settings in the eastern Gawler.
- Regional compressive deformation (1.58 Ga).
- Development of Au systems associated with compressional structures in the central Gawler.

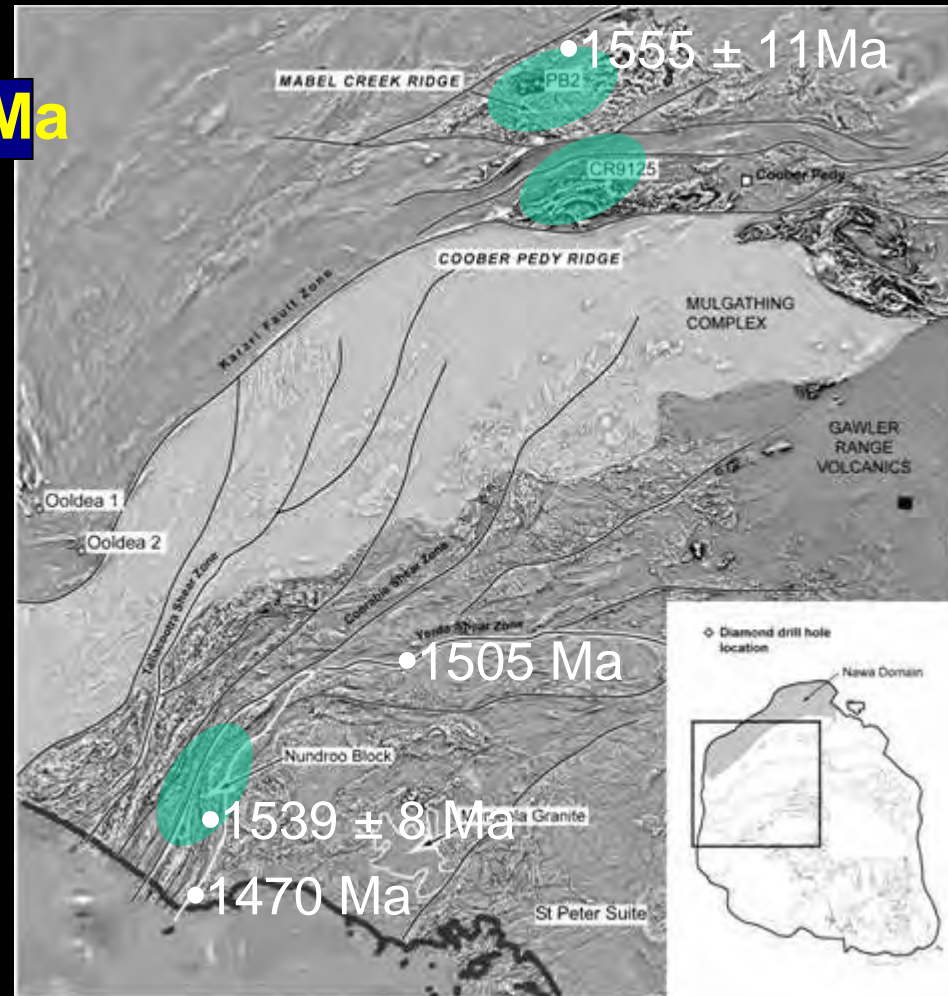


# Towards a tectonic framework for the Gawler Craton

## Megacycle 2

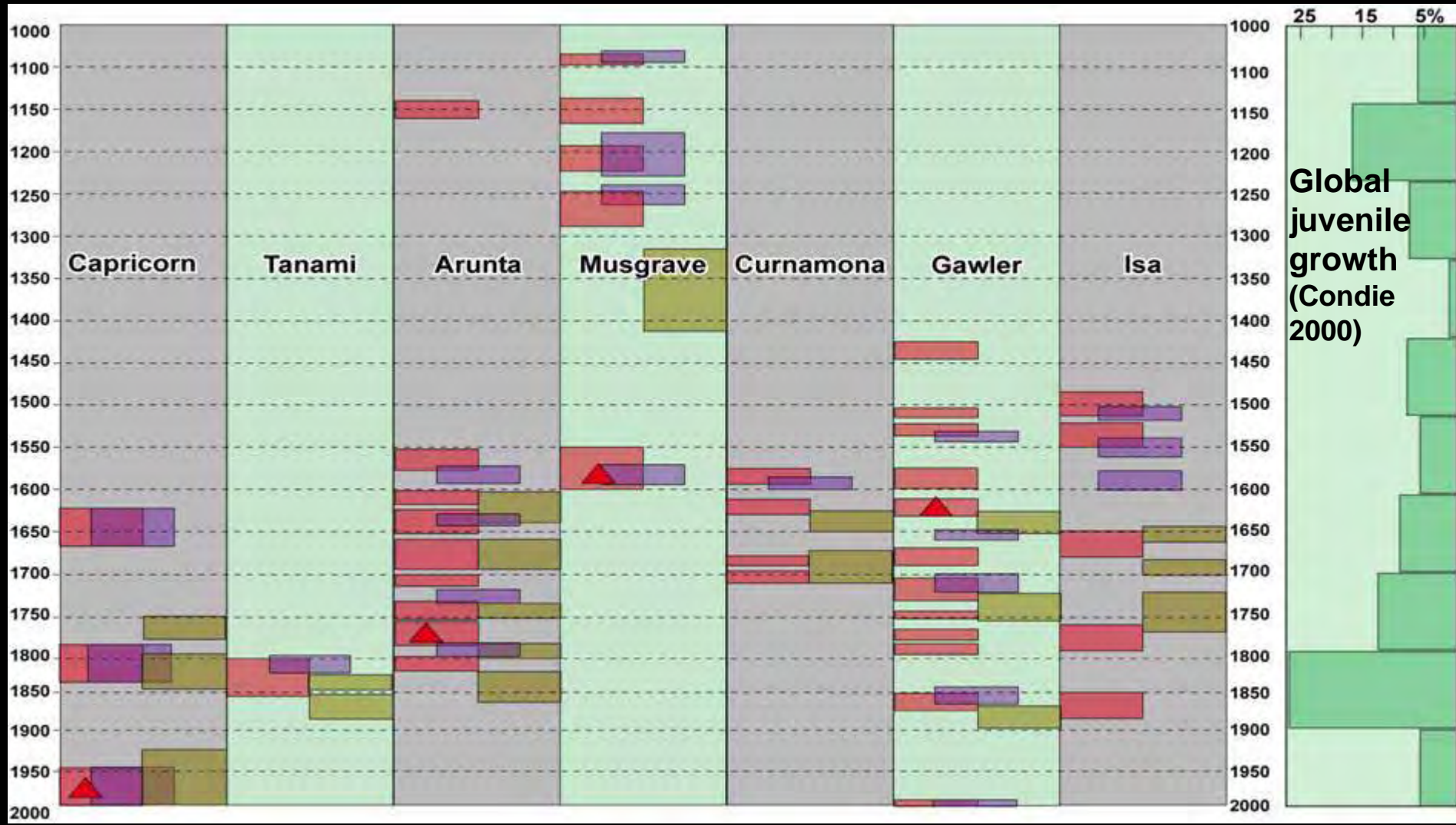
### Post Hiltaba tectonism – 1550 Ma

- Regional high-grade tectonism in the northern Gawler. Reworks rocks 1.74-1.72 Nawan packages affected by the Kimban.
- High-grade metamorphism in the Fowler Belt.
- Regional-scale transpressional zone systems driving deep exhumation of crustal rocks.



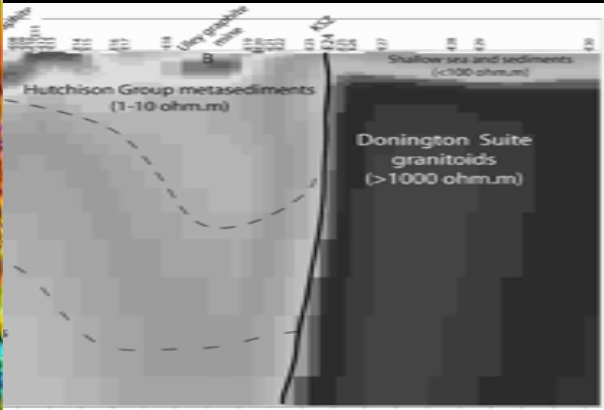
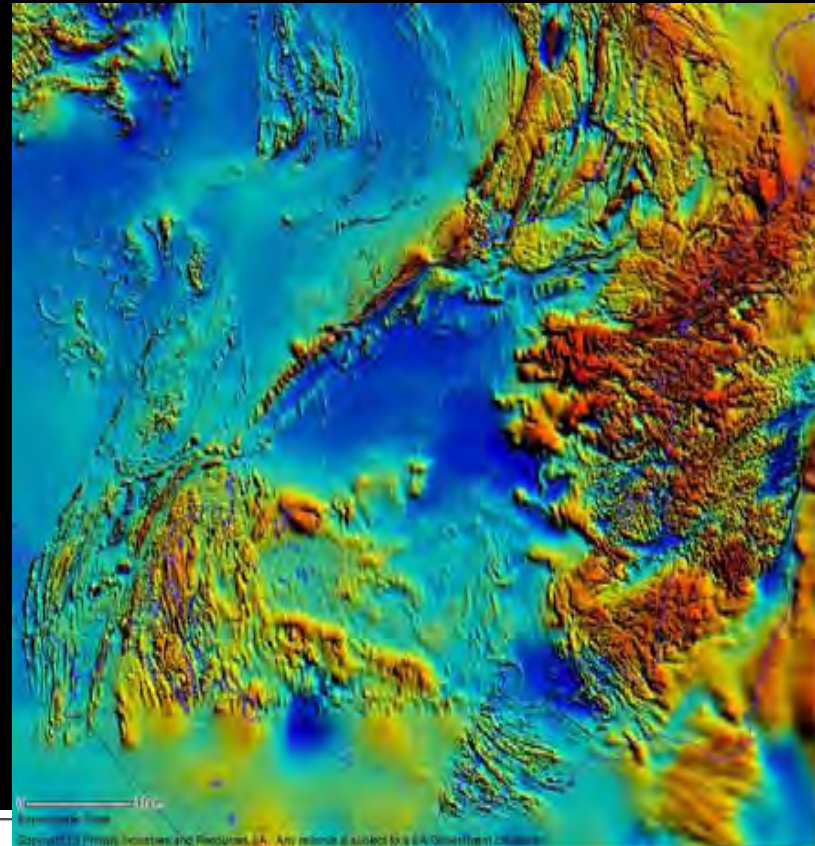
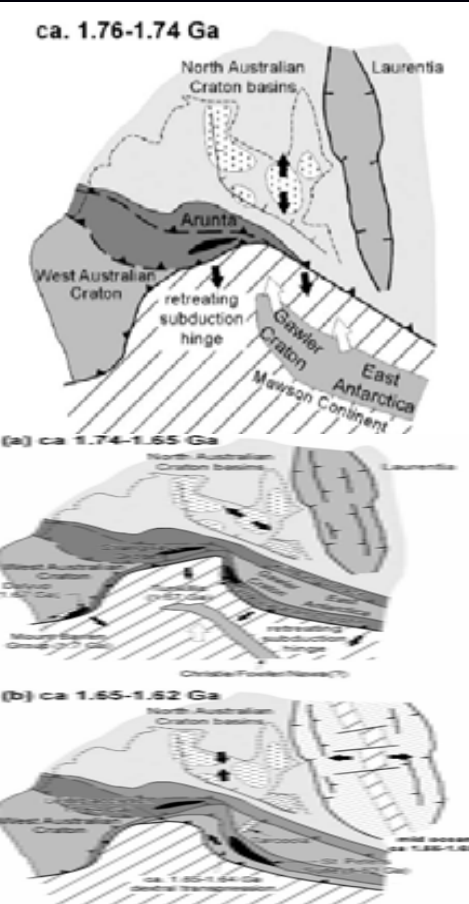
# Towards a tectonic framework for the Gawler Craton

What does it all mean, and why and how did it happen?

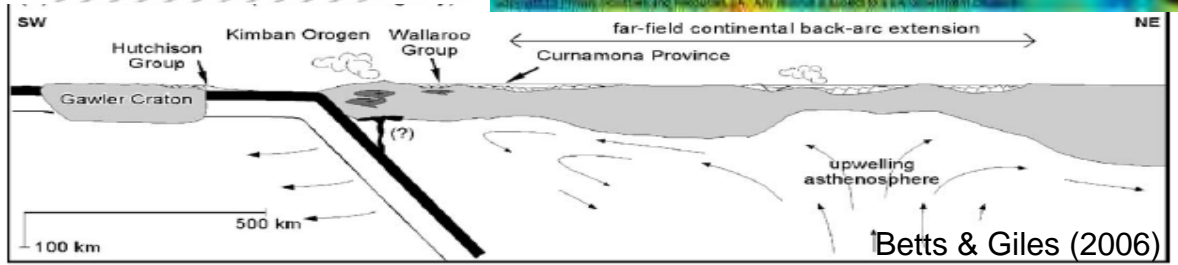


# Towards a tectonic framework for the Gawler Craton

## Sutures and Plates....fact or wishful thinking?



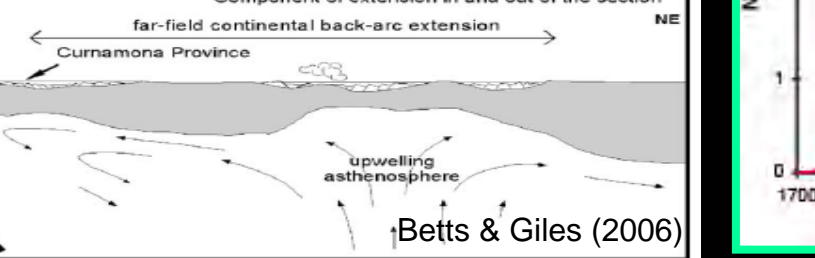
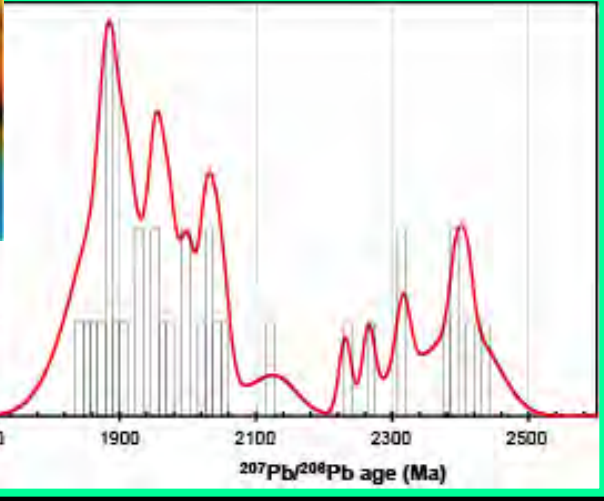
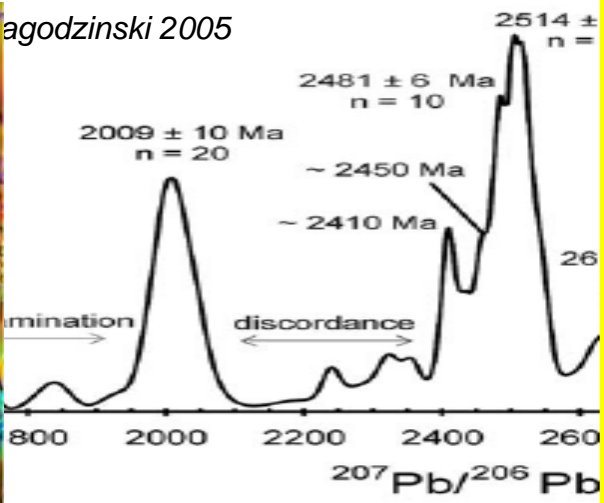
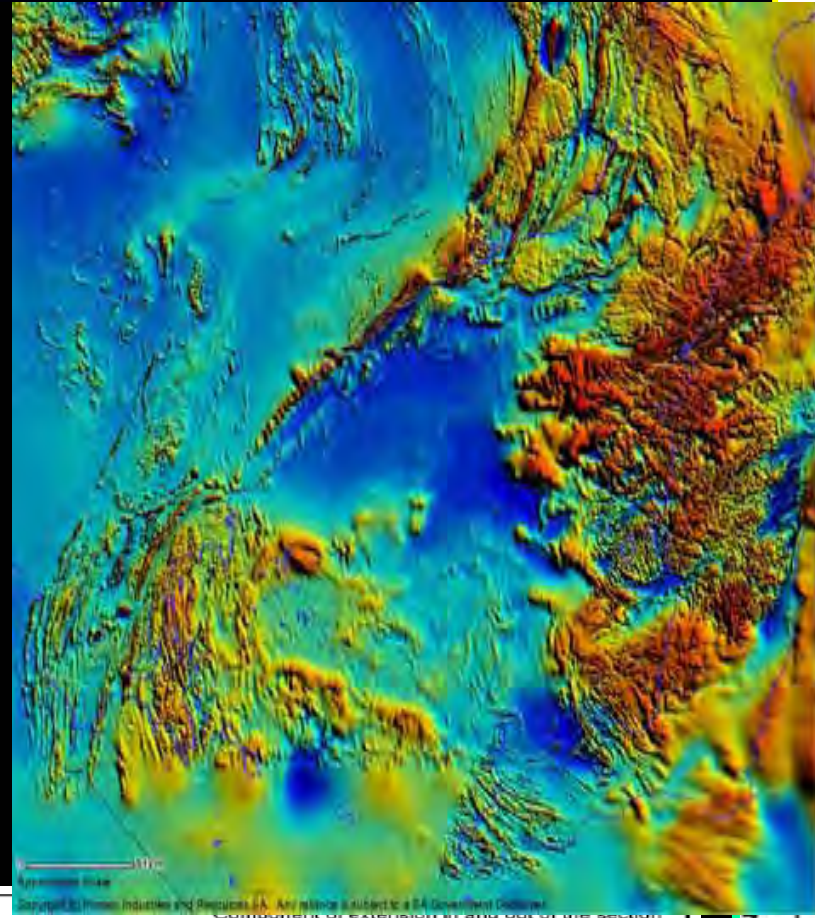
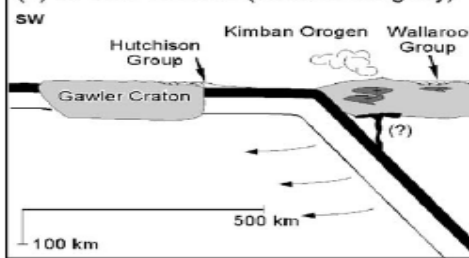
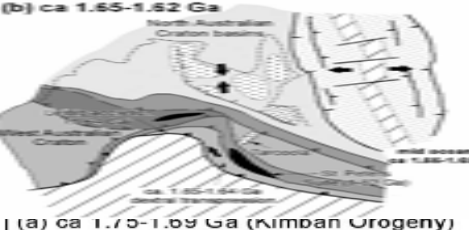
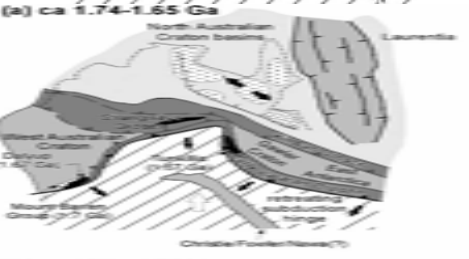
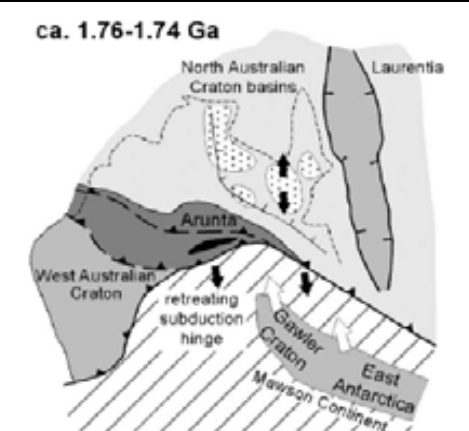
Theil et al., (2005)



Betts & Giles (2006)

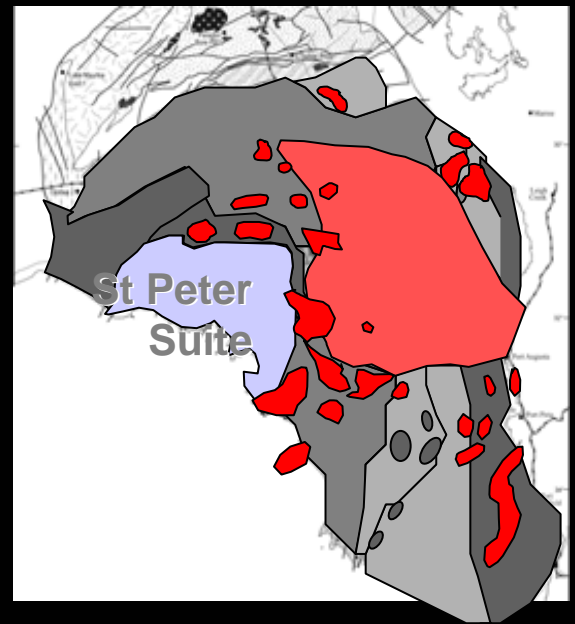
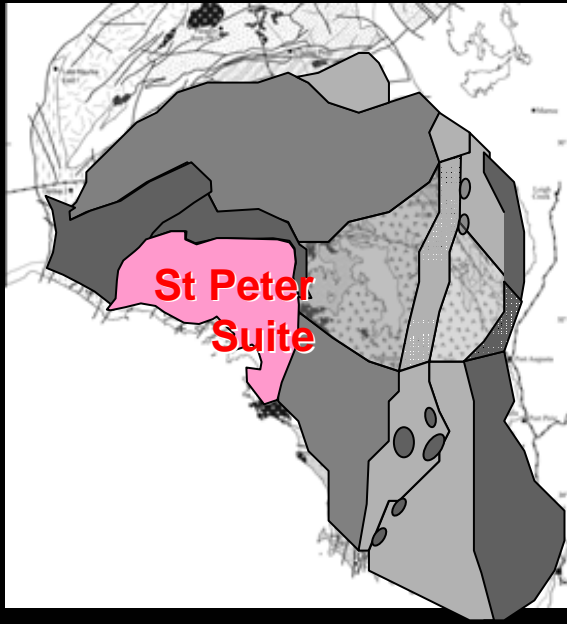
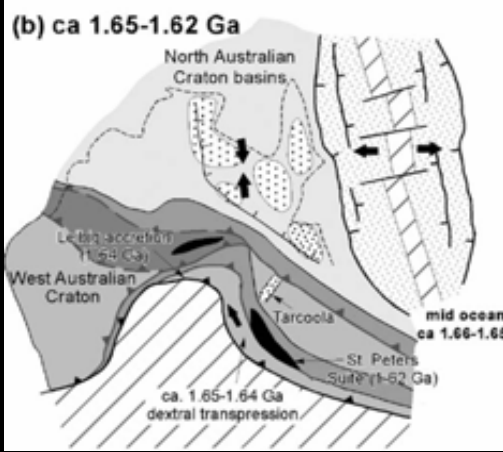
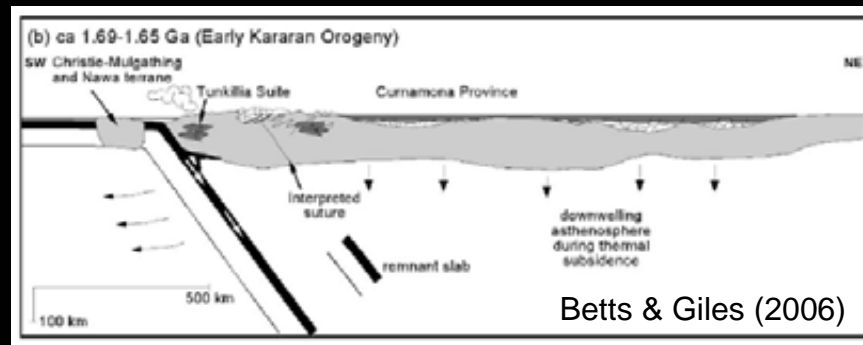
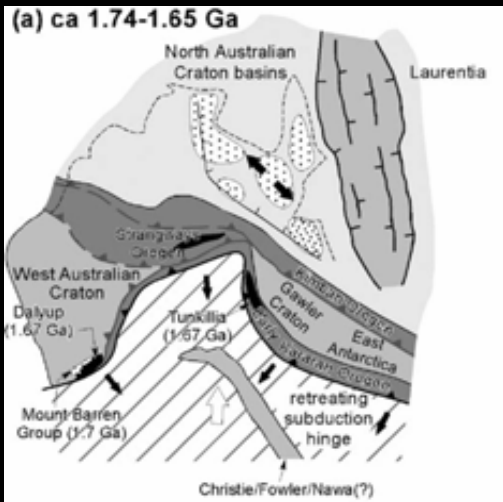
- Rock systems east of the “Kimban front” belong to the north Australia Craton.
- Olympic Cu-Au province affinities with the NAC
- Central Gawler Au...

# Towards a tectonic framework for the Gawler Craton



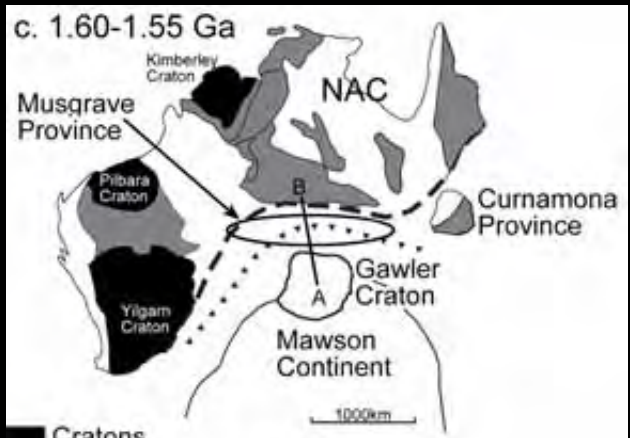
# Towards a tectonic framework for the Gawler Craton

Sutures and Plates...fact or wishful thinking?

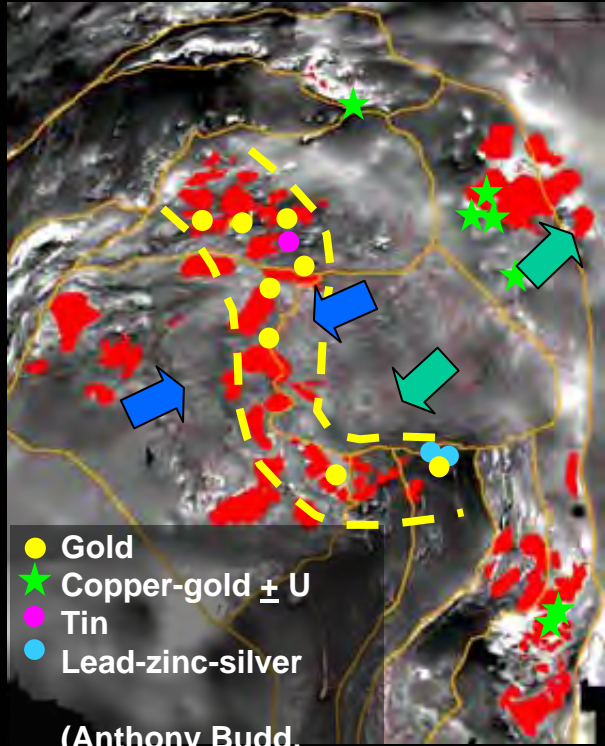
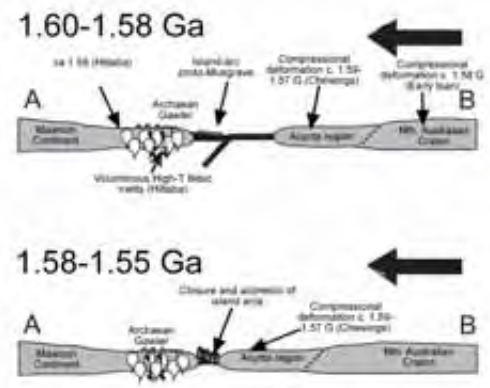


# Towards a tectonic framework for the Gawler Craton

Sutures and Plates...fact or wishful thinking?



Wade et al., (2006)



(Anthony Budd, 2002)

Is there a Hiltaba Suite subduction link?

Is there a mantle connection?

Are there large-scale fluid systems?

# Towards a tectonic framework for the Gawler Craton

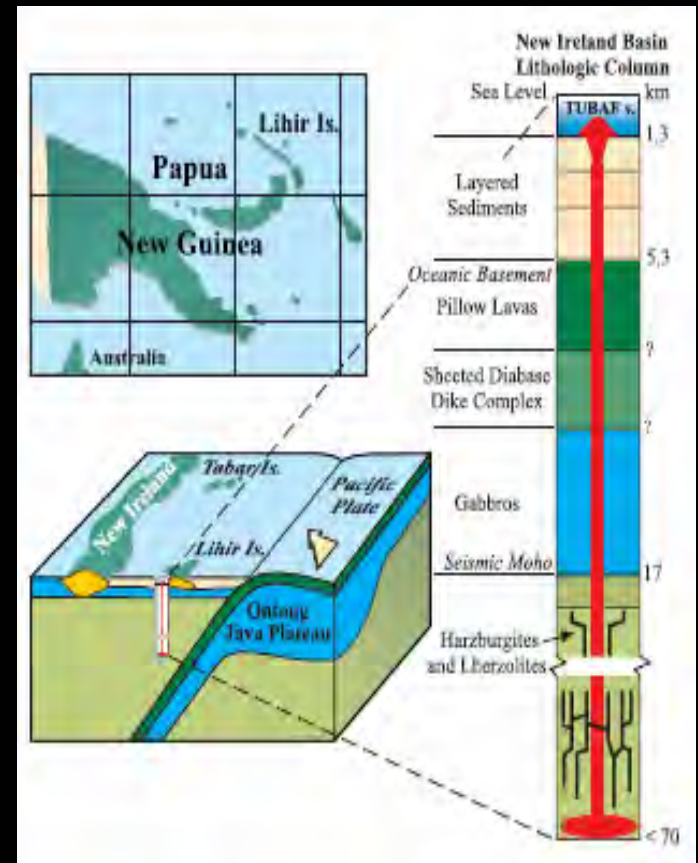
Where does the metal come from in big deposits?

**Ladolm Au deposit: 45 million ounces**

Metasomatised (from slab fluids) mantle xenoliths beneath the deposit are 2 to 800 times more enriched in Cu, Au, Pt and Pd compared to the surrounding depleted arc mantle.

Au ores from Ladolm have similar Os isotope compositions to the metasomatised Au-rich mantle.

The Au et al comes from the Mantle and is transported in fluids.



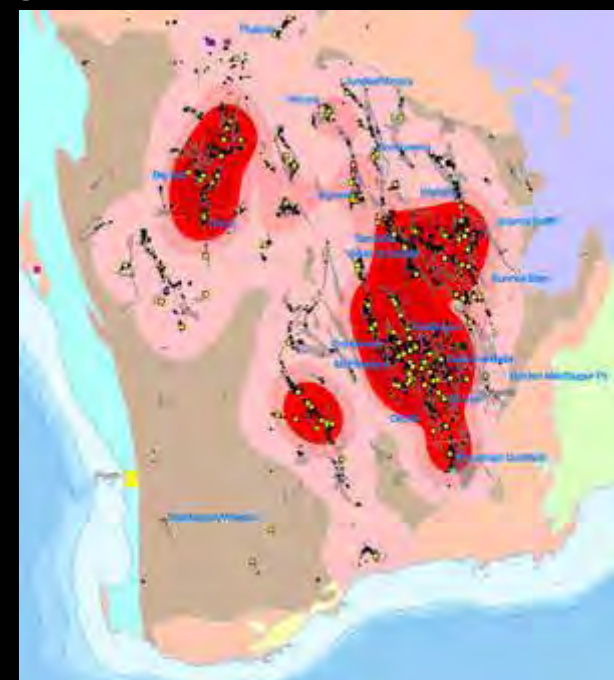
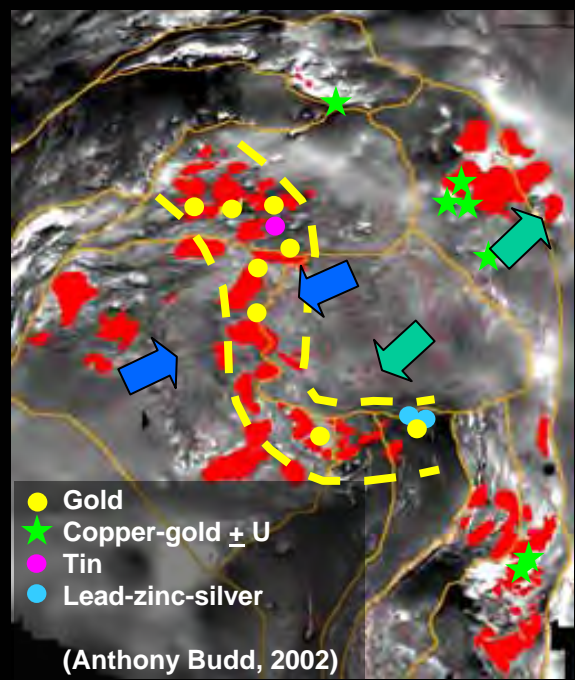
# Towards a tectonic framework for the Gawler Craton

Where does the metal come from in big deposits?

**Ladolm Au deposit: 45 million ounces**

The Au-Cu etc comes from the Mantle.

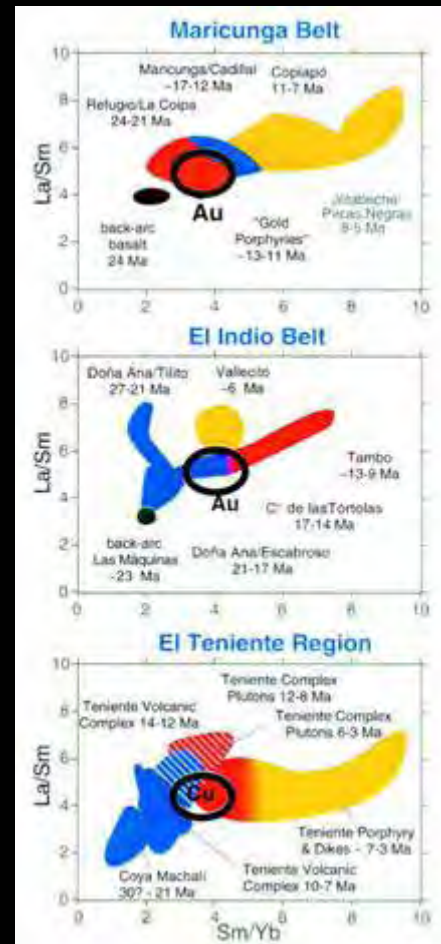
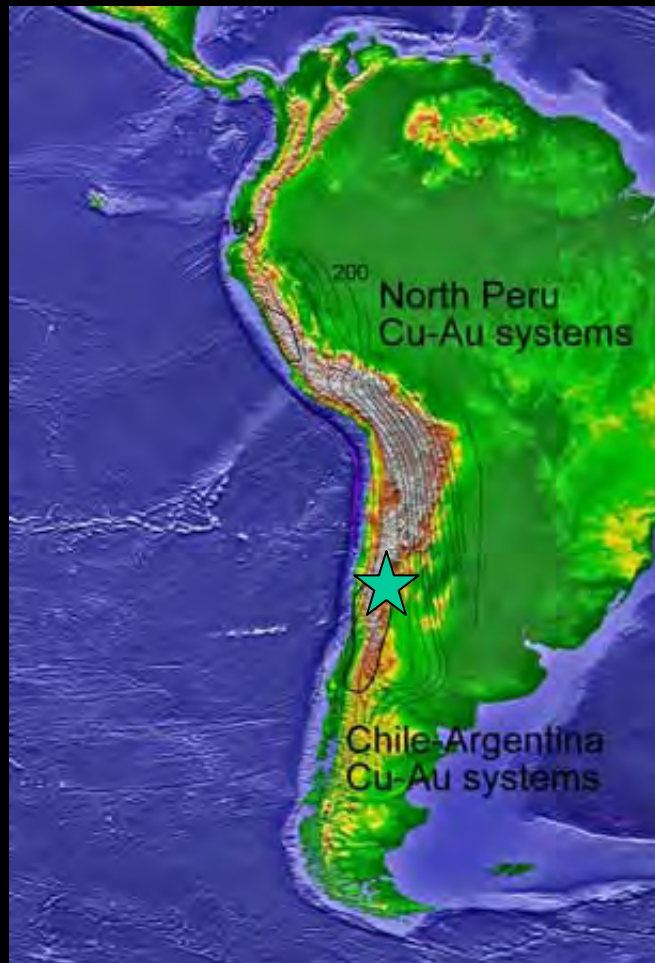
Yes.....that's stating the obvious, but....



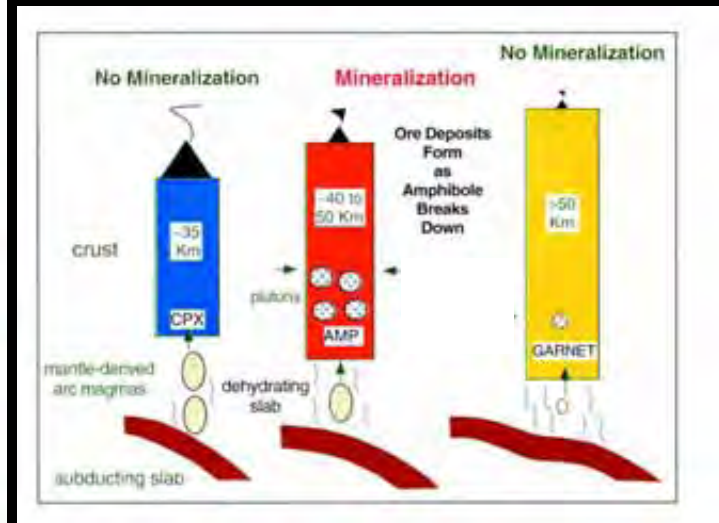
In both the Yilgarn and the Gawler Au (+Cu) post date major fluid/tectonic systems.

# Towards a tectonic framework for the Gawler Craton

If the mantle is the key player how might crustal fluid systems get involved?



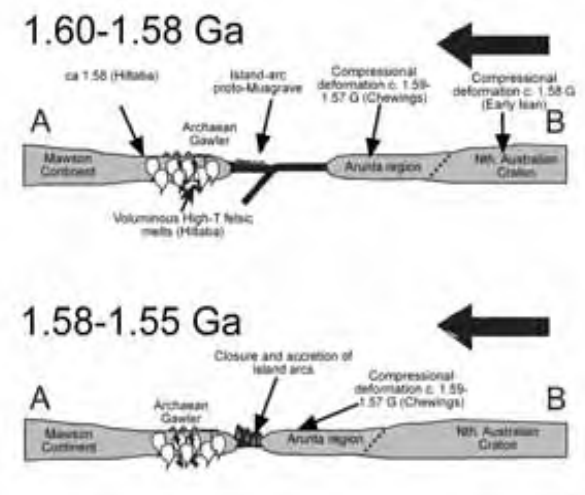
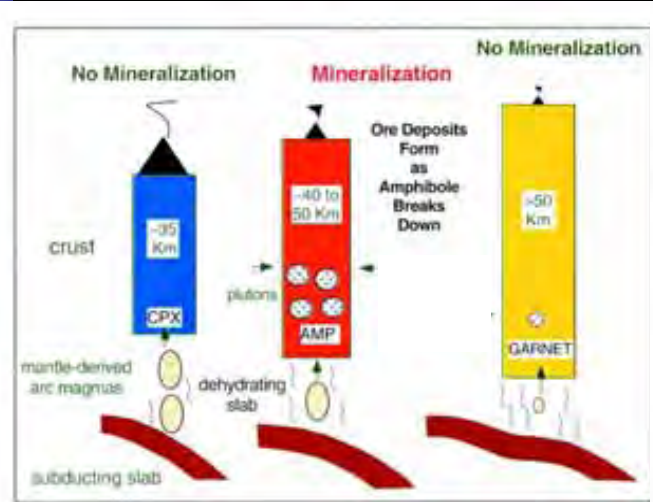
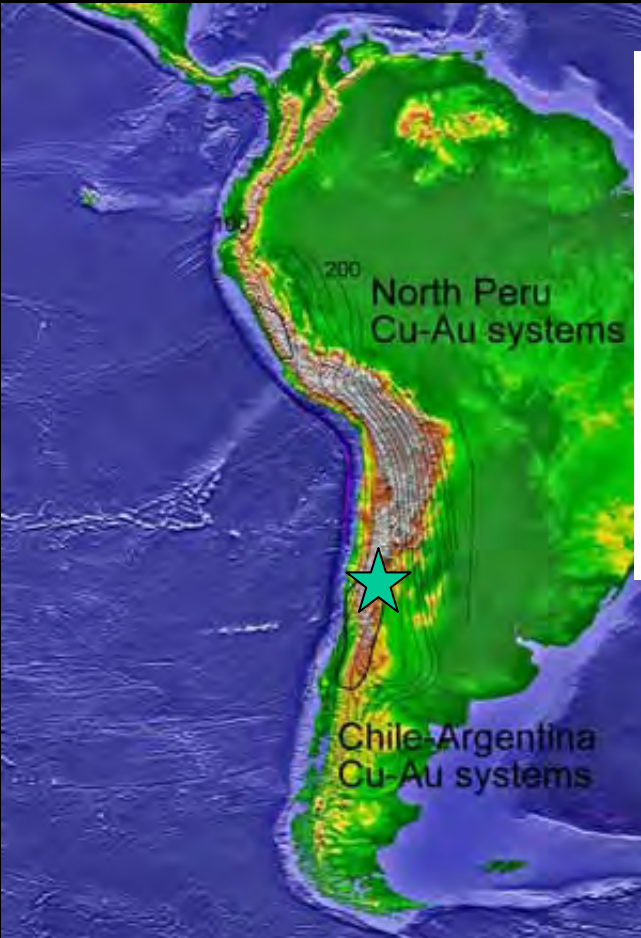
Granitic melts that bracket the mineralising events show a smooth evolution in REE composition, reflecting involvement of dehydrating lower crust.



# Towards a tectonic framework for the Gawler Craton

If the mantle is the key player how might crustal fluid systems get involved?

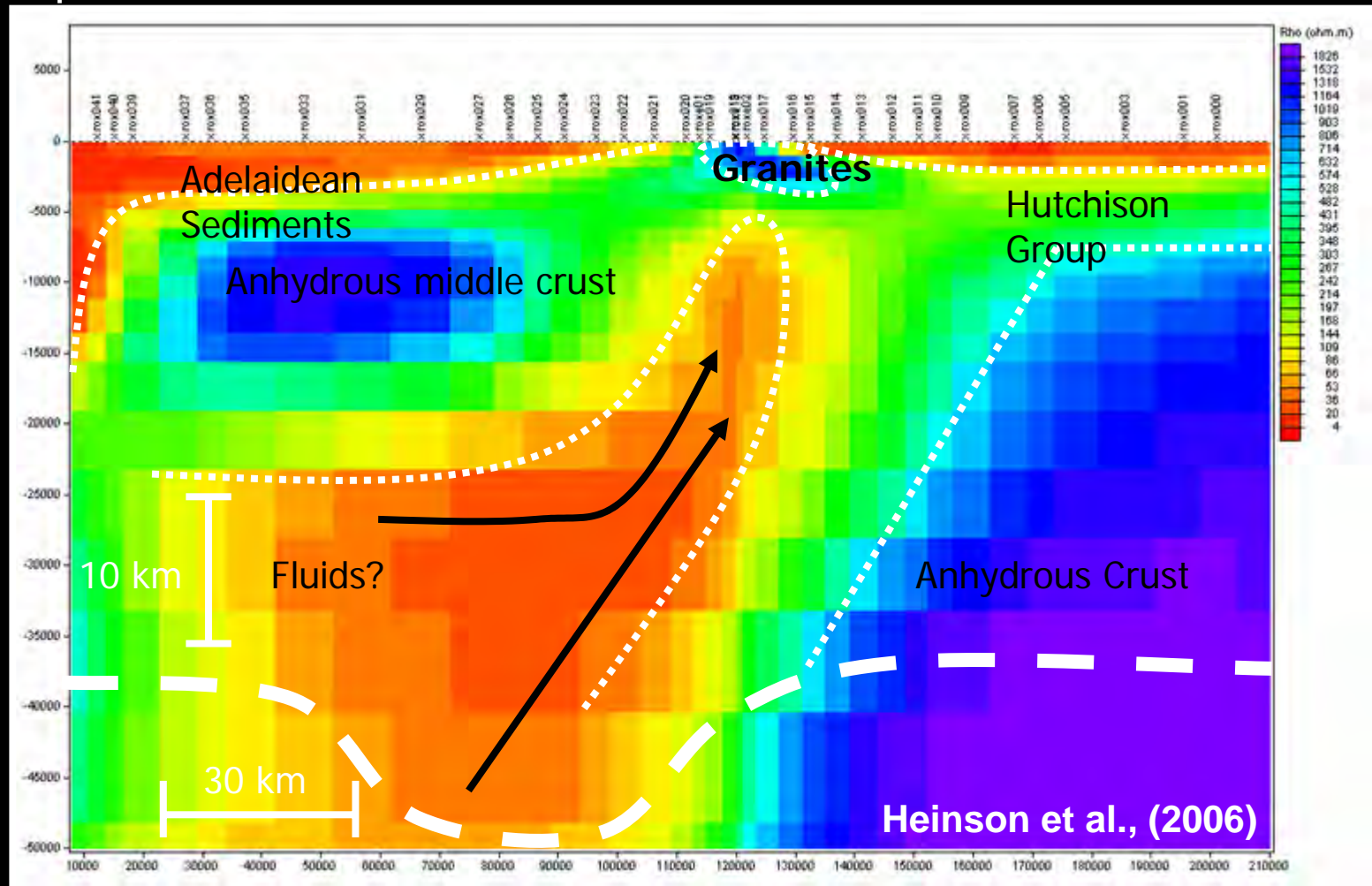
Forget South America: think Gawler



- The key ingredients are:
- (1) Hydrated mantle.
  - (2) Hydrous minerals in the lower crust.
  - (3) Metals in the bottom of the system.
  - (4) A process that dehydrates the lower crust.

# Towards a tectonic framework for the Gawler Craton

Crustal-scale electrical anomaly under Olympic Dam: Was it caused by a lower crustal derived metal-bearing fluid – driven by the Hiltaba mafic underplate?



# Towards a tectonic framework for the Gawler Craton



1. Major basin(s) system 1760-1720 Ma in the eastern and northern Gawler, in part derived from a source region that has affinities with lower Willyama sources -> Northern Australian Craton?
2. The role of plate margin processes.....? Well the St Peter Suite looks like an arc system, however sutures and even polarity remain unclear.

For mineralisation

Fertile regions: tectonics that lead to hydration of lower crust and upper mantle.

Need a tectonic regime that leads to large-scale deeply-derived fluid systems.

Understand which structures were active during dehydration events and where major boundaries exist in terrains.

Image those systems geophysically, and look for crust-mantle connections where rehydration processes are likely to have occurred.