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Regional guides to mineralisation in the Olympic Cu-Au province

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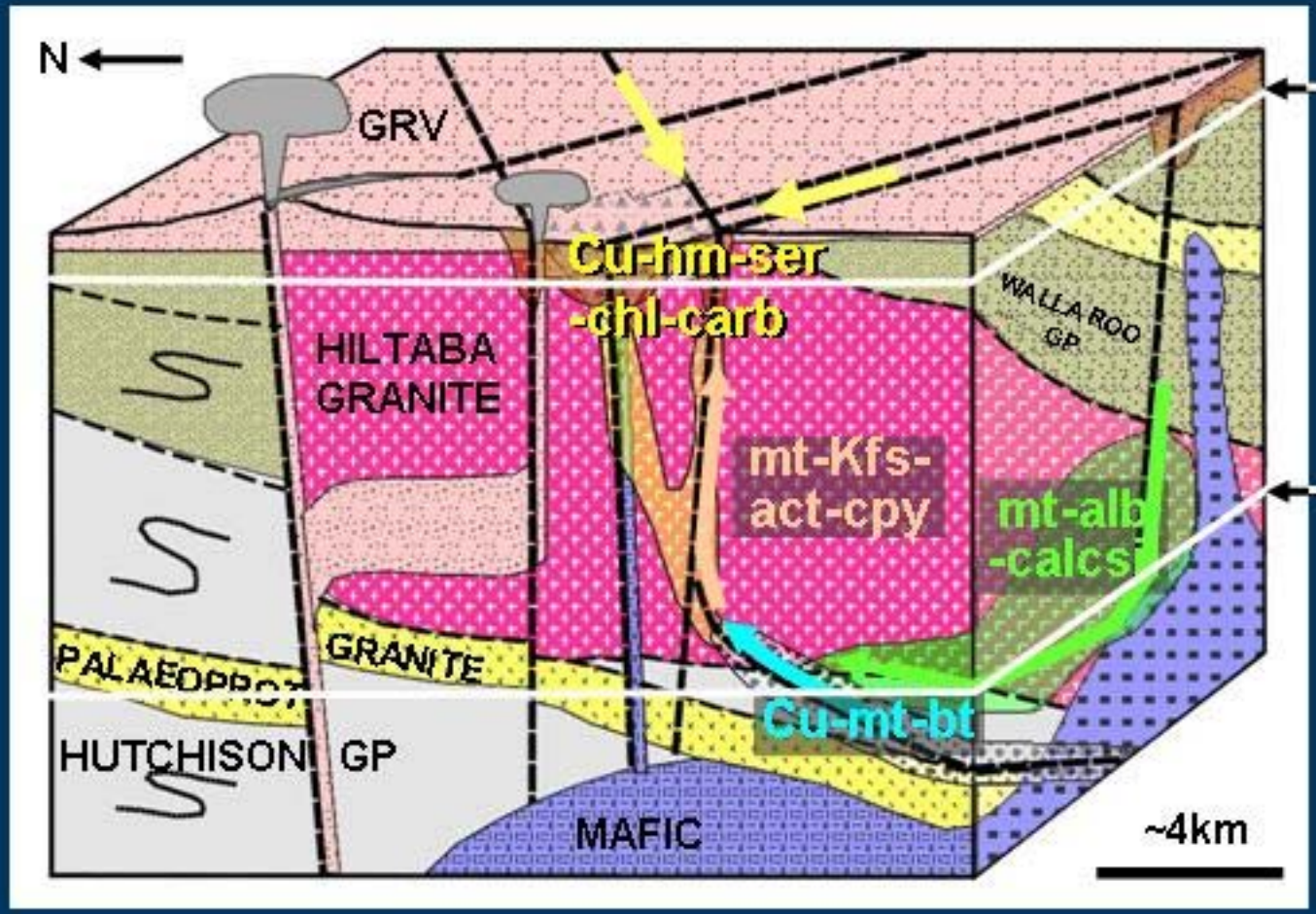
Geoscience Australia

Gawler Craton: State of Play 2004

This talk -

4 Regional Guides for targeting high-level style IOCG mineralisation

High-level & deeper-level IOCG systems in the Olympic Cu-Au province



(From Skirrow et al., 2002)

What's new since GCSoP 2002?

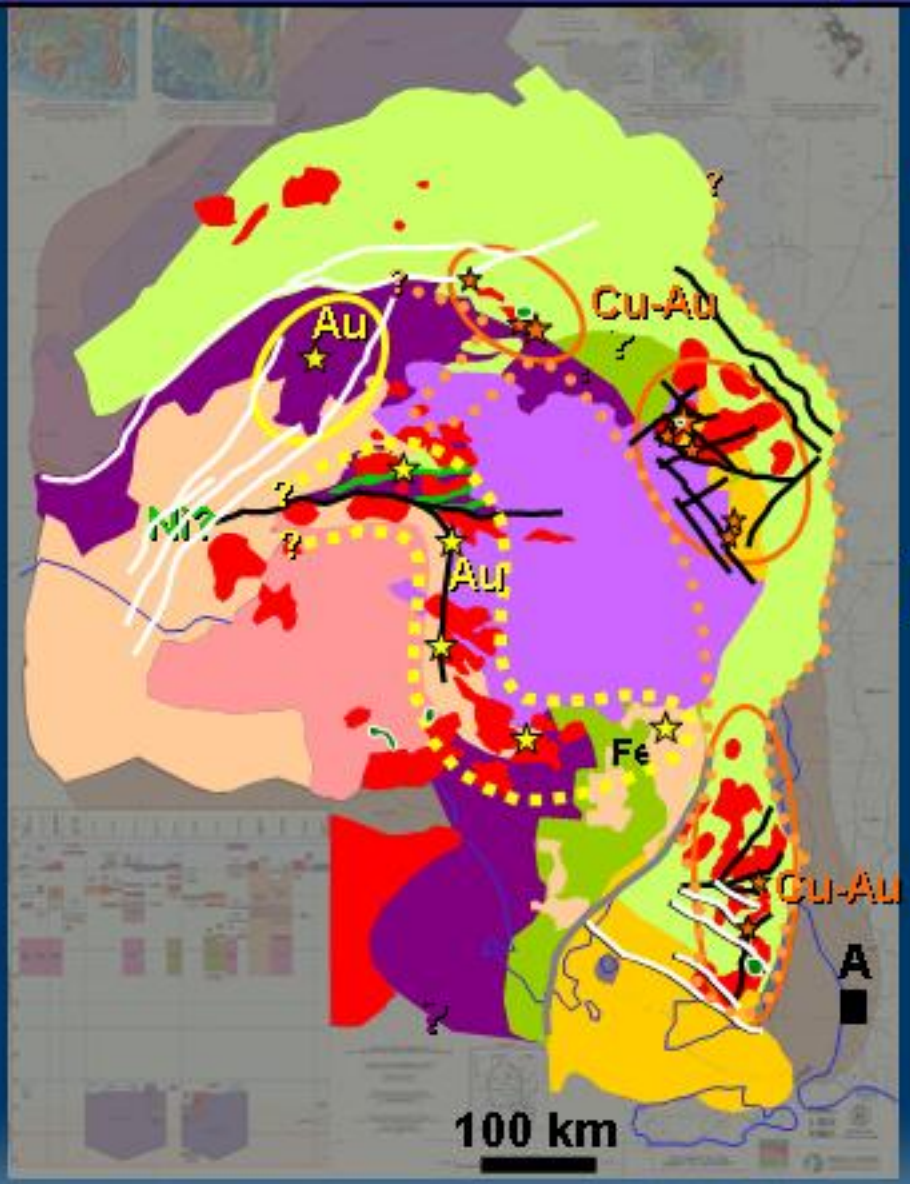
- Inversion modelling, including alteration
- Seismic past OD
- More geochronology on alt'n/mineralisation
- Oxygen, hydrogen, sulfur isotope data
- More Sm-Nd isotopic data

Guide 1.

Mafic intrusions assoc with Hiltaba Suite & Gawler Range Volcanics

- symptoms of the thermal anomalies that drove hydrothermal systems
- possible sources of *some* metals, sulfur

1. How do we conclude 1580-1600 Ma magmatism was important for IOCG? Spatial associations . . .



~1590 Ma: Gawler Range Volcanics (bimodal)

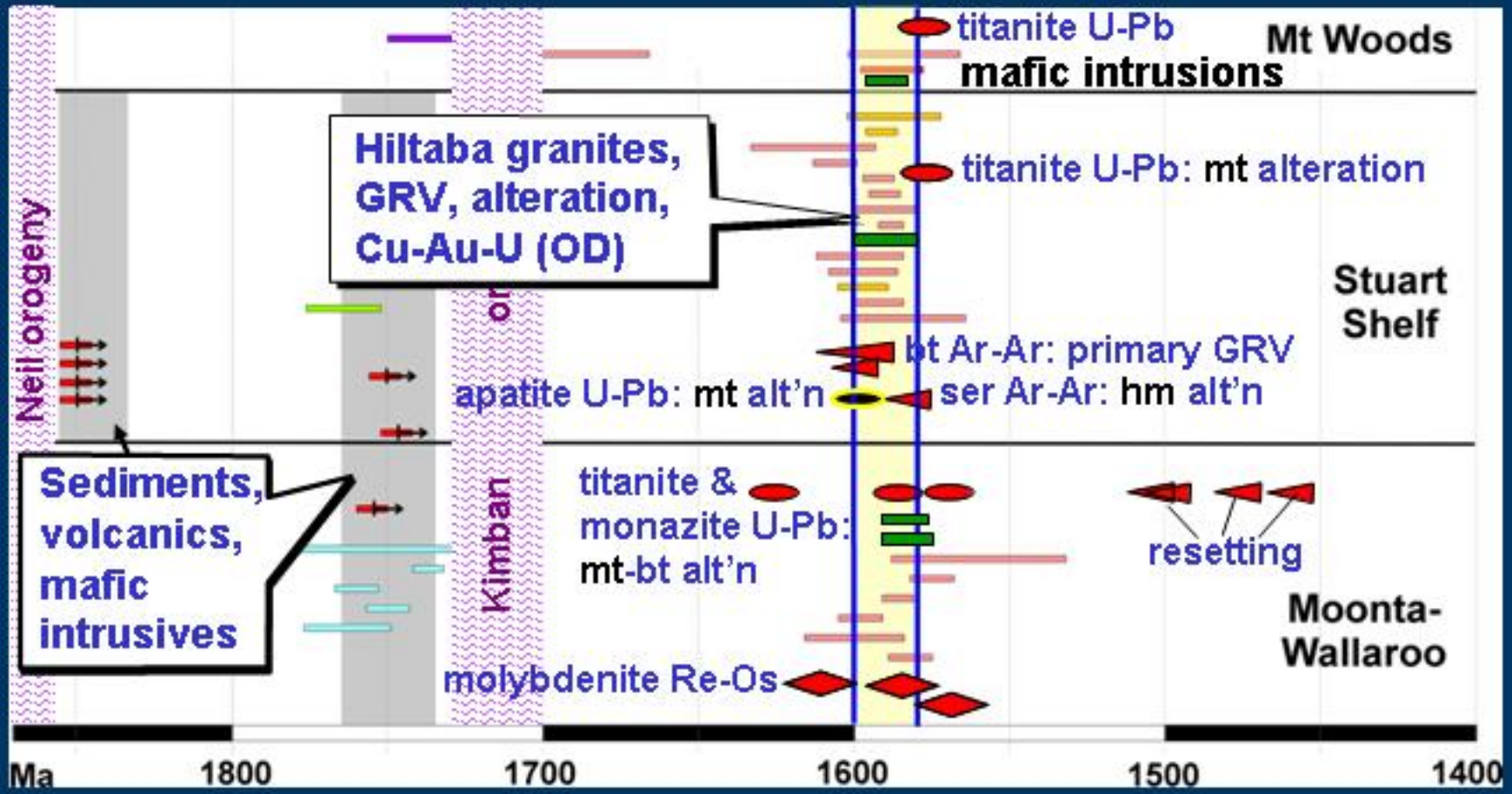
~1590-1575 Ma: Hiltaba Suite granitoid and mafic intrusions; faults

~1590 Ma: Olympic Cu-Au province; **3+ 'footprints'**

~1590-1580 Ma: Central Gawler Au province

~1530-1450 Ma: shear zones

1. How do we conclude 1580-1600 Ma magmatism was important for IOCG? Temporal associations . . .

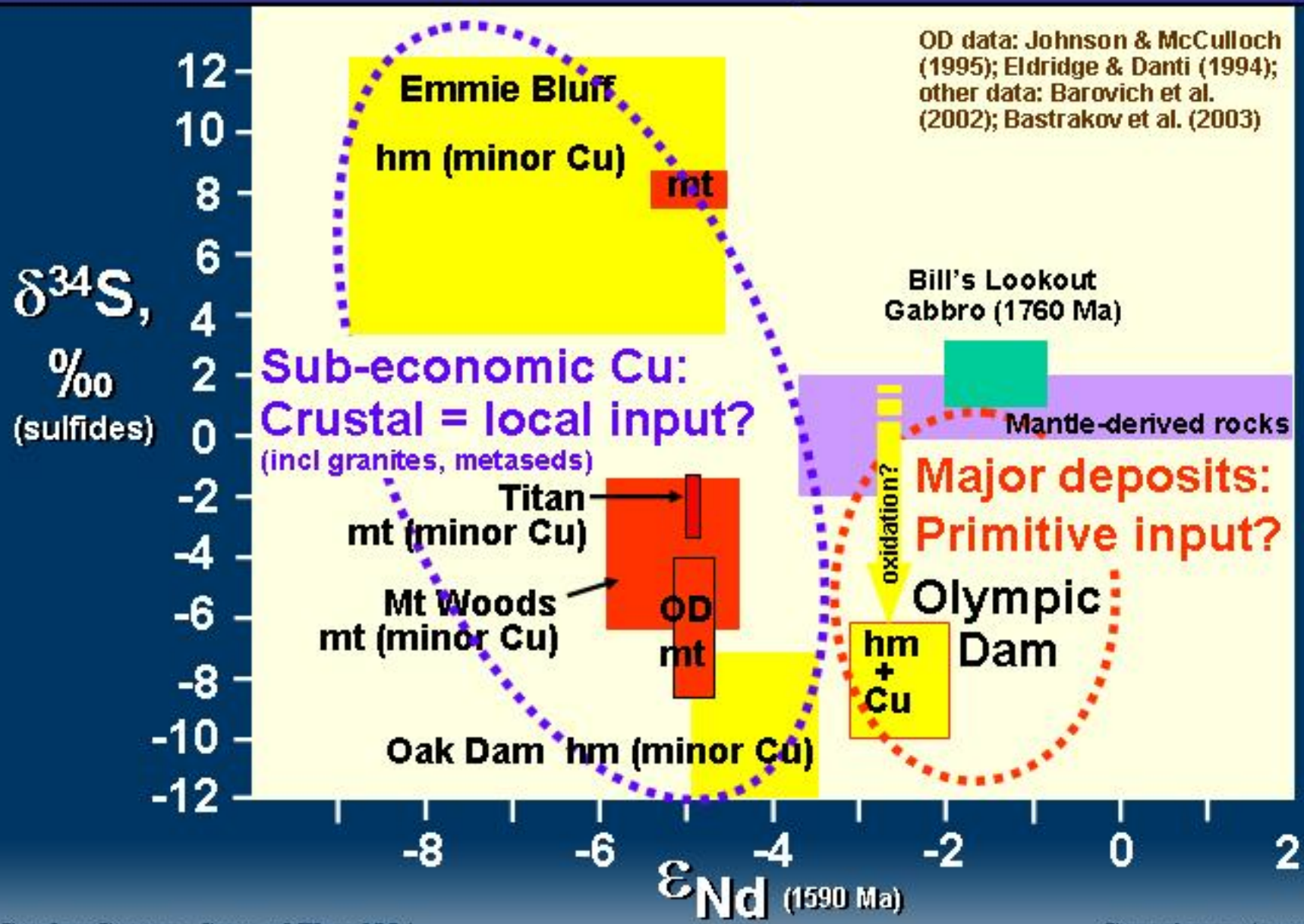


Time, Ma

(new results in red; ◀ = Ar-Ar, other data: U-Pb & Re-Os)

(E. Jagodzinski, G. Fraser, O. Raymond, R. Skirrow, E. Bastrakov)

1. How do we conclude *mafic* magmatism was important for IOCG? Isotopes . . .



But -

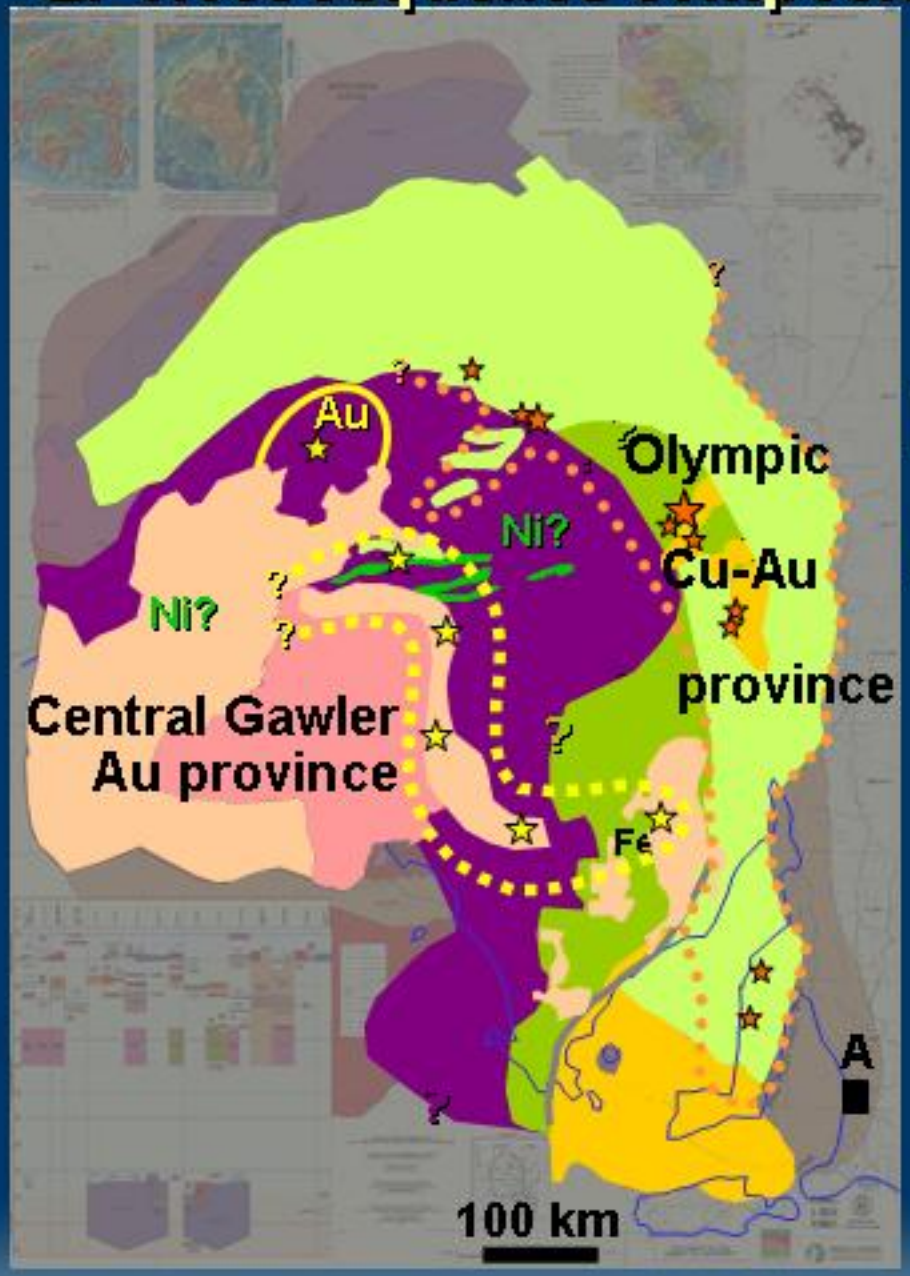
- Mafic & felsic igneous rocks/magmas were *NOT* the only possible sources of metals, sulfur, fluids
- Oxygen-hydrogen-isotope and fluid inclusion data suggest significant contributions from the host meta-sedimentary sequences.

Guide 2.

Regional host sequence:

- **Olympic Cu-Au province**: oxidised, feldspathic; minor carbonate, BIF, graphite
- **Central Gawler gold province**: granitoids; graphitic metaseds; Archaean gneiss & greenstones – more reduced?

2. Host sequence composition as a guide to IOCG



- 2900?-2520 Ma: Archaean seds, volcs, incl. komatiites
- Au mineralisation, pre- or syn-2440 Ma metamorphism
- <2000-1850 Ma: BIF, carbonates, siliciclastics
- 1850 Ma: granitoids, syn-orogenic
- <1850-1740 Ma: siliciclastics, felsic volcs, BIF, rare graphite
- ~1720-1670 Ma: granitoid and mafic intrusions, syn-orogenic shear zone – Kimban Orogeny
- ~1620 Ma: I-type granitoids

Guide 3.

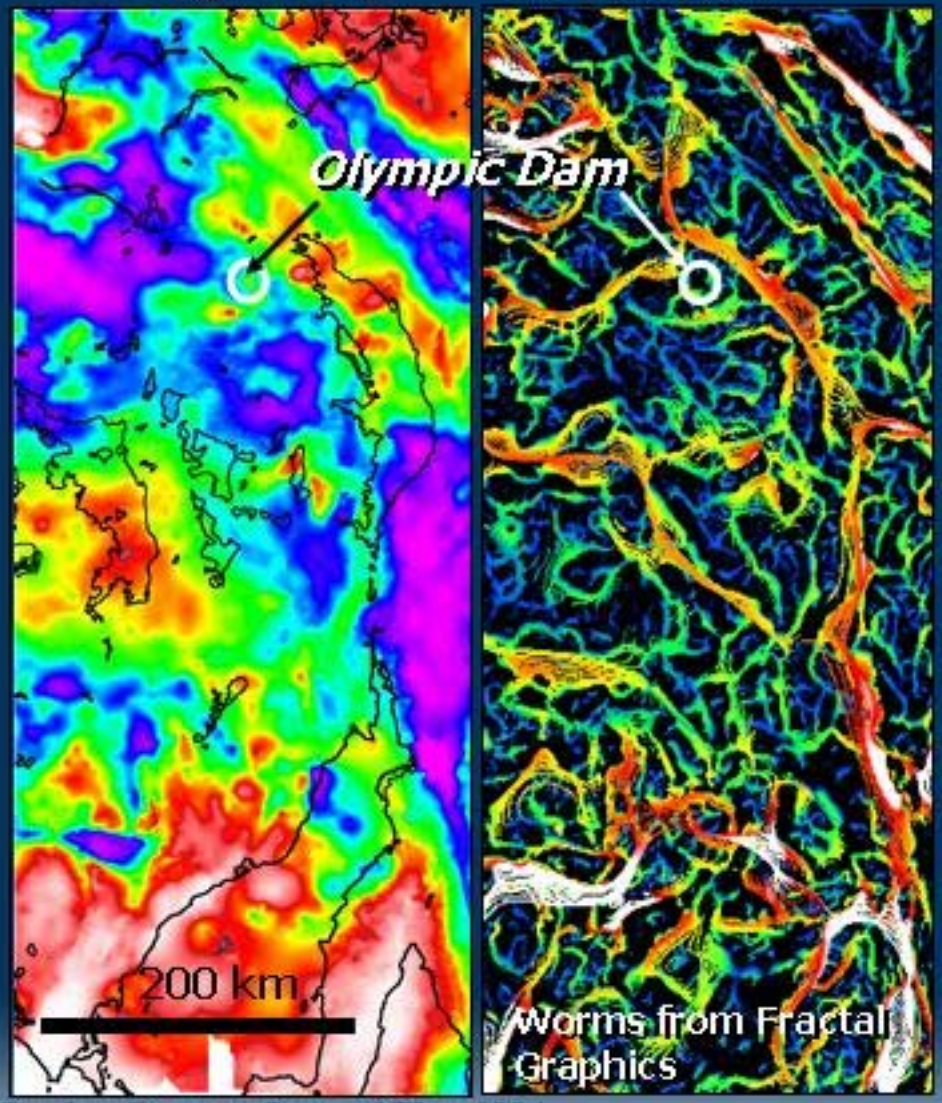
Major fault networks:

- NW-WNW & NE sets controlled fluid flow at ~1570-1600 Ma

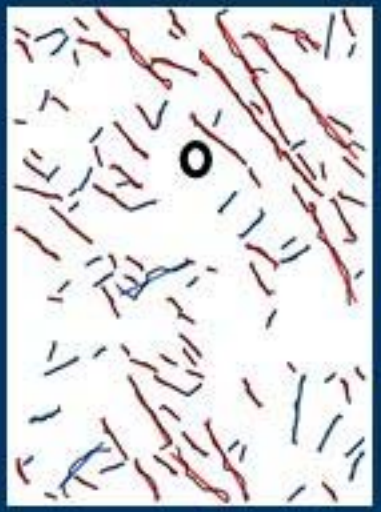
3. Crustal-scale fault network – Olympic Cu-Au prov.

OCGP gravity

Gravity edges or 'worms'



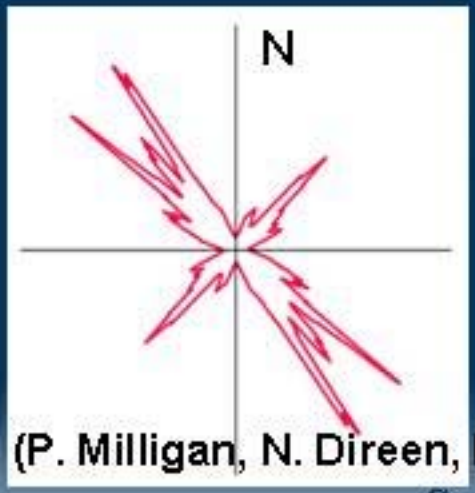
Structure - conjugate NW & NE worm/fault network



NW edges: red

NE edges: blue

(major structures only)

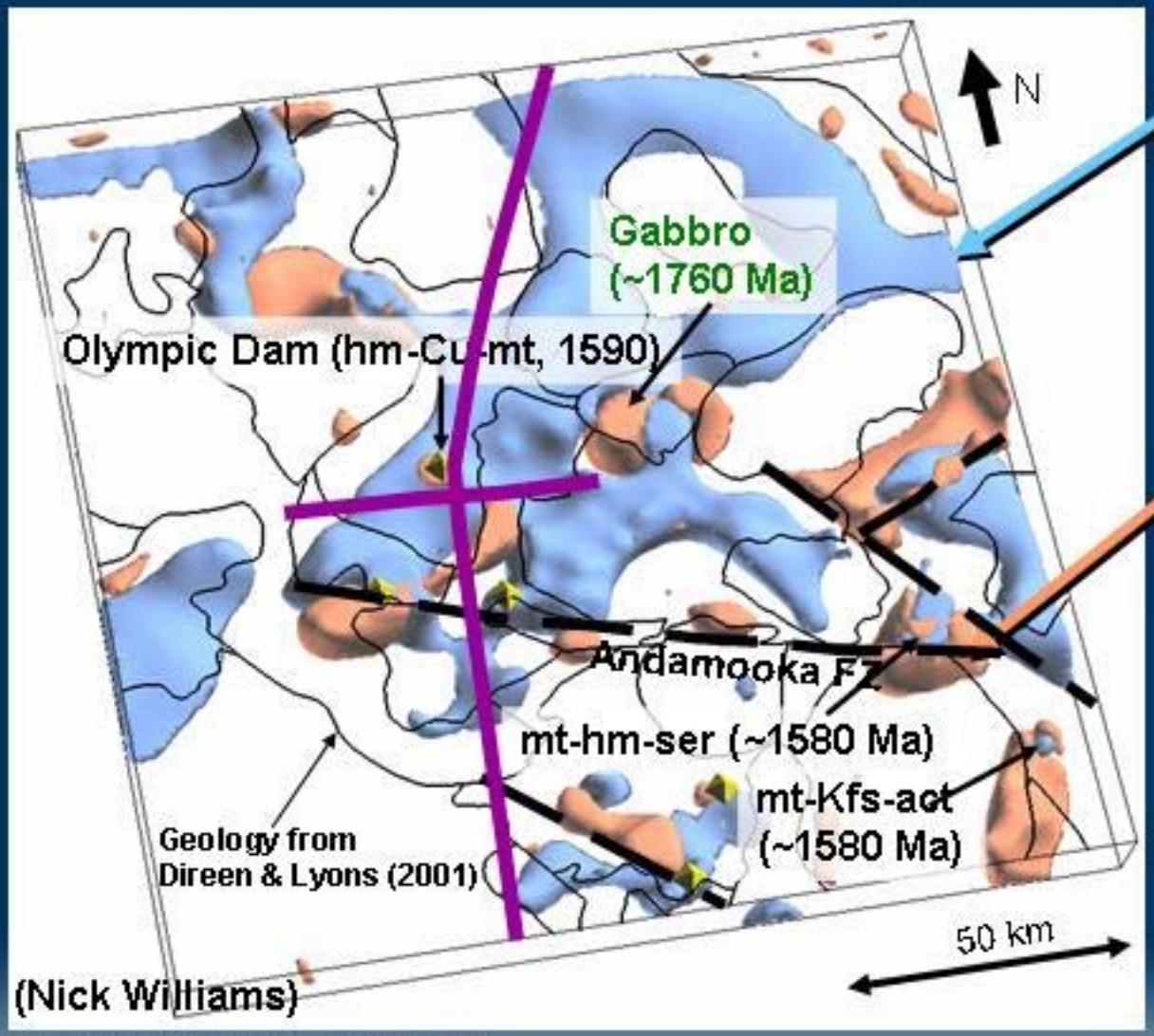


Edge azimuth histogram

(P. Milligan, N. Direen, P. Lyons)

3. Crustal-scale fault network – Olympic Cu-Au prov.

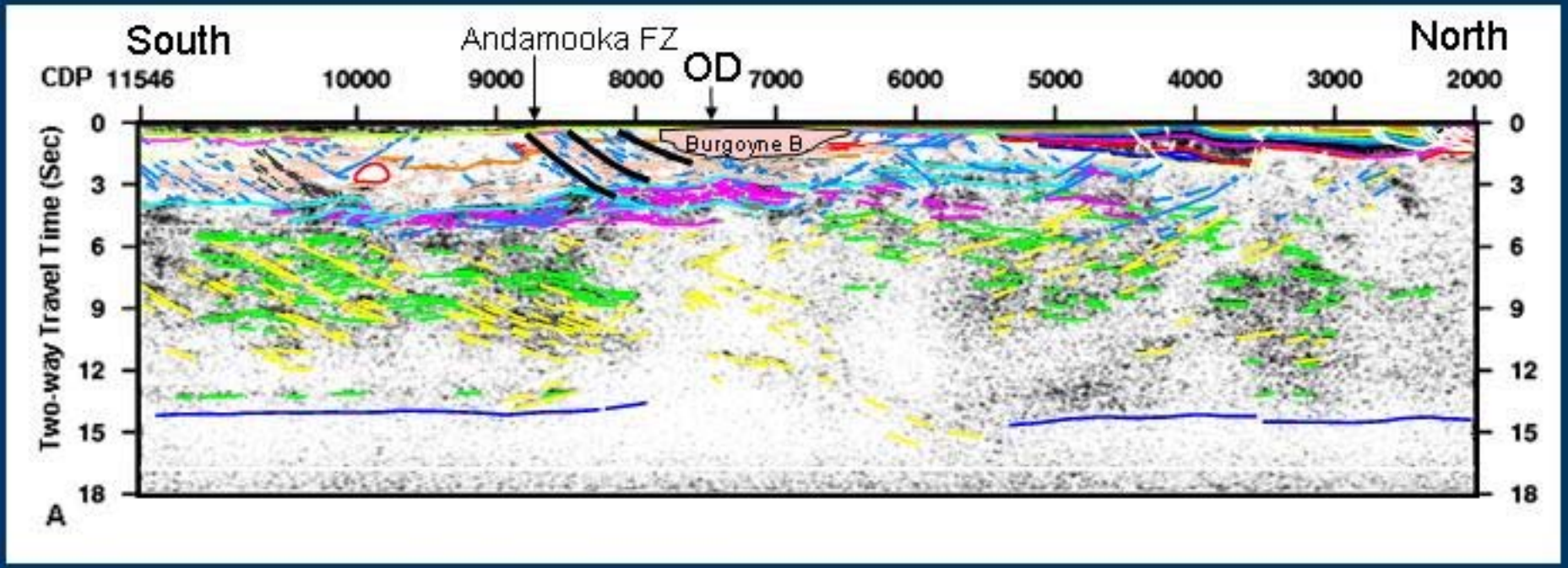
Inversion of magnetic & gravity data: magnetite & hematite alteration along 1580-1590 Ma faults?



>1% "magnetite" (includes all susceptible minerals as their magnetite equivalent)

>1% "haematite" (includes haematite, sulphides, amph/px, and remanent magnetism)

3. Seismic section (~190 x 35 km)

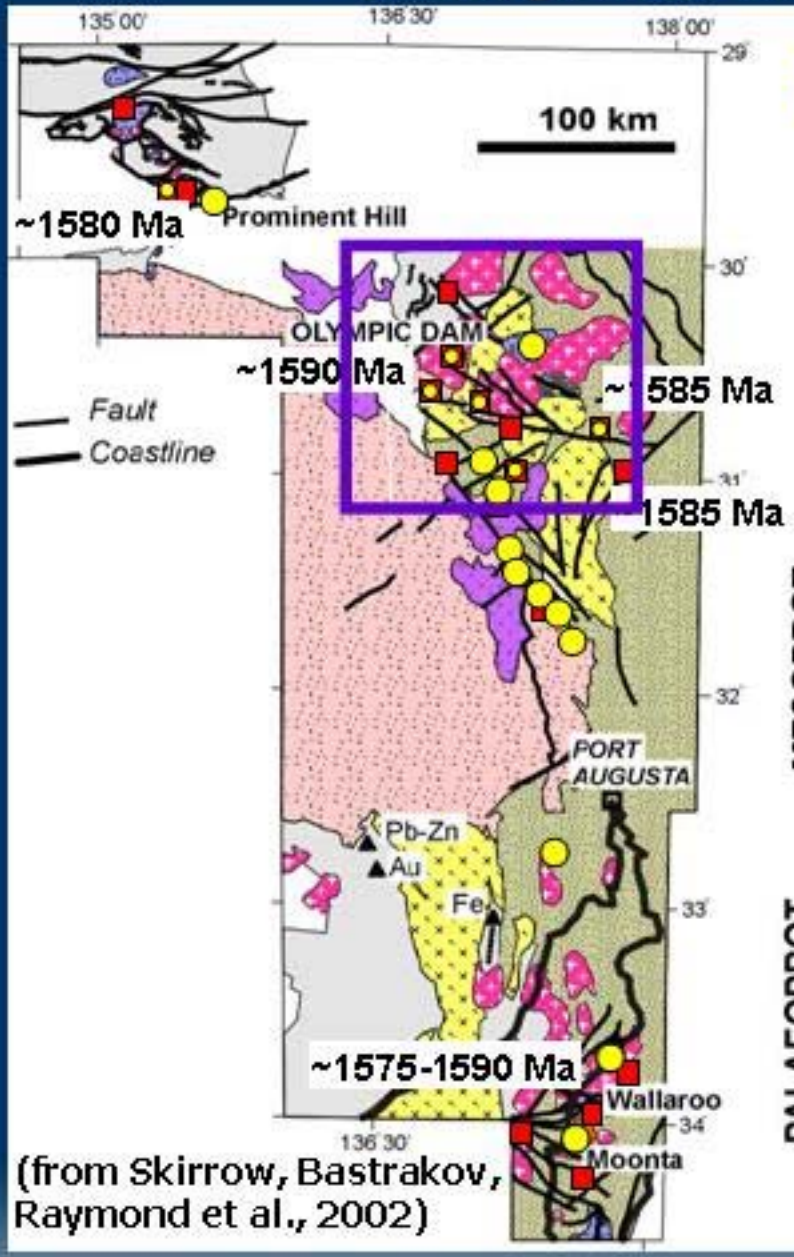


- **Burgoyne batholith: <5km thick**
- **Andamooka FZ: dips north, marks a change in crustal structure between north & south zones; re-activated Kimban structures?**
- **These structures may have been part of plumbing system for IOCG systems in the region, based on inversion models**

Guide 4.

Regional and local alteration

4. Regional and local alteration



Olympic Cu-Au province

- Magnetite – alk feld – calcsil
  Magnetite – biotite ± Cu-Au
- Hematite – ser – chl – carb
  ± Cu-Au-U
- Hm overprinting magnetite

MESOPROT.

- Hiltaba Suite granitoid (1595-1570 Ma)
  Mafic intrusions
- Gawler Range Volcanics
- Mafic Gawler Range Volcanics

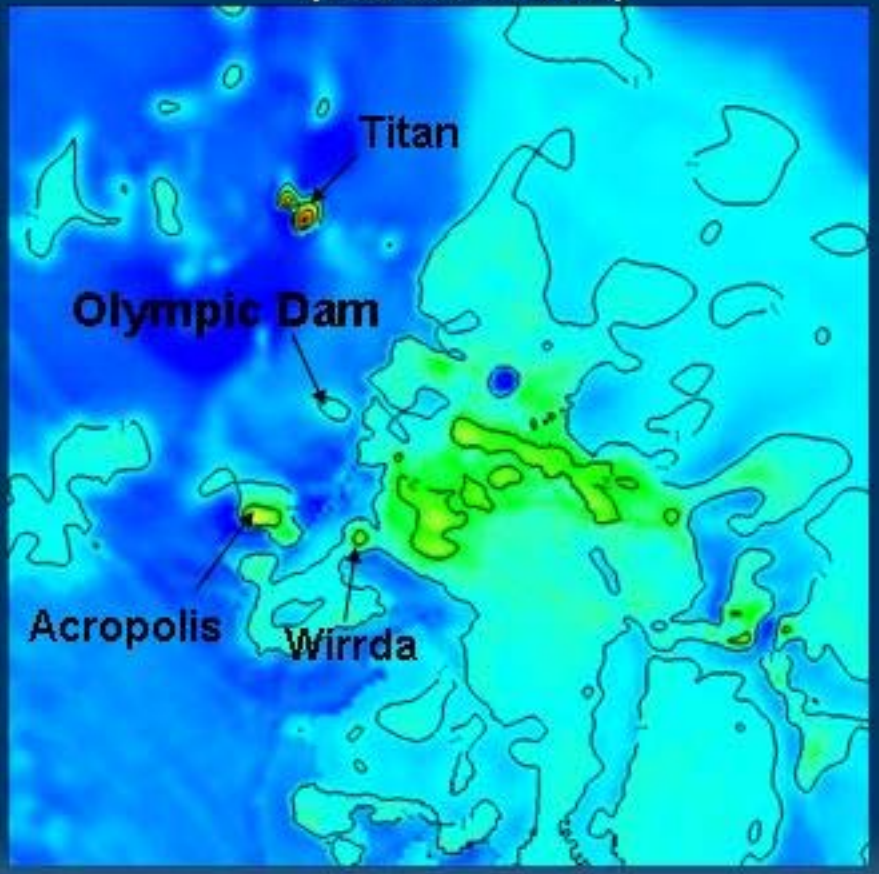
PALAEOPROT.

- Wallaroo Gp - metasedimentary & metavolcanic rocks
- Intrusive rocks, mainly felsic; mafic
- Hutchison Gp & equivalents; BIF
- Undifferentiated Archaean to Palaeoproterozoic rocks

Inversion model slices
(at Mesoprot unconformity)
- part of a new dataset at www.ga.gov.au

Hematite/sulfide/
dense silicate distribution
(1% contours)

Magnetite distribution
(1% contours)



Conclusions

4 Regional guides to high-level IOCG:

- ~1570-1590 Ma mafic intrusions, assoc with Hiltaba granites & GRV
- Host sequences: feldspathic clastics, Fe-rich, low-med metamorphic grade; not reduced
- Crustal-scale fault networks, NW- & NE-trending in OD region (but may differ elsewhere)
- Higher grade Cu-Au located in transition from magnetite regional alteration to hematitic local/district alteration

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