



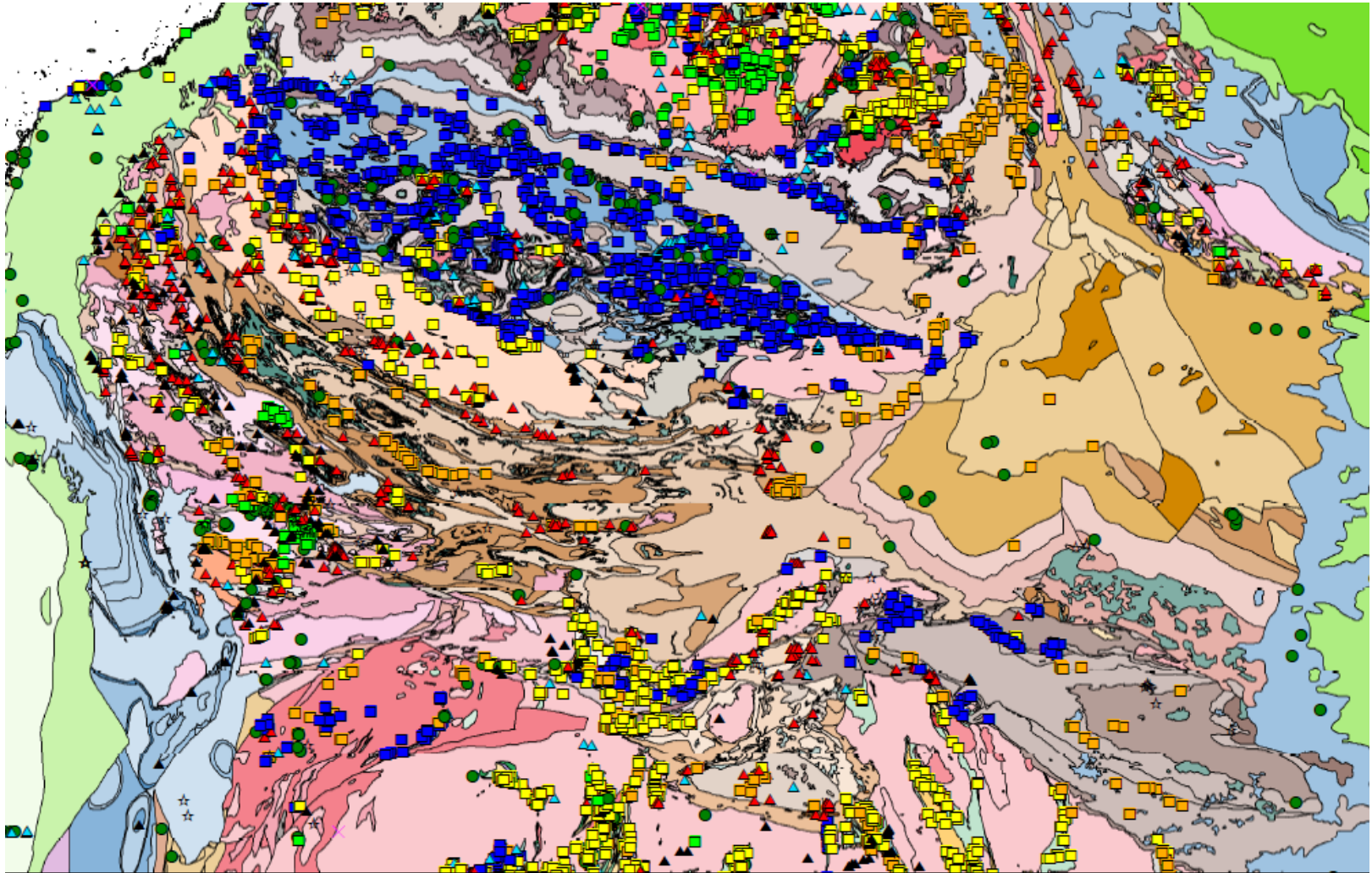
Government of **Western Australia**  
Department of **Mines and Petroleum**

# Implications of the Capricorn deep seismic survey for mineral systems

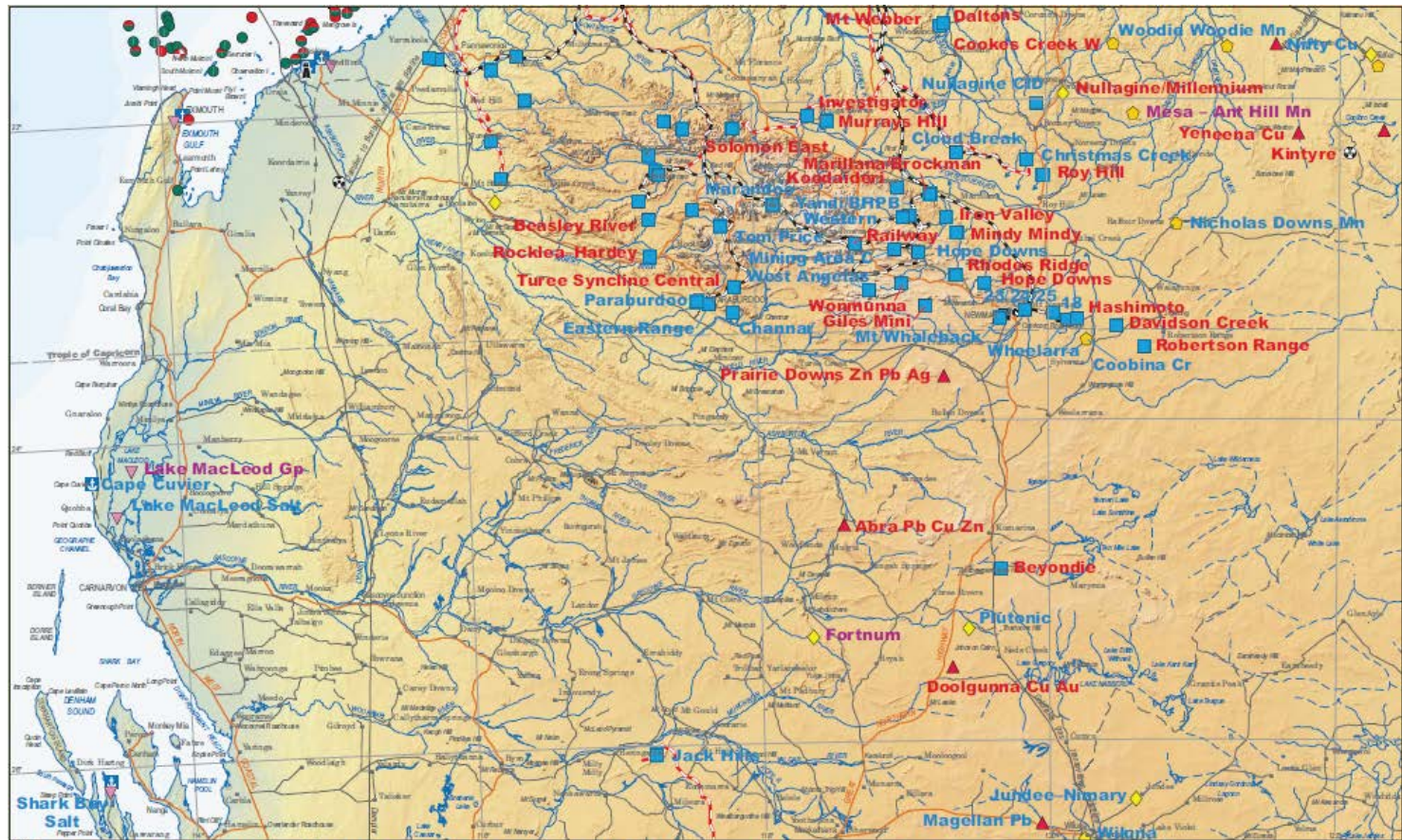
Ian Tyler, Simon Johnson, Alan Thorne and Huntly Cutten



# Mineralization: MINDEX



# Mine-free zone?

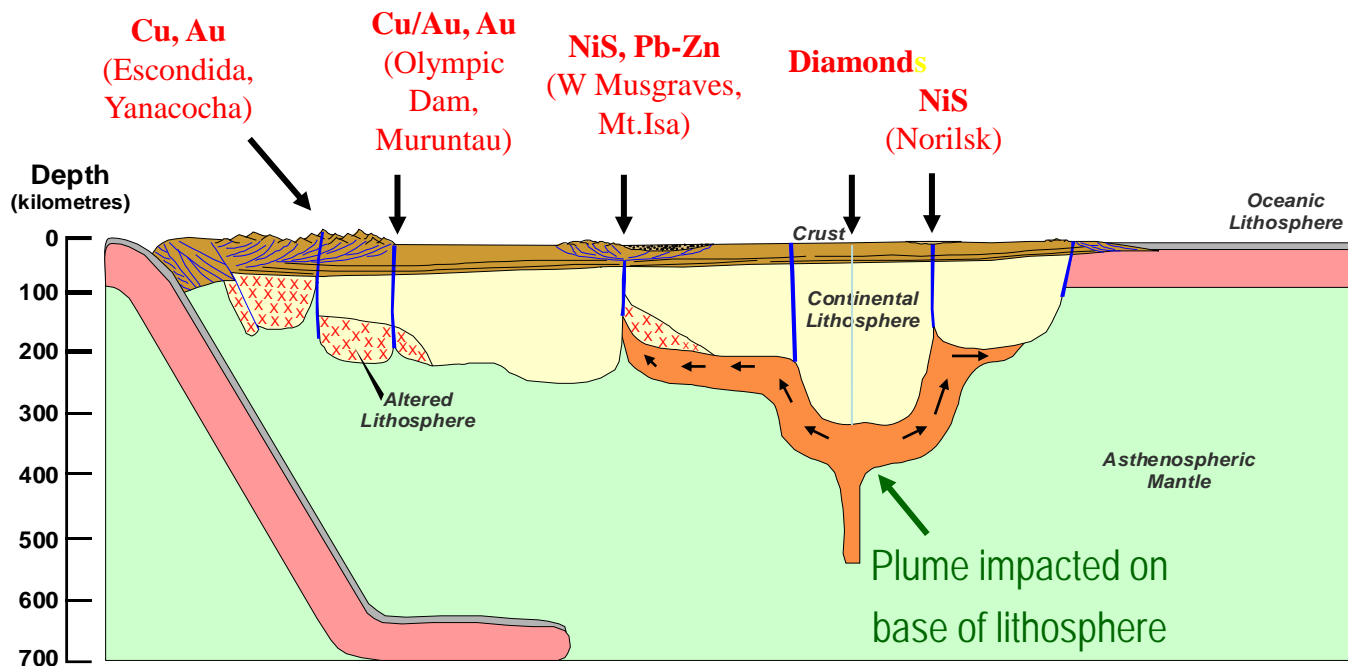


# Objective



- Identify structures cutting through the crust to the mantle as pathways for fluid flow to mineral systems (hematite iron ore, Cu-Pb, orogenic lode-Au)

# Metallogenic Settings in Lithospheric Context (stolen from Graham Begg)



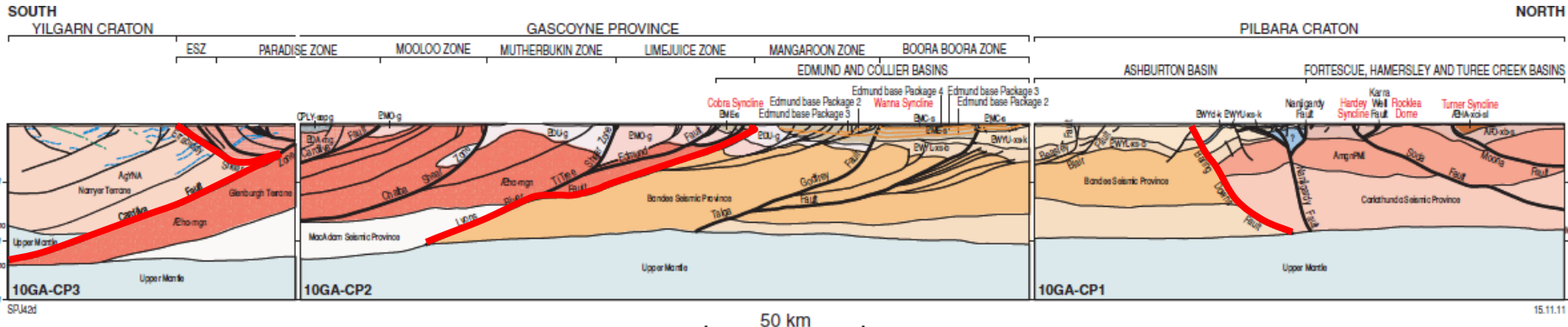
## MANTLE STRUCTURES IN KEY SETTINGS



**Giant magmatic & hydrothermal ore deposits controlled by mantle structures and combined mantle-crustal processes**

Minerals Targeting International PL

# Assembly of West Australian Craton



~2005 Ma

~2215 Ma

>2630 Ma (?)

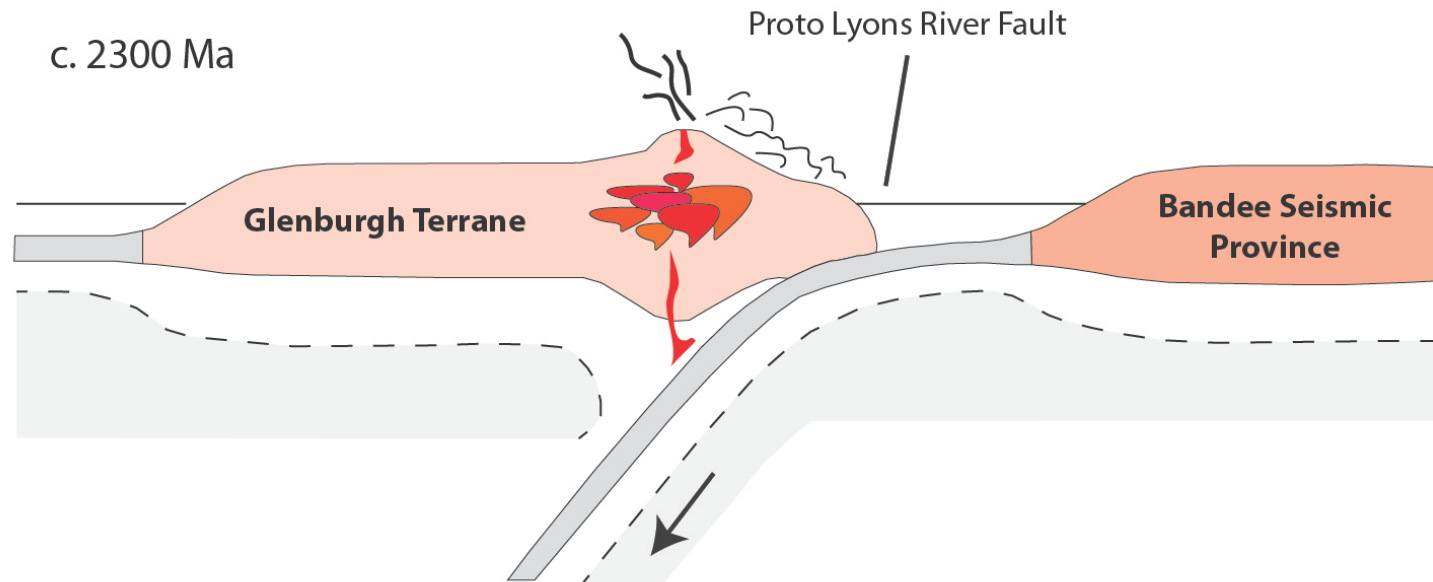
- Three probable sutures recognised

# Ophthalmia Orogeny 2215–2145 Ma

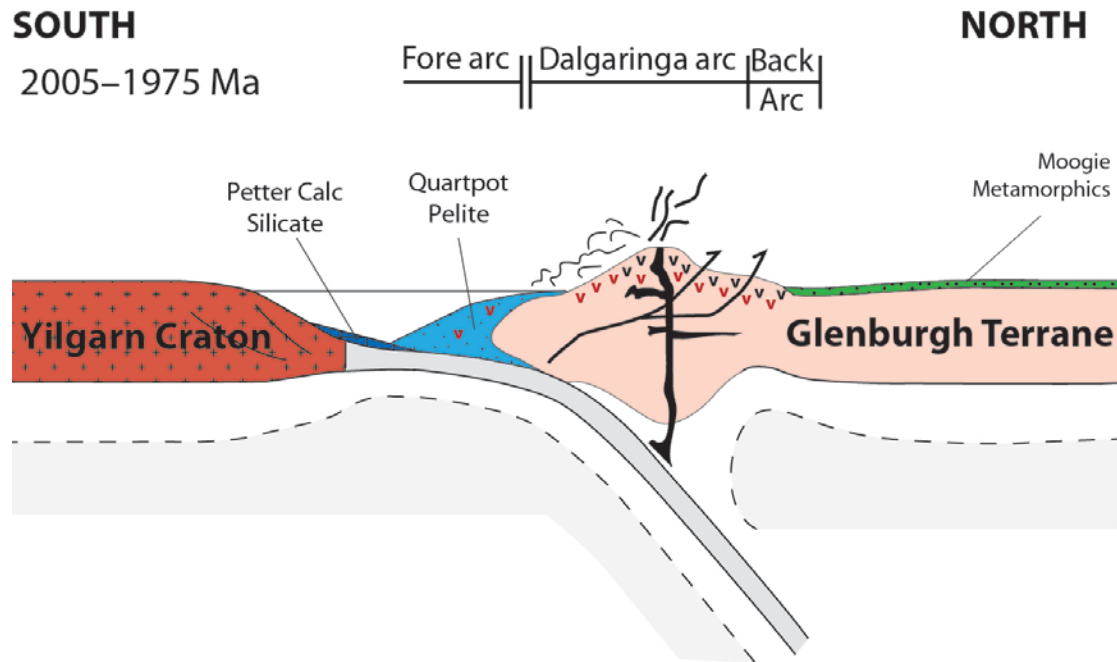


SOUTH

NORTH



# Glenburgh Orogeny 2005–1950 Ma



Dalgaringa magmatic arc gives polarity of subduction



# Reactivation: potential mineralizing events



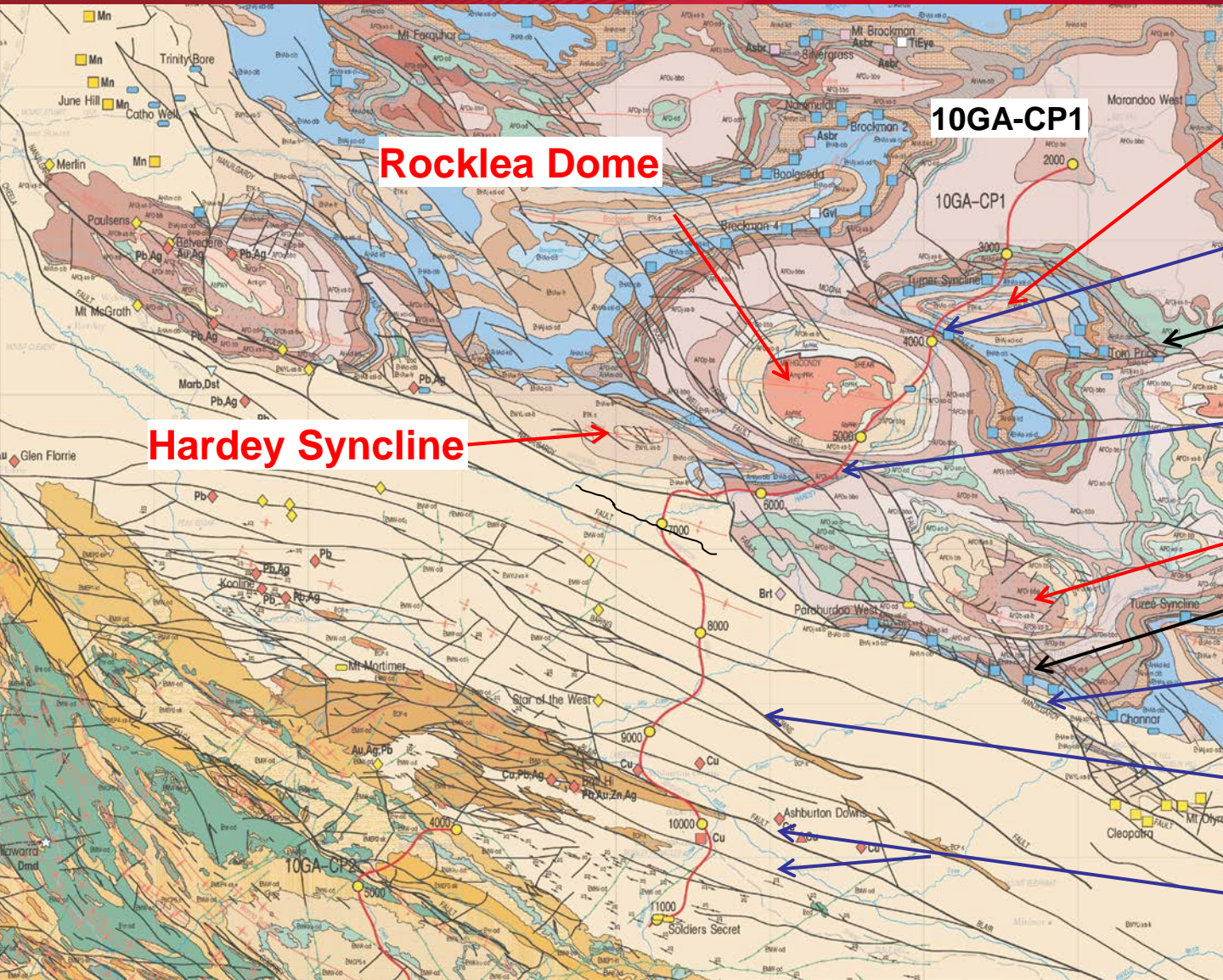
- Capricorn Orogeny c. 1820–1770 Ma
- Mangaroon Orogeny c. 1690–1620 Ma
- Edmund Basin c. 1620 Ma
- Basin and mafic sills – Narimbunna Dolerite at 1460 Ma and Kulkatharra Dolerite at 1070 Ma
- Mutherbukin tectonic Event 1385–1200 Ma
- Edmondian Orogeny 1030–950 Ma
- Mulka Tectonic Event c. 570 Ma

# Ophthalmia Fold Belt: BIF-hosted iron ore



- Premium martite–microplaty hematite ores (Tom Price/Paraburdoo/Whaleback)
  - supergene martite–goethite ores upgraded by regional metamorphism/diagenesis
- Or
  - Hypogene–supergene ores related to hydrothermal fluid flow in the foreland to the Ophthalmia Orogeny

# Ophthalmia Fold Belt: BIF-hosted iron ore



**Turner  
Syncline**

**Moona Fault**

**Tom Price**

**Soda + Karra  
Well Faults**

**Bellary Dome**

**Paraburdoo**

**Nanjilgardy  
Fault**

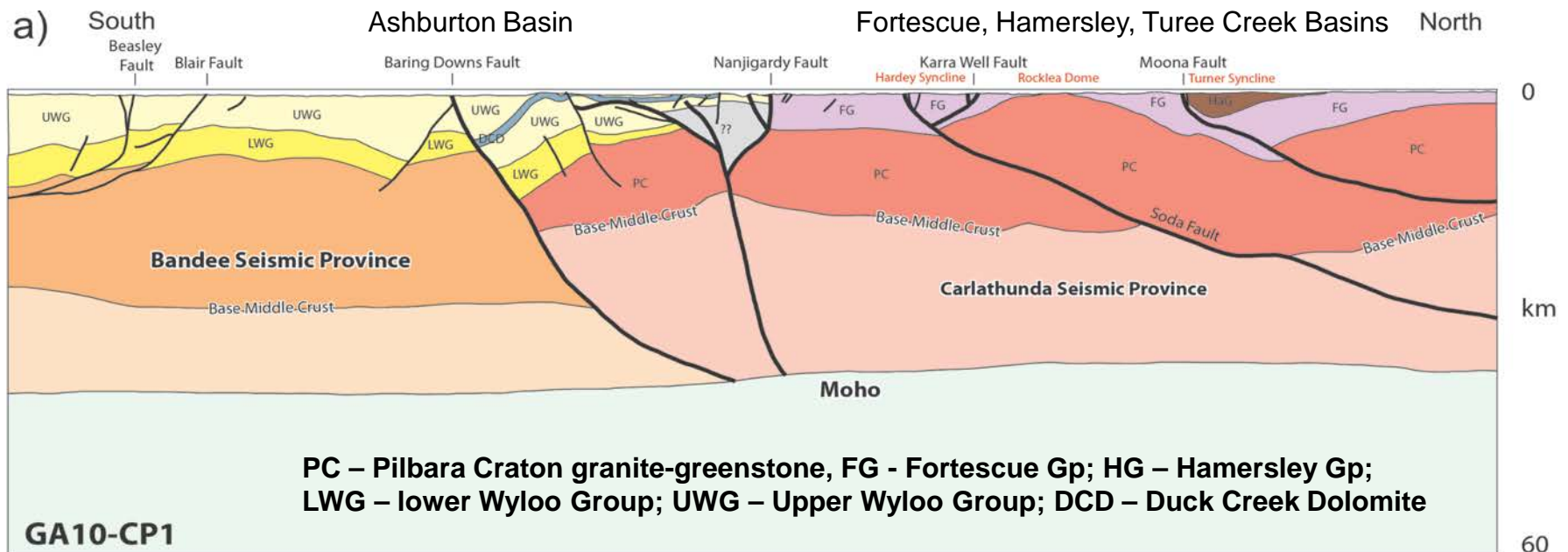
**Baring Downs  
Fault**

**Blair + Beasley  
Faults**

# Ophthalmia Fold Belt: BIF-hosted iron ore



- Tom Price lies on the Moona Fault
- Paraburdoo lies on the Nanjilgardy Fault
- North-dipping faults – difficult to pump Ophthalmia orogenic fluids into the faults

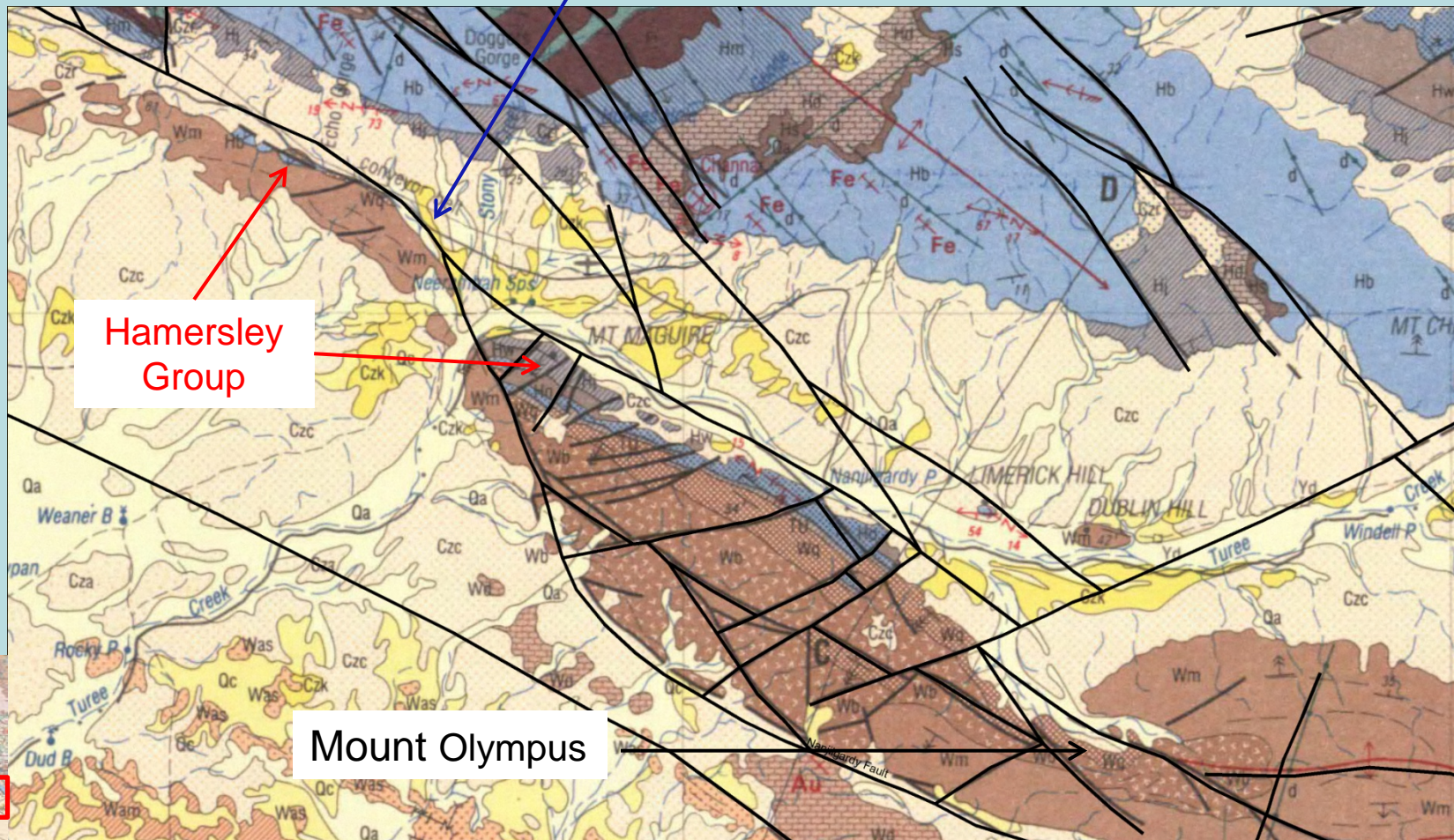


# Ophthalmia Fold Belt: BIF-hosted iron ore



**Turee Creek 1:250k  
Geology**

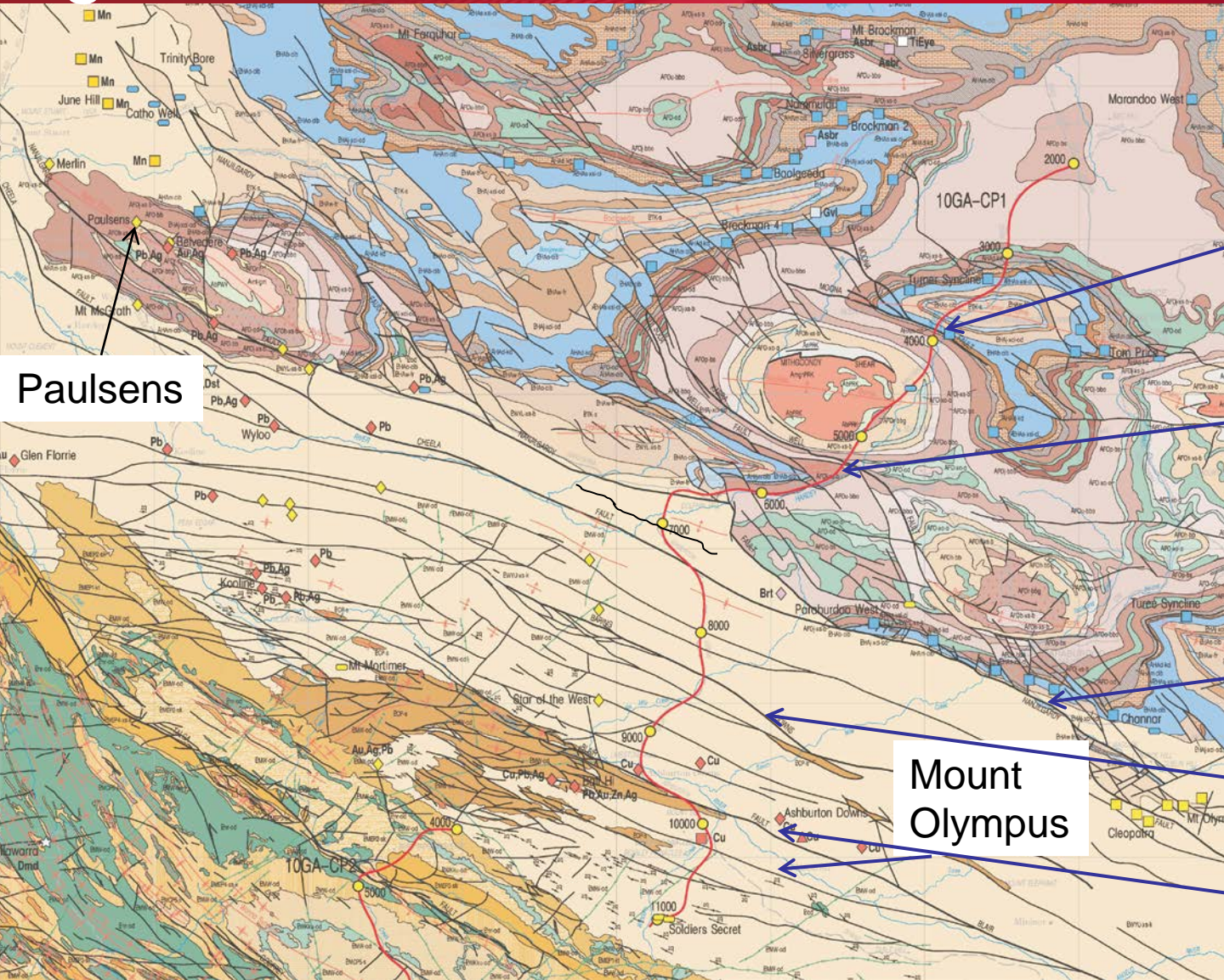
Nanjilgardy  
Fault



Hamersley  
Group

Mount Olympus

# Northern Capricorn Orogen: orogenic gold



**Moona Fault**

**Soda + Karra Well Faults**

**Nanjilgardy Fault**

**Baring Downs Fault**

**Blair + Beasley Faults**

**Paulsens**

**Mount Olympus**

# Northern Capricorn Orogen: orogenic gold



- Paulsens Mine (Northern Star Resources)
  - Quartz vein-hosted
  - Production of 70 000 to 80 000 ounces Au/year
  - 1 268 000 t @ 5.3g/t = 226 000 ounces
- Mount Olympus (Sipa Resources)
  - 350 000 ounces Au

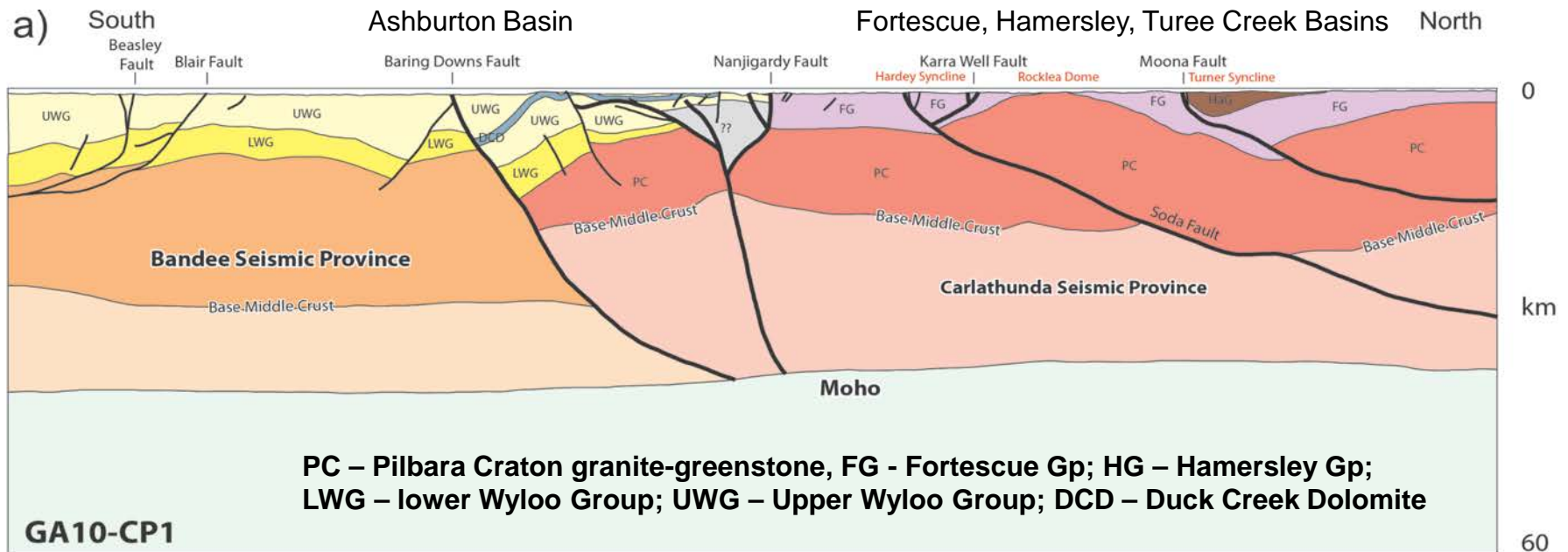
# Northern Capricorn Orogen: orogenic gold



## Paulsens and Mount Olympus on Nanjilgardy Fault

– Mount Olympus dated at c. 1740 Ma

- Reactivation
- Further potential along the Baring Downs Fault?

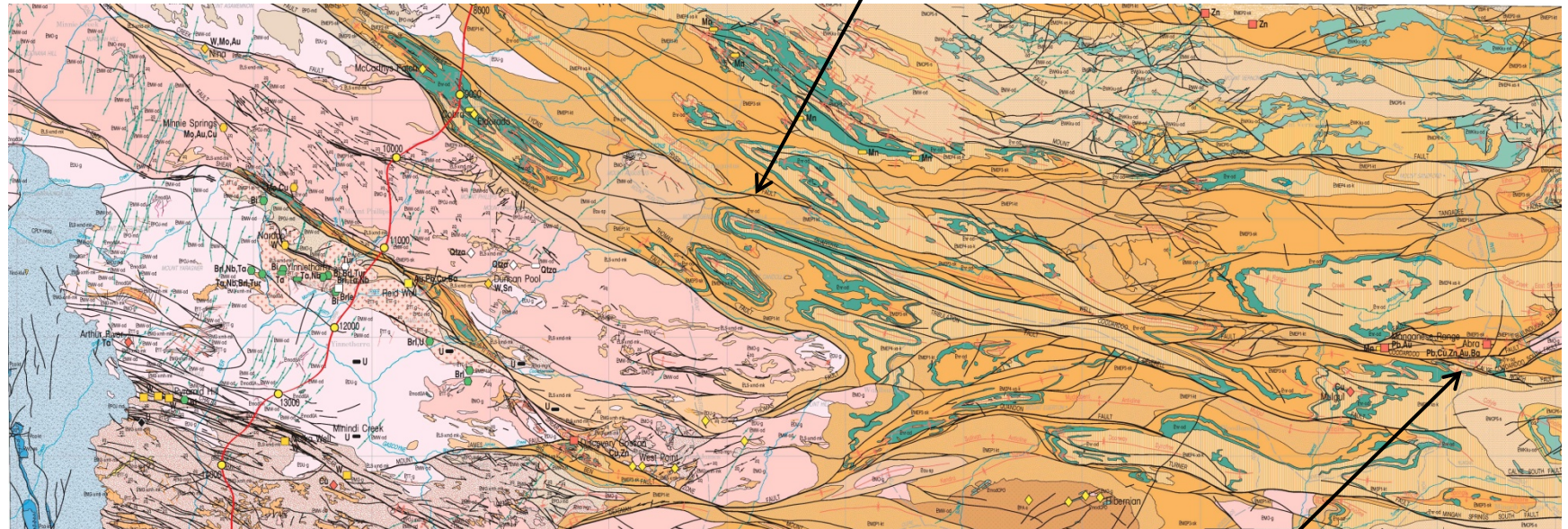




# Edmund Basin



Lyons River Fault



Abra

# Edmund Basin

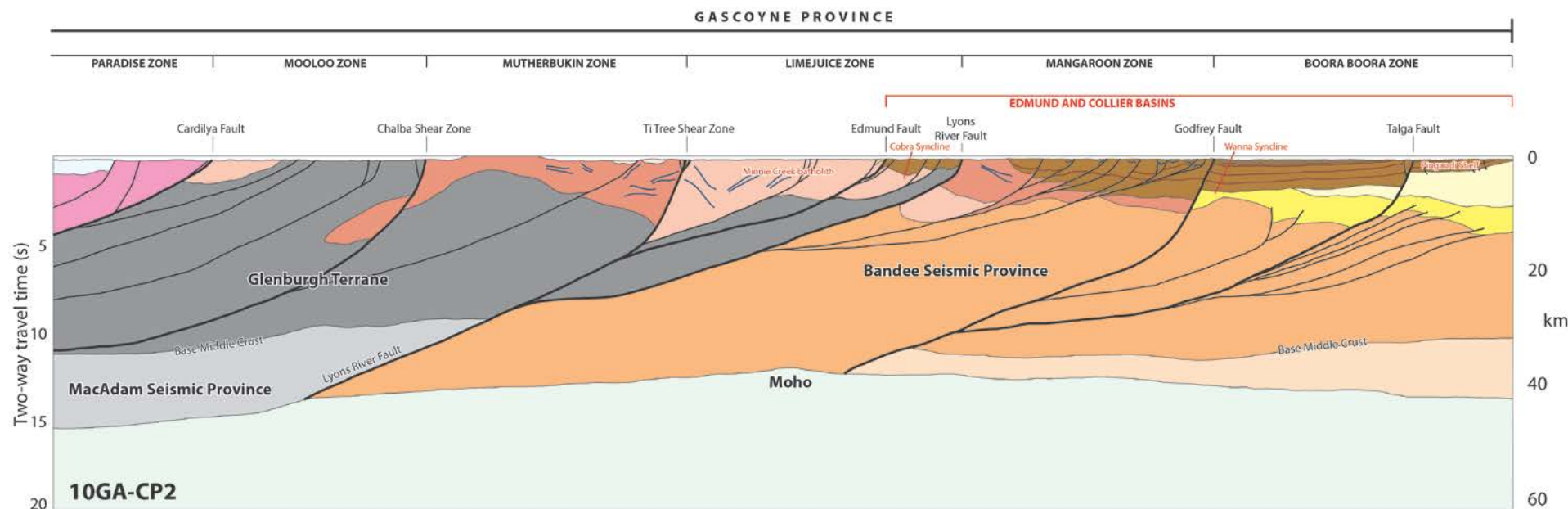


- Abra
  - Sediment-hosted, syn-depositional upgraded during 1385–1200 Ma Mutherbukin Tectonic Event?
  - 93 million tons @ 4% Pb, 10 g/t Ag
  - 14 million tons @ 0.6% Cu and 0.5 g/t Au
  - Weak surface expression
  - Deposit is open in most directions

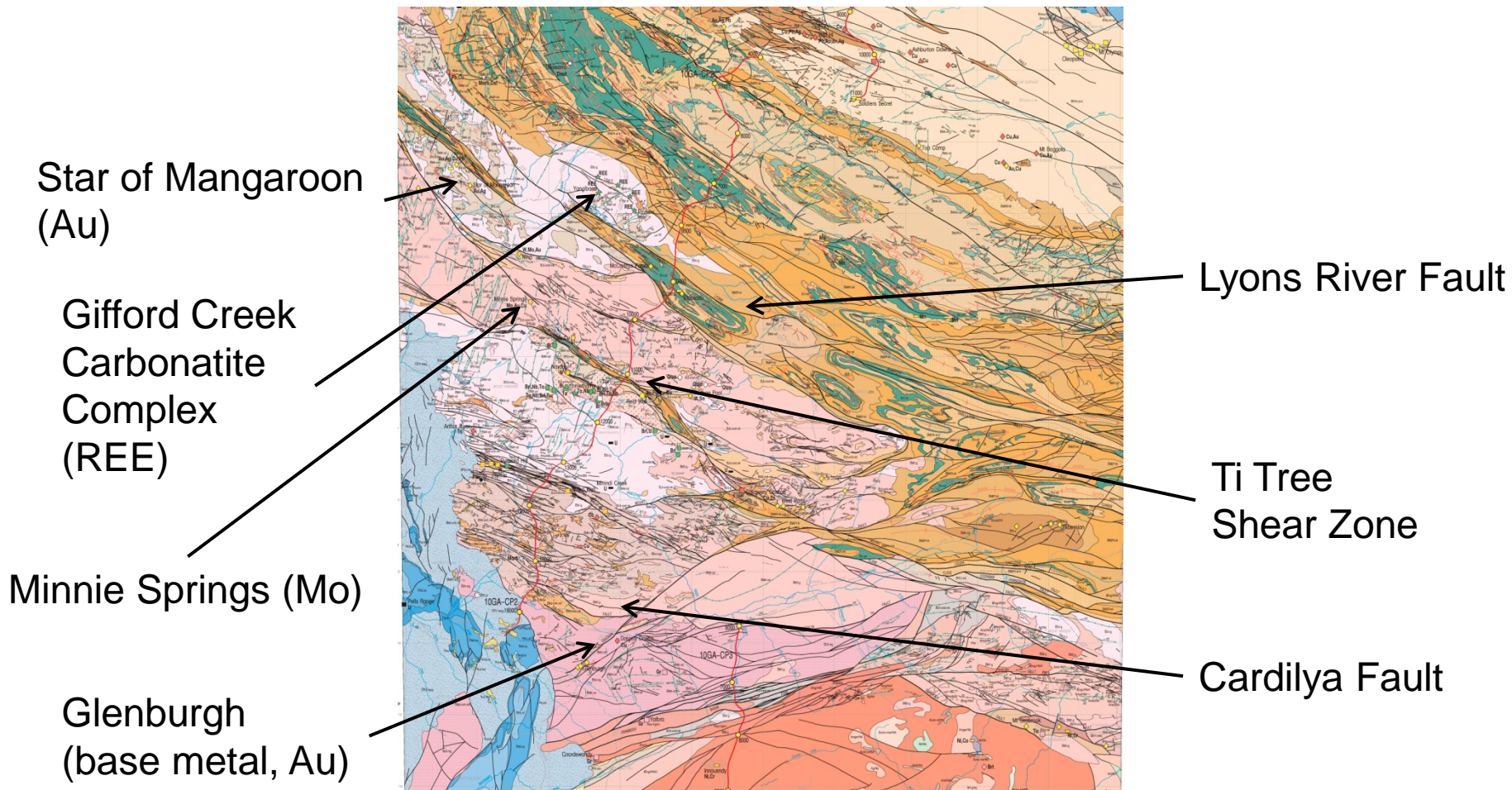
# Edmund Basin



- Abra polymetallic deposit on Lyons River Fault
- Further potential along basin growth faults



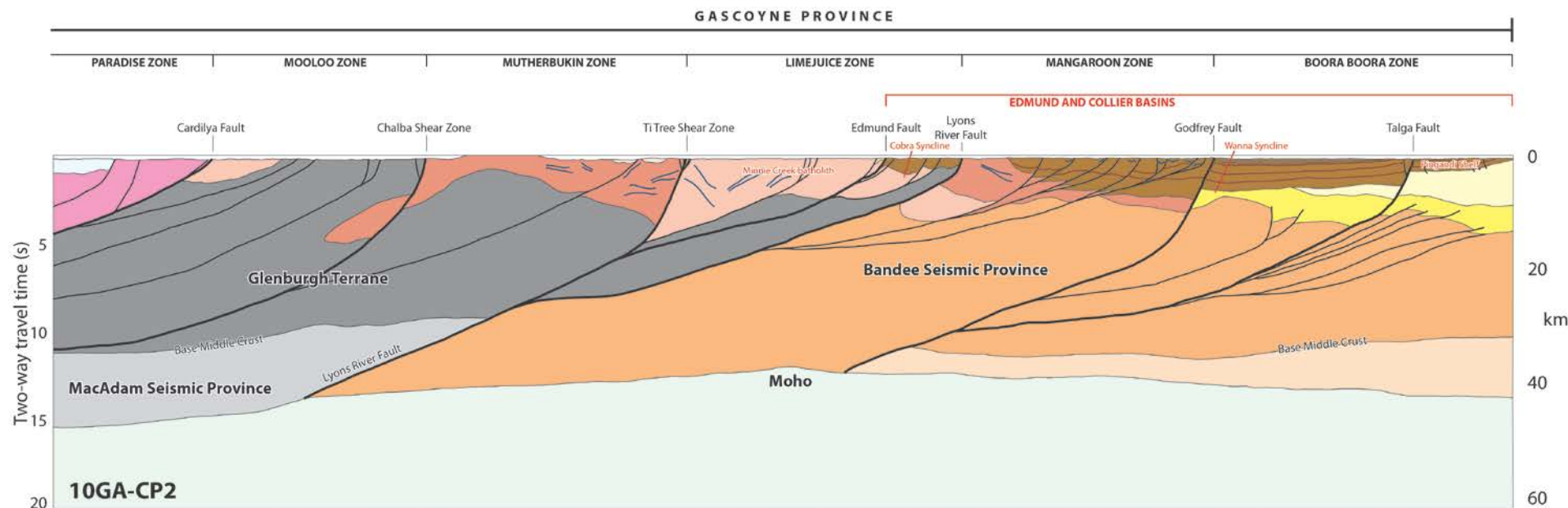
# Gascoyne Province



# Gascoyne Province

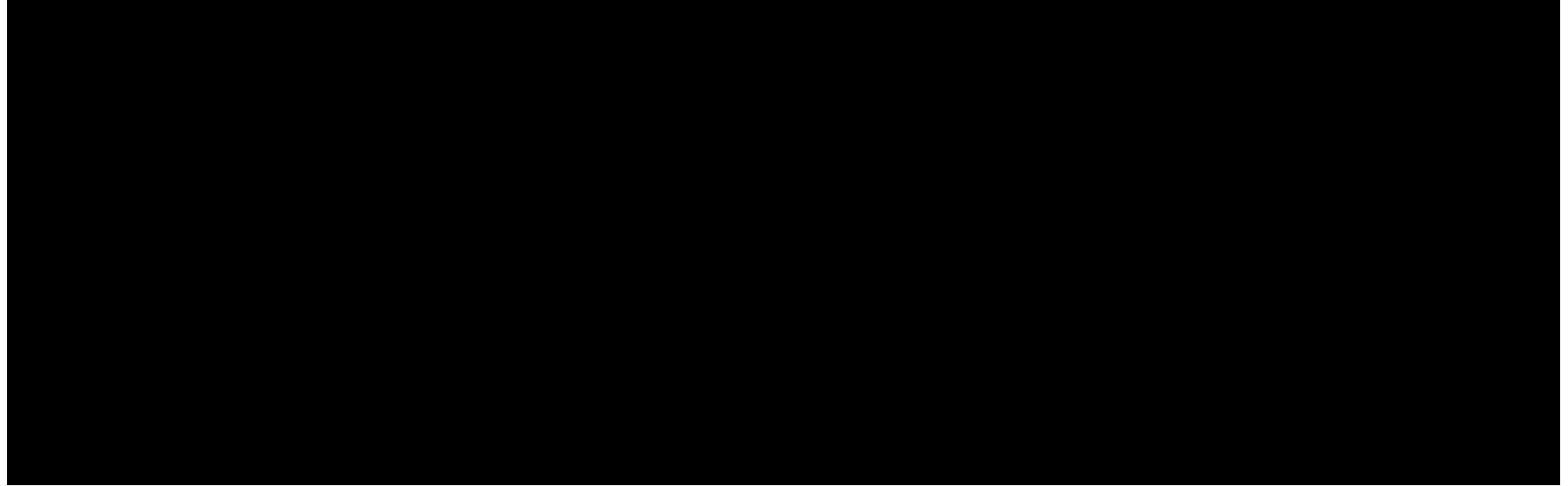


- Lyons River Fault and Ti Tree Shear Zone
- Potential of the Cardilya Fault



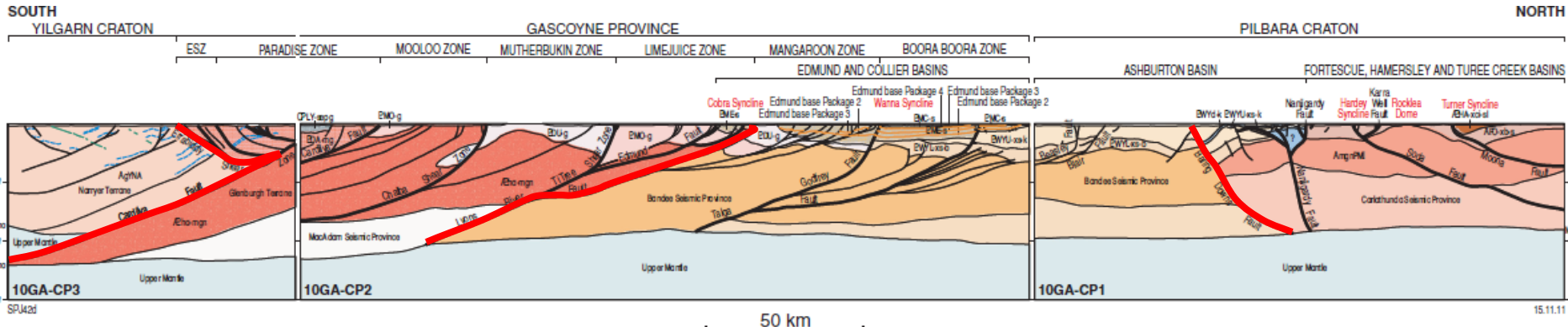


# Errabiddy Shear Zone and Cardilya Fault



- Errabiddy Shear Zone cut off – no direct connection to mantle? Unsuccessful diamond exploration
- Potential of the Cardilya Fault?

# Three probable sutures recognised



~2005 Ma

~2215 Ma

>2775 Ma (?)

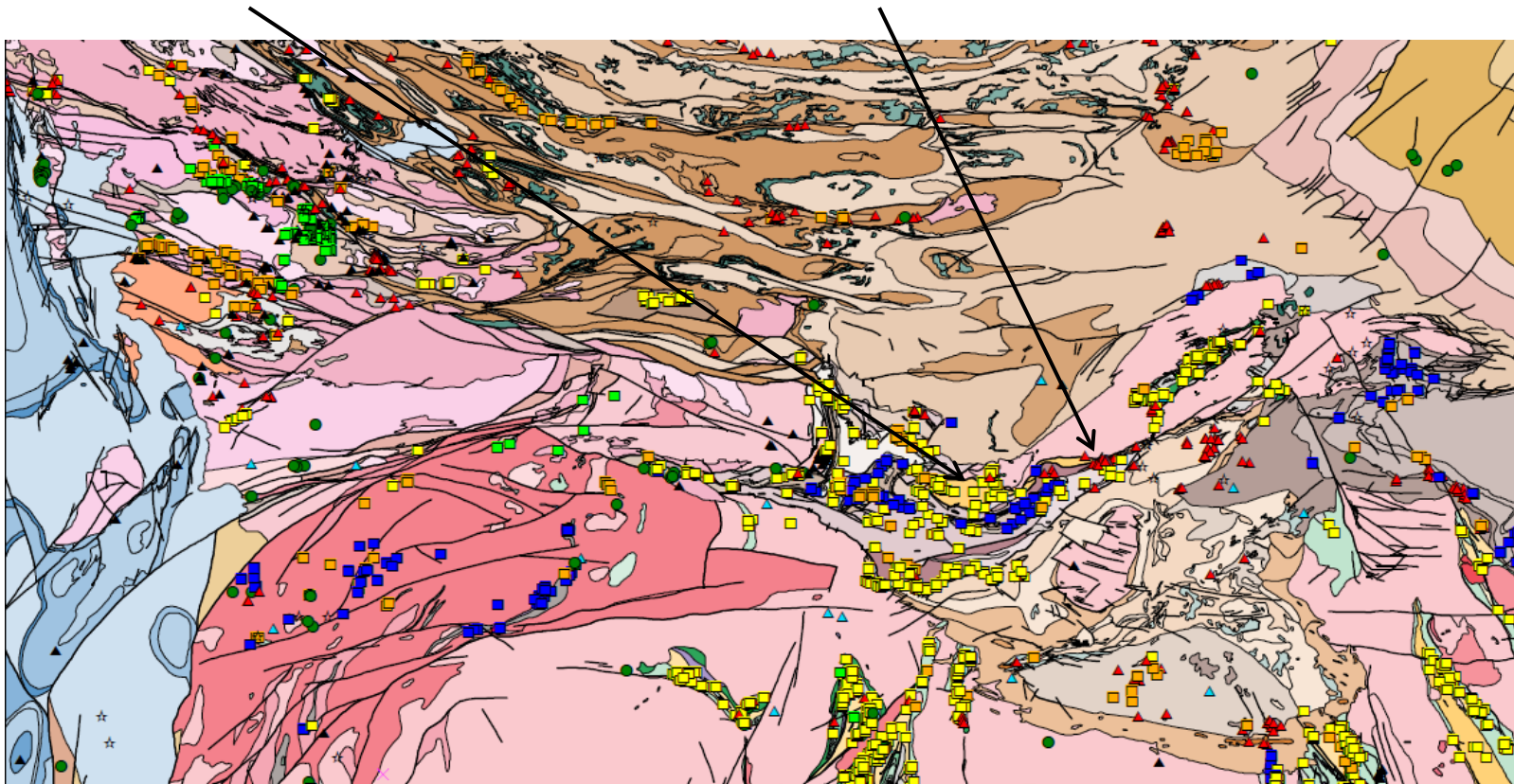
- Cryptic structures
- Repeated reactivation



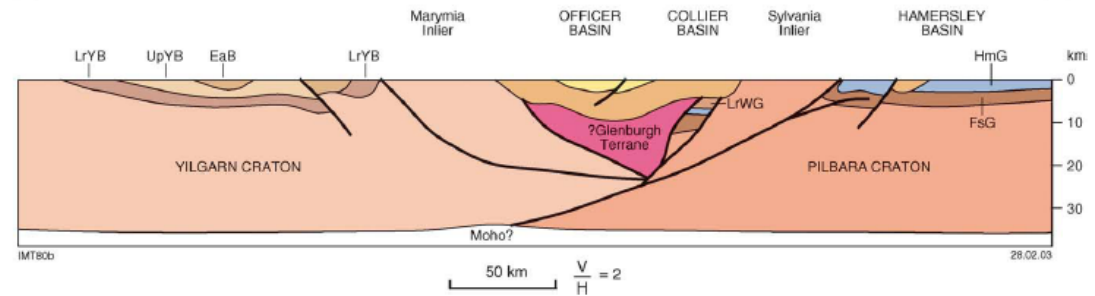
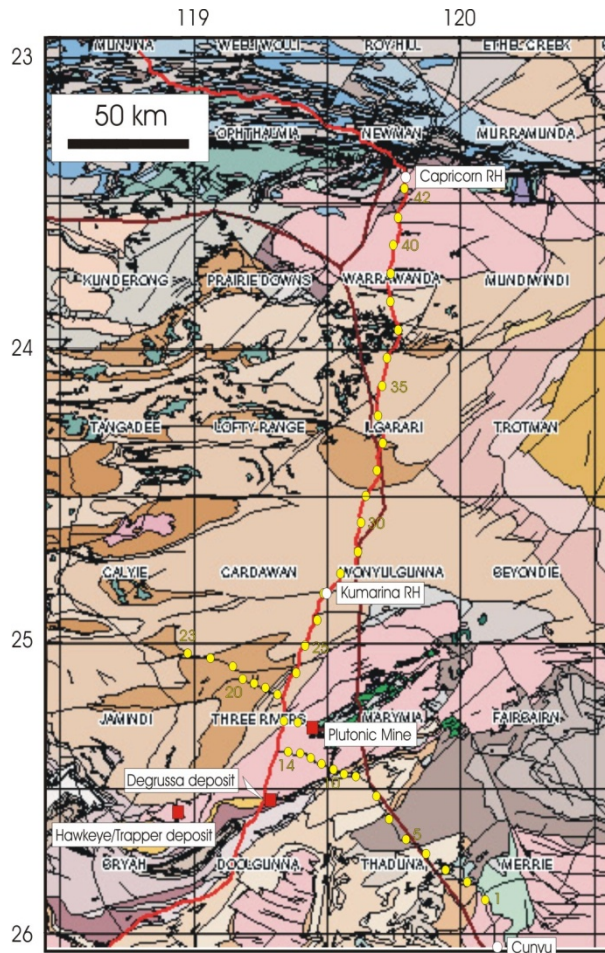
# Projecting sutures to the east:



- Peak Hill Au and Doolgunna Cu



# East Capricorn: Marymia–Sylvania MT



# EIS Centre for Exploration Targeting



- 4D metallogenic map
  - Gascoyne Province
  - Yilgarn margin basins
  - Edmund and Collier Basins
  - Northern Capricorn margin

## TERRAIN-SCALE PROSPECTIVITY

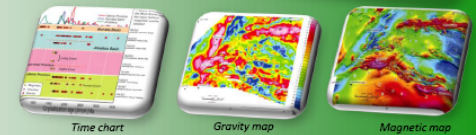
### CONTEXT

- ↗ Exploration Incentive Scheme
- ↗ GSWA ⇔ CET
- ↗ 1st terrain: West Arunta



### METHODOLOGY

- ↗ Stratigraphy review
- ↗ Deep geophysics
- ↗ Gravity and magnetic imagery
- ↗ Radiometry and regolith geochemistry



### INTERPRETATION

- ↗ Interpretation of the aeromagnetic and gravity
- ↗ 2D gravity forward modelling
- ↗ Inferred geological history



### MINERAL SYSTEM ANALYSIS

- ↗ Prospectivity analysis for different commodities

