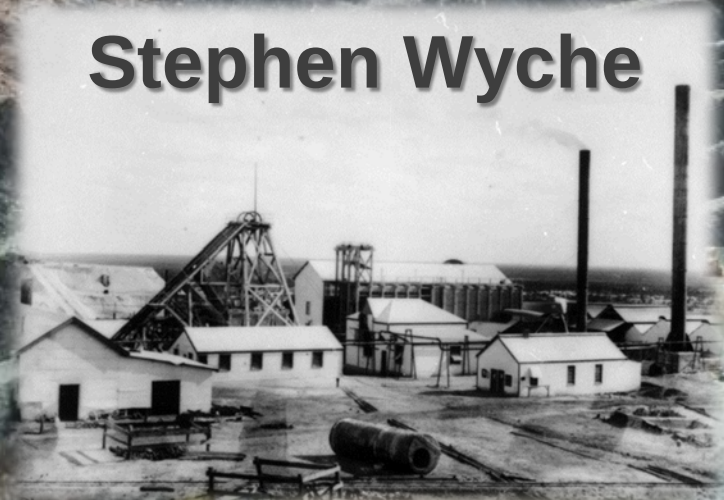
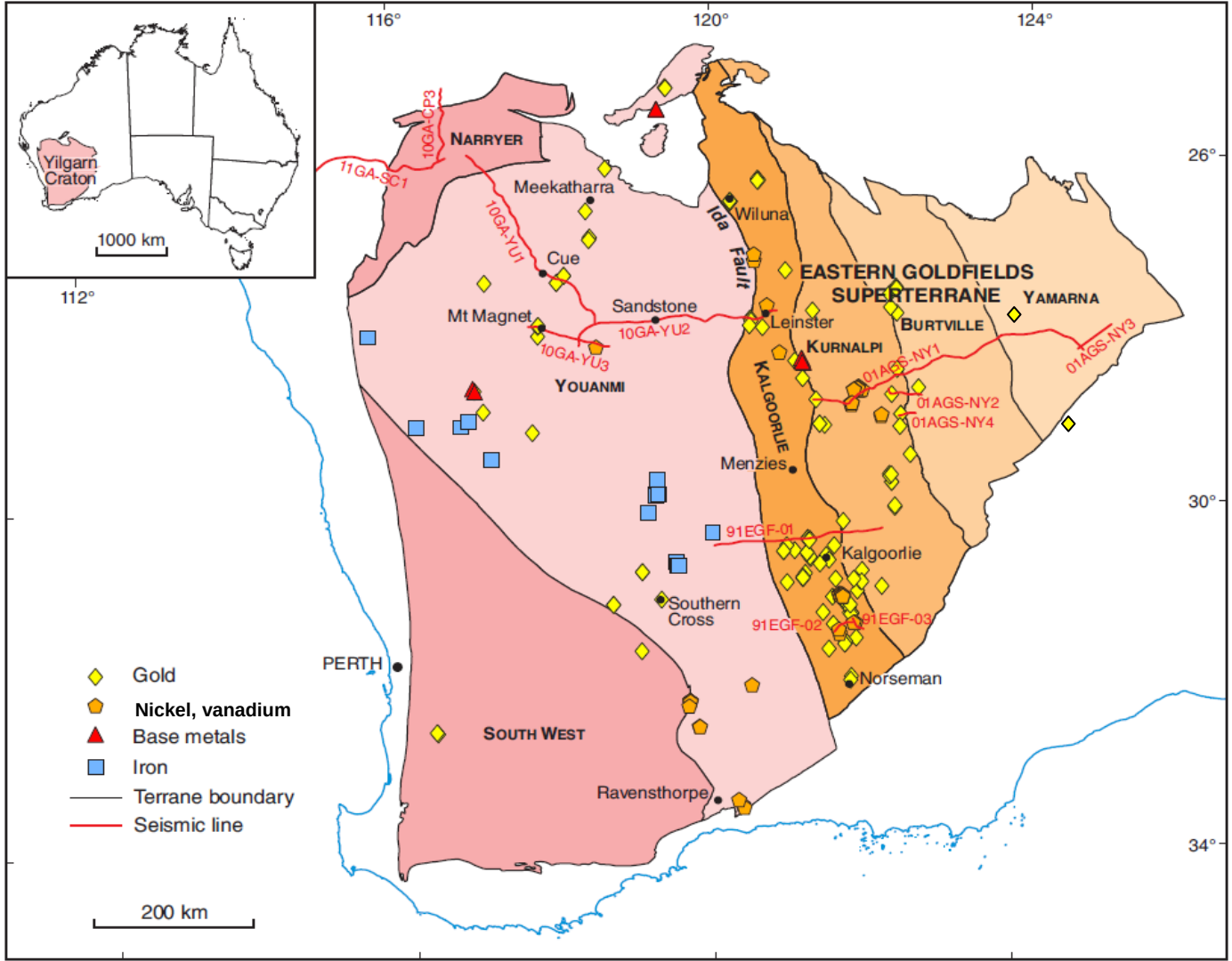
Controls on mineral (gold) distribution in the Yilgarn

Stephen Wyche




Yilgarn Craton
1000 km
116°
120°
124°
26°
30°
34°
112°
NARRYER
10GA-CP3
11GA-SC1
Meekatharra
10GA-YU1
Cue
Mt Magnet
Sandstone
10GA-YU2
10GA-YU3
YOUANMI
Ida Fault
Wiluna
EASTERN GOLDFIELDS SUPERTERRANE
YAMARNA
BURTVILLE
Leinster
KURNALPI
01AGS-NY1
01AGS-NY3
01AGS-NY2
01AGS-NY4
KALGOORLIE
Menzies
91EGF-01
Kalgoorlie
Southern Cross
91EGF-02
91EGF-03
Norseman
PERTH
SOUTH WEST
Ravensthorpe
Gold
Nickel, vanadium
Base metals
Iron
Terrane boundary
Seismic line
200 km

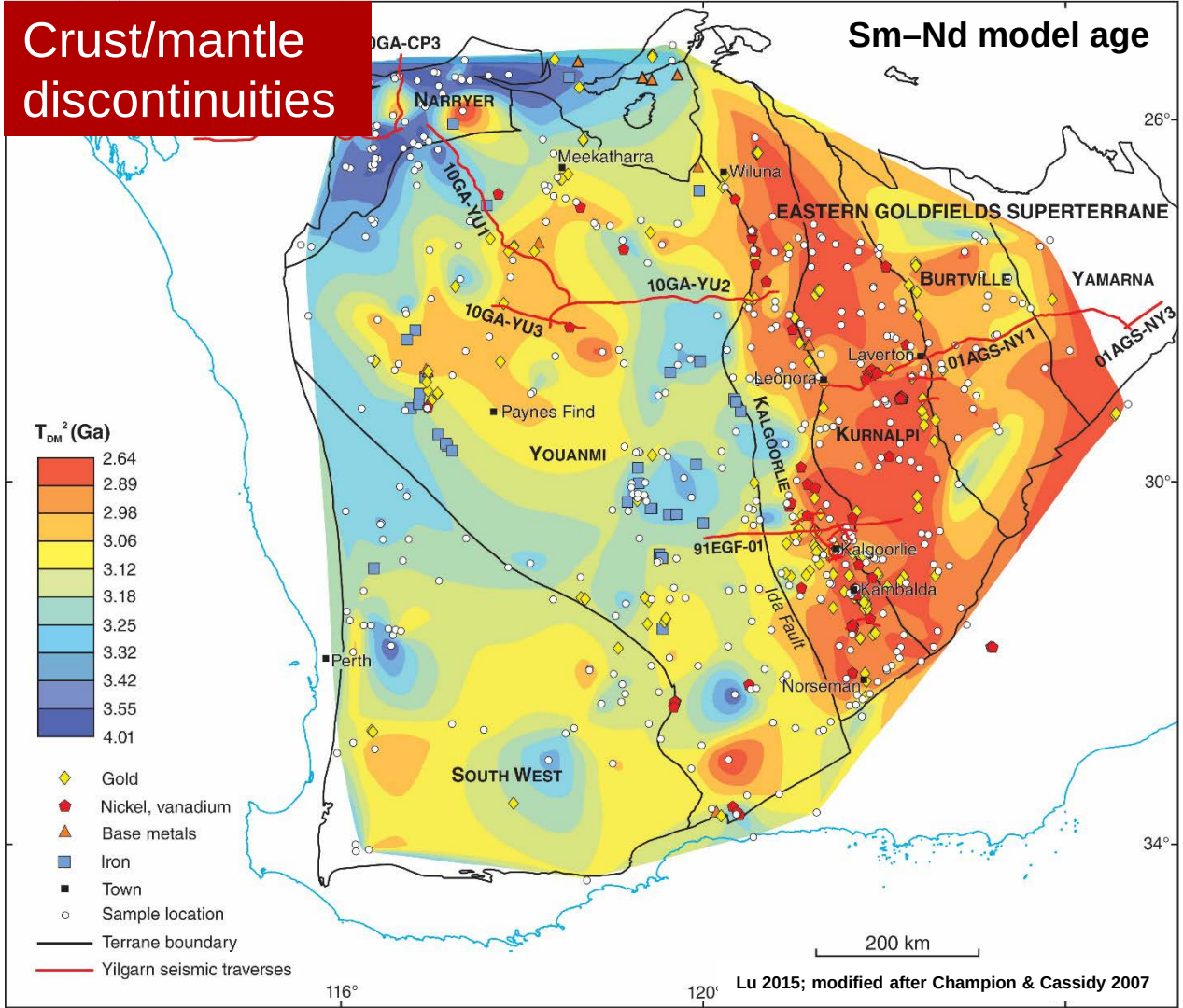
Yilgarn gold

- Mostly after c. 2660 Ma
  - Diachronous/multiple mineralizing events?
- Relationship with granites
  - Switch from high-Ca to low-Ca granites
- Relationship to structures visible in large-scale geophysical and isotopic datasets

Gold (& others) distribution

- Fertile source
- Structures: pathways and depositional sites
  - Crustal/mantle discontinuities
  - Deeply penetrating shear zones
  - Domes
- Zones of alteration/redox fronts

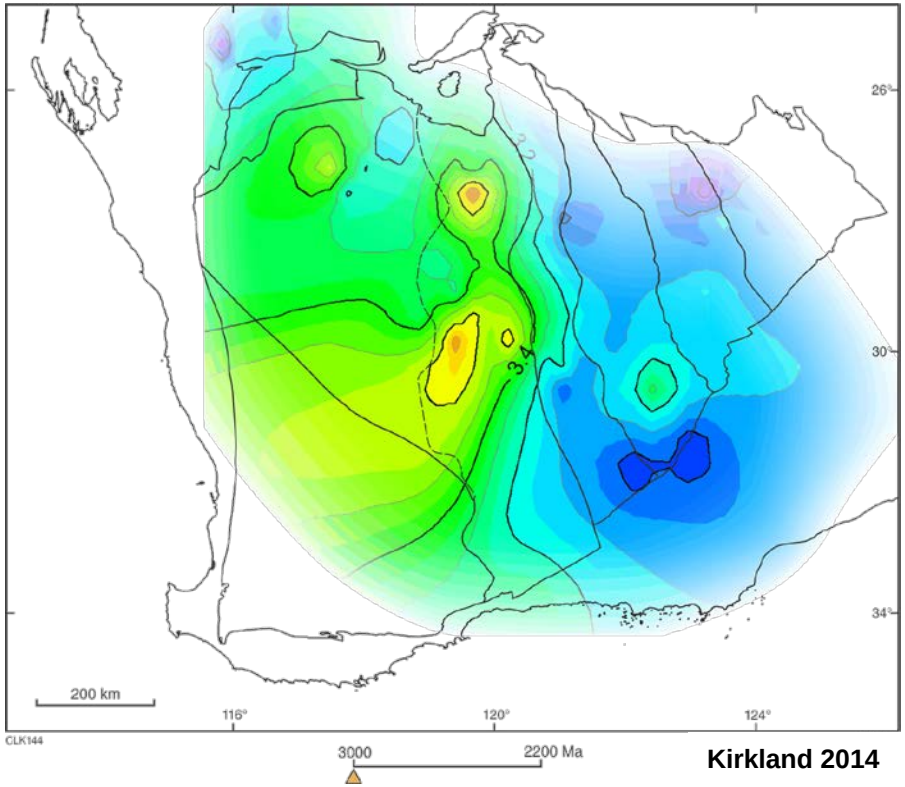
Crust/mantle discontinuities



Lu 2015; modified after Champion & Cassidy 2007

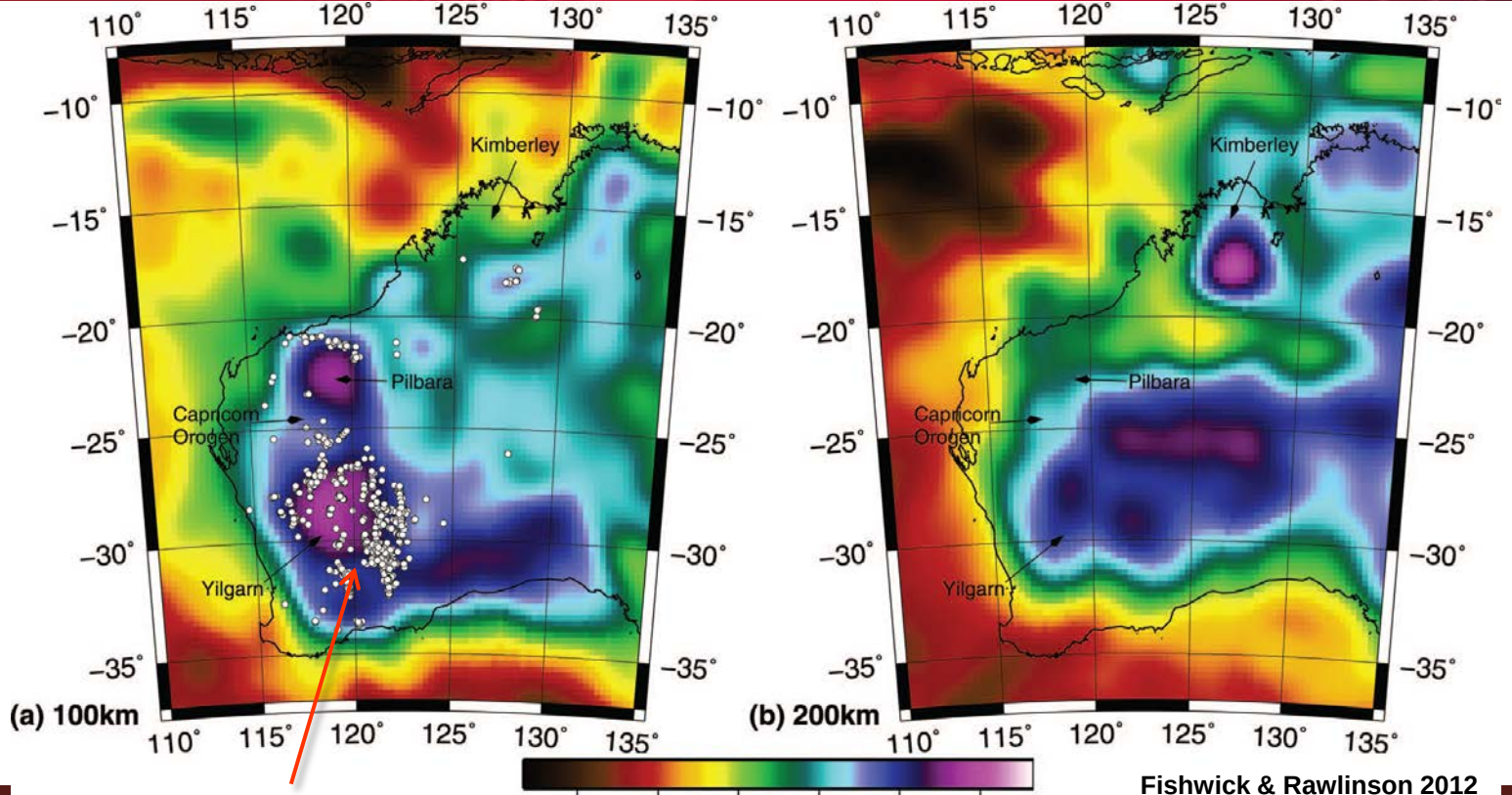
Crustal evolution (Hf isotopes)

Each in situ measured Hf analysis has its **time of crystallization** independently constrained and has its **geographic location known** = integrated approach (using U-Pb and Lu-Hf) can image crustal evolution in both space and time.



Kirkland 2014

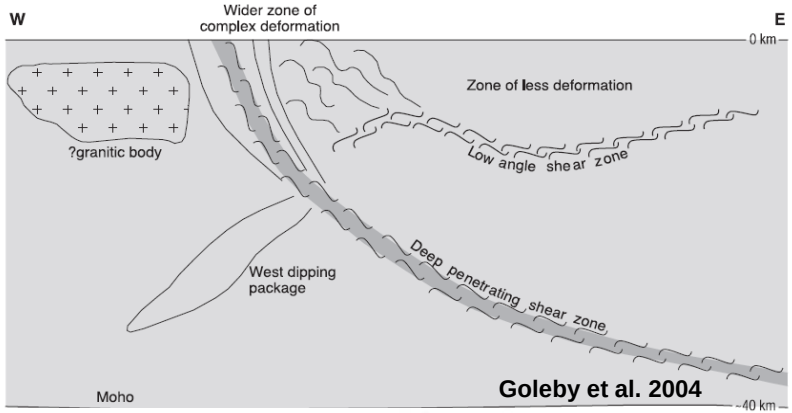
Crust/mantle discontinuities: seismic tomography

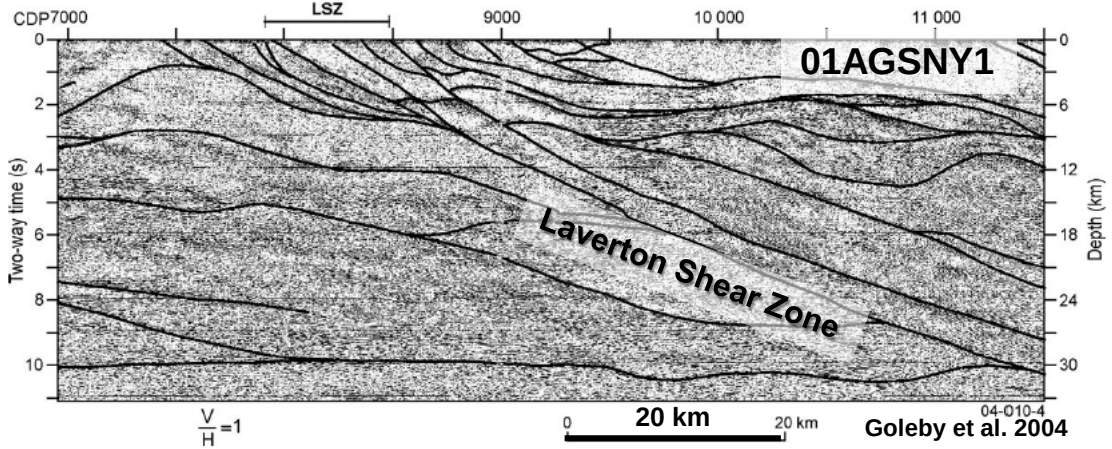


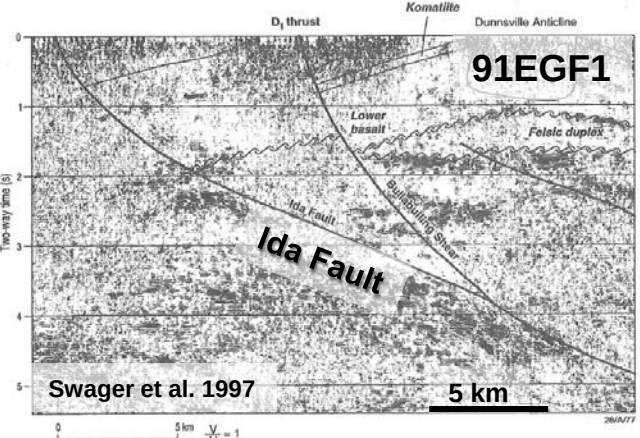
White spots are gold deposits

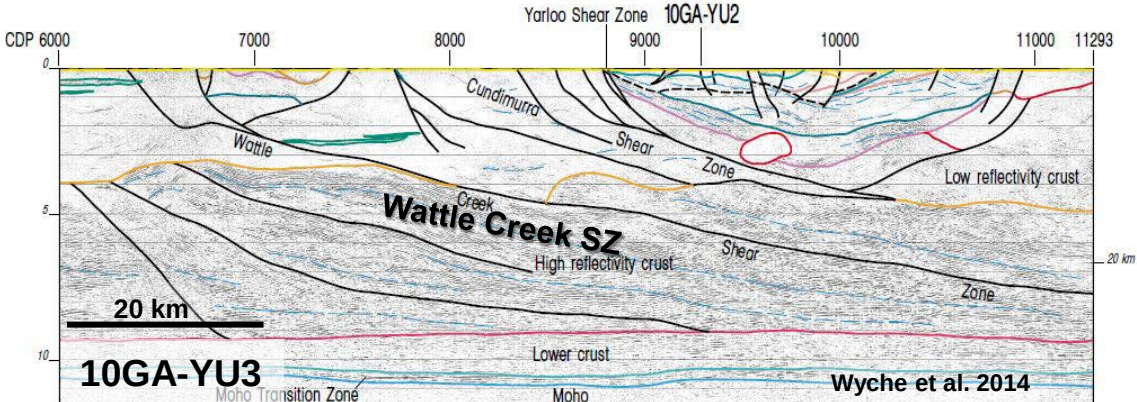
Fishwick & Rawlinson 2012

Deeply penetrating shear zones









Domes

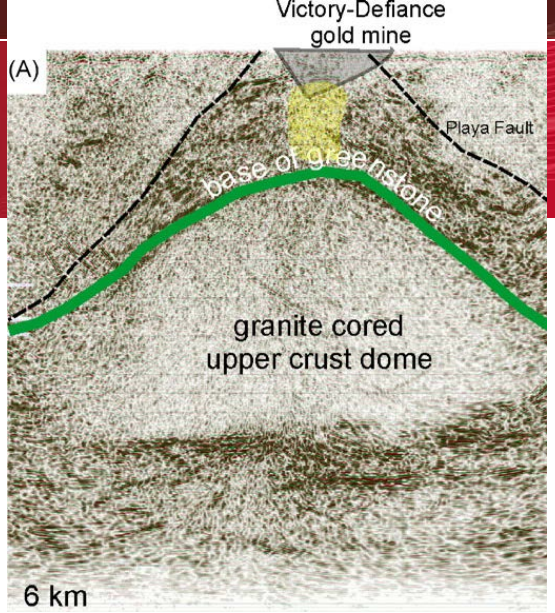
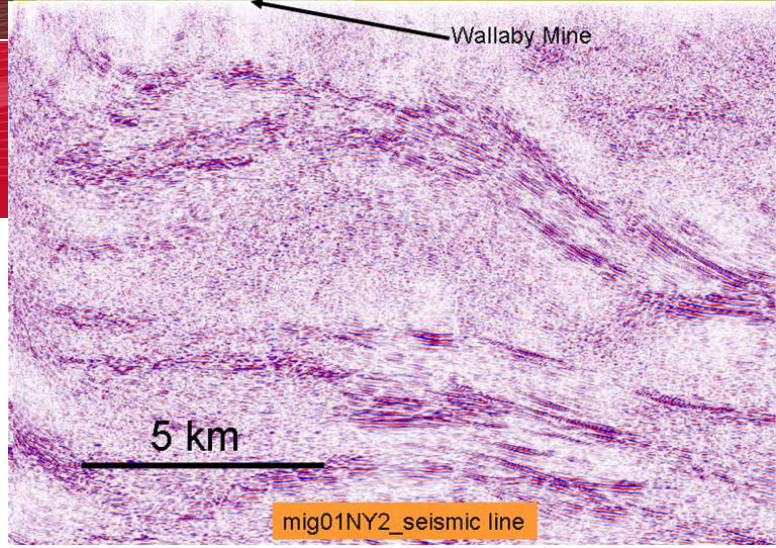
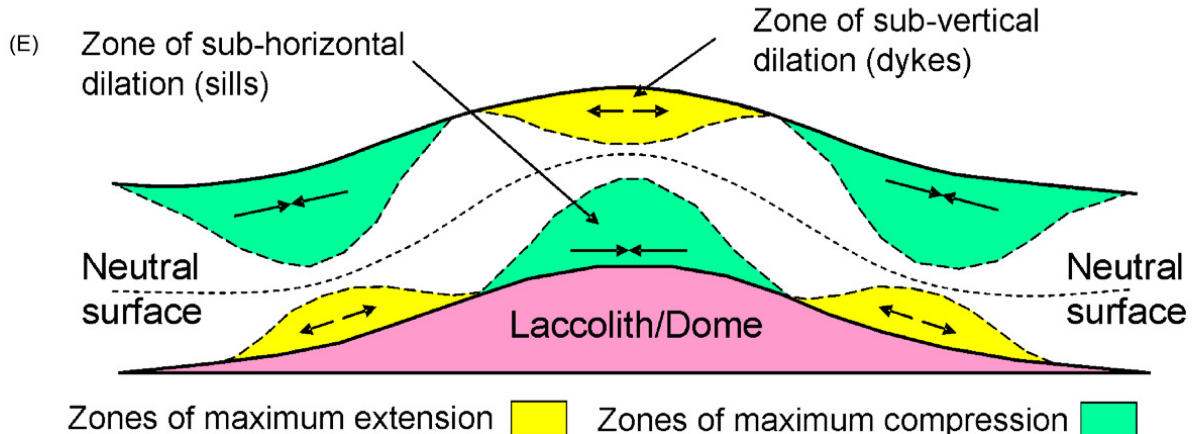


Image from Gold Fields St Ives

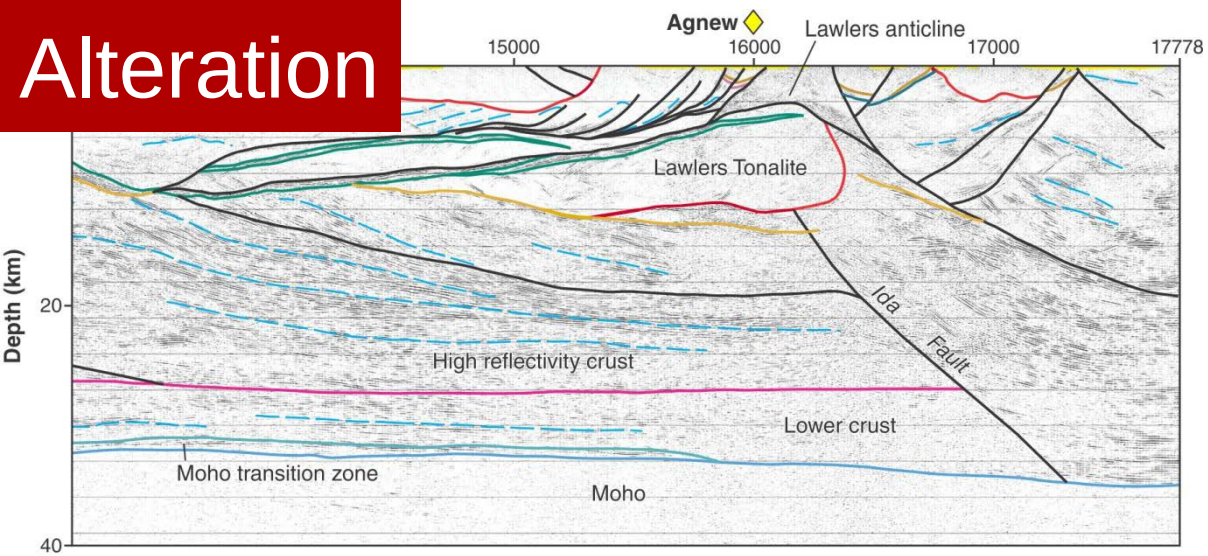


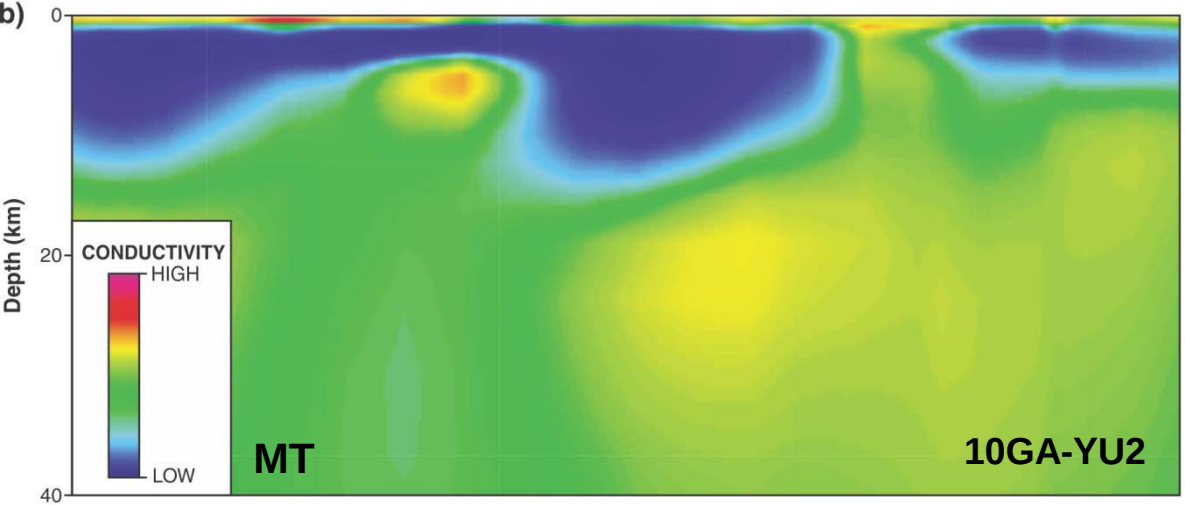
pmd*CRC: Blewett & Hitchman 2006

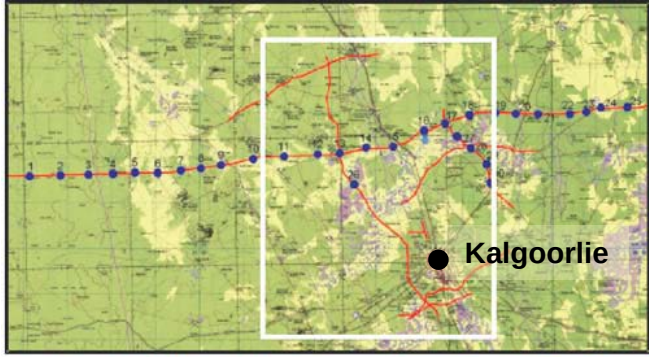


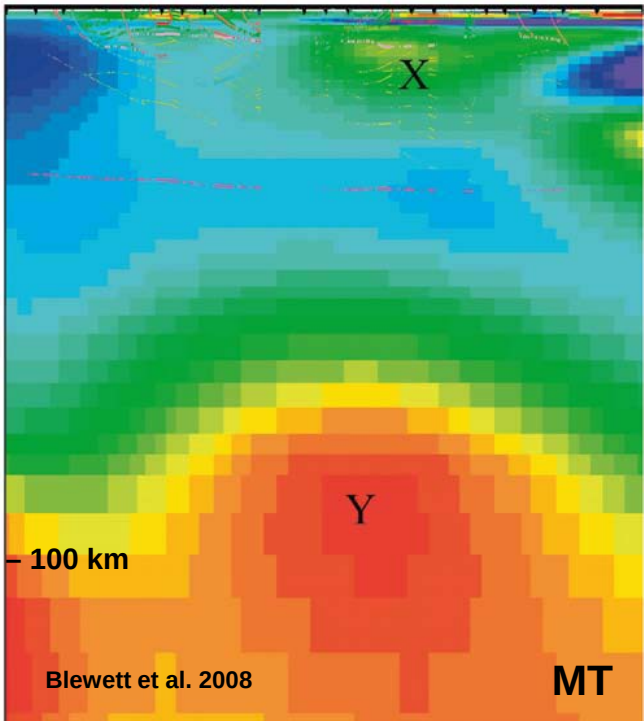
Blewett et al. 2010

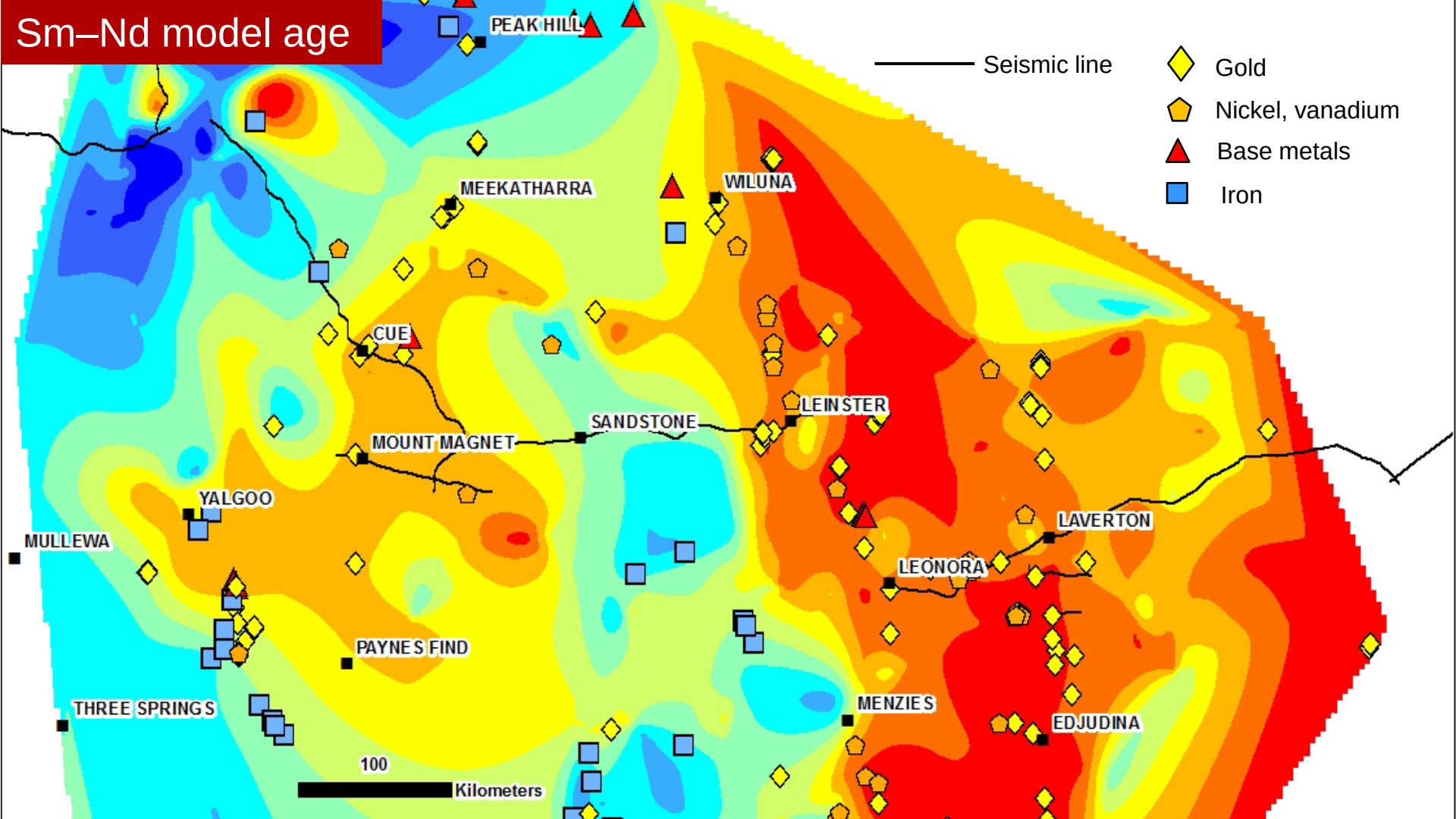
Alteration


Agnew
15000
16000
Lawlers anticline
17000
17778
Lawlers Tonalite
Depth (km)
20
Ida
Fault
High reflectivity crust
Lower crust
Moho transition zone
Moho
40


b)
0
Depth (km)
20
CONDUCTIVITY
HIGH
LOW
MT
10GA-YU2
40

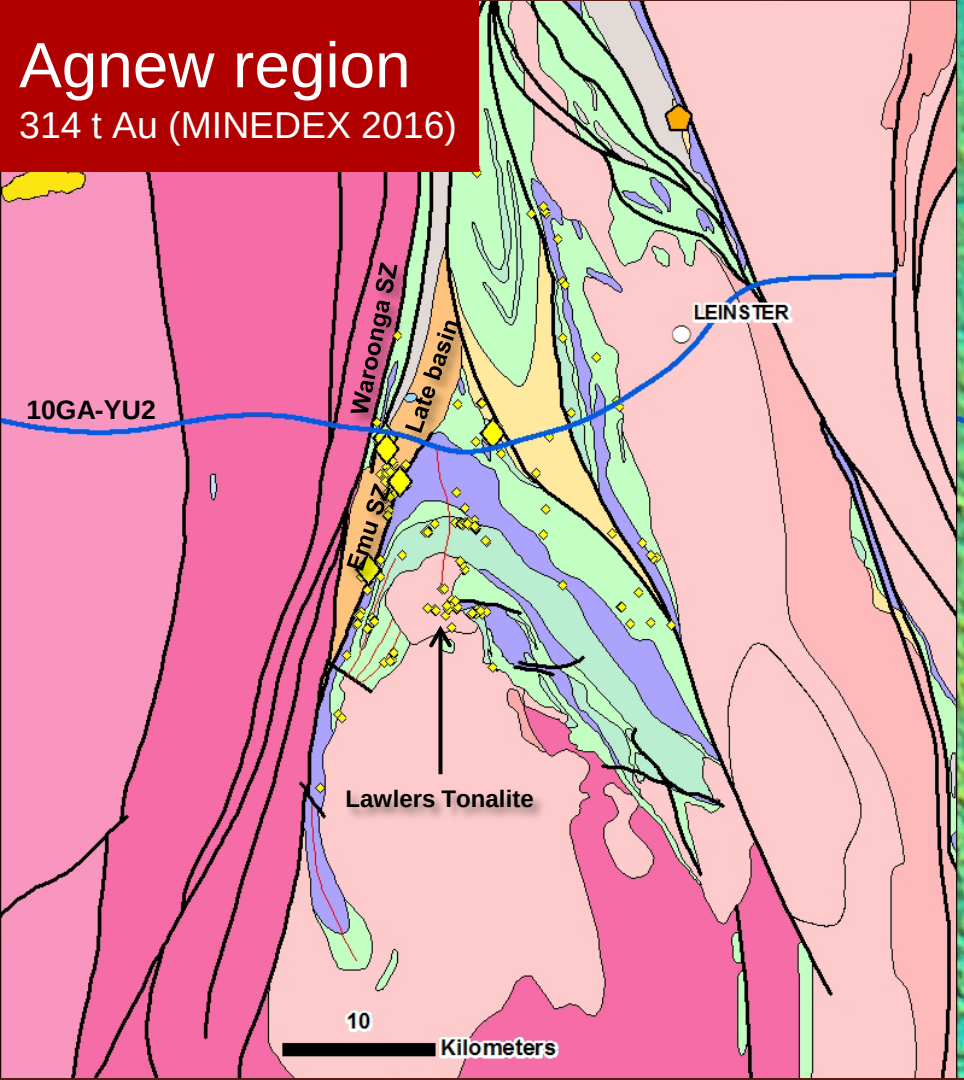

Kalgoorlie

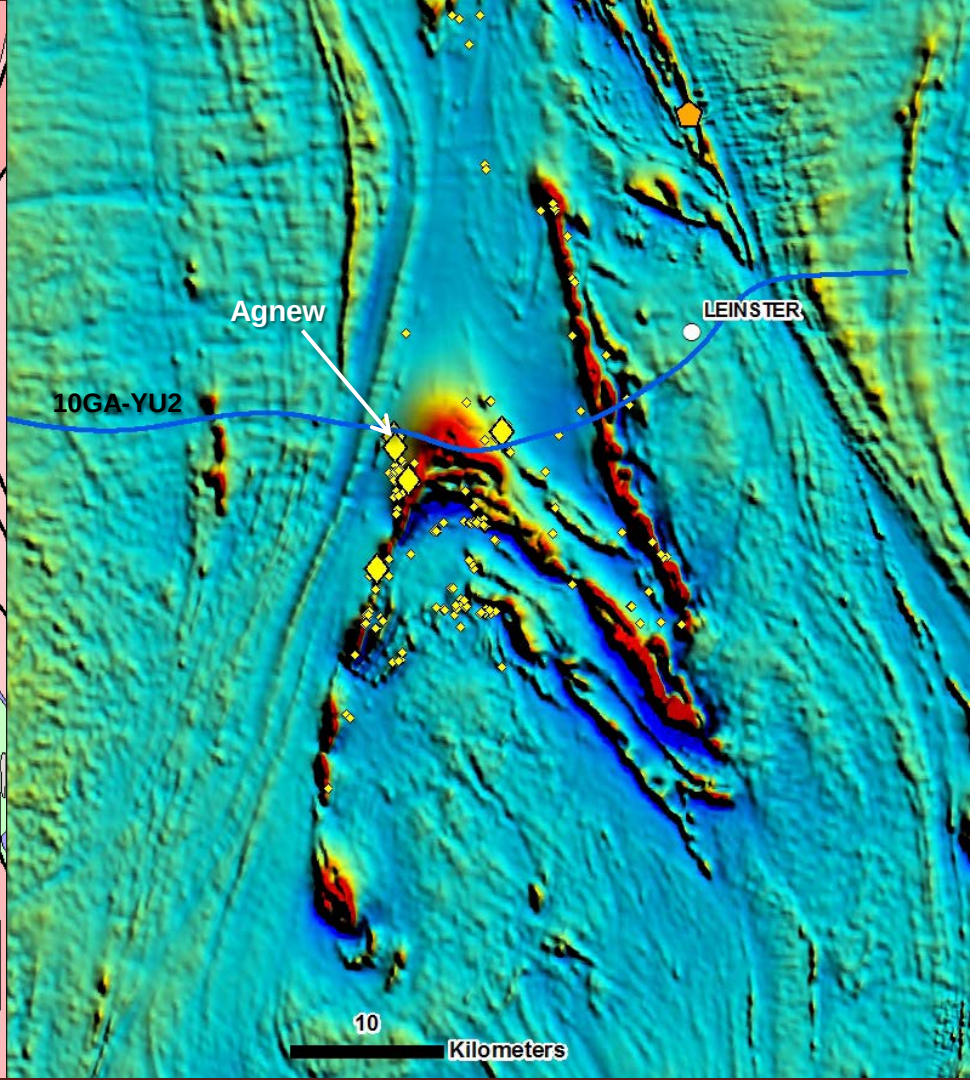

X
Y
100 km
Blewett et al. 2008
MT


Sm–Nd model age
Seismic line
Gold
Nickel, vanadium
Base metals
Iron
PEAK HILL
MEEKATHARRA
WILUNA
CUE
LEINSTER
SANDSTONE
MOUNT MAGNET
YALGOO
MULLEWA
LAVERTON
LEONORA
PAYNES FIND
THREE SPRINGS
MENZIES
EDJUDINA
100
Kilometers

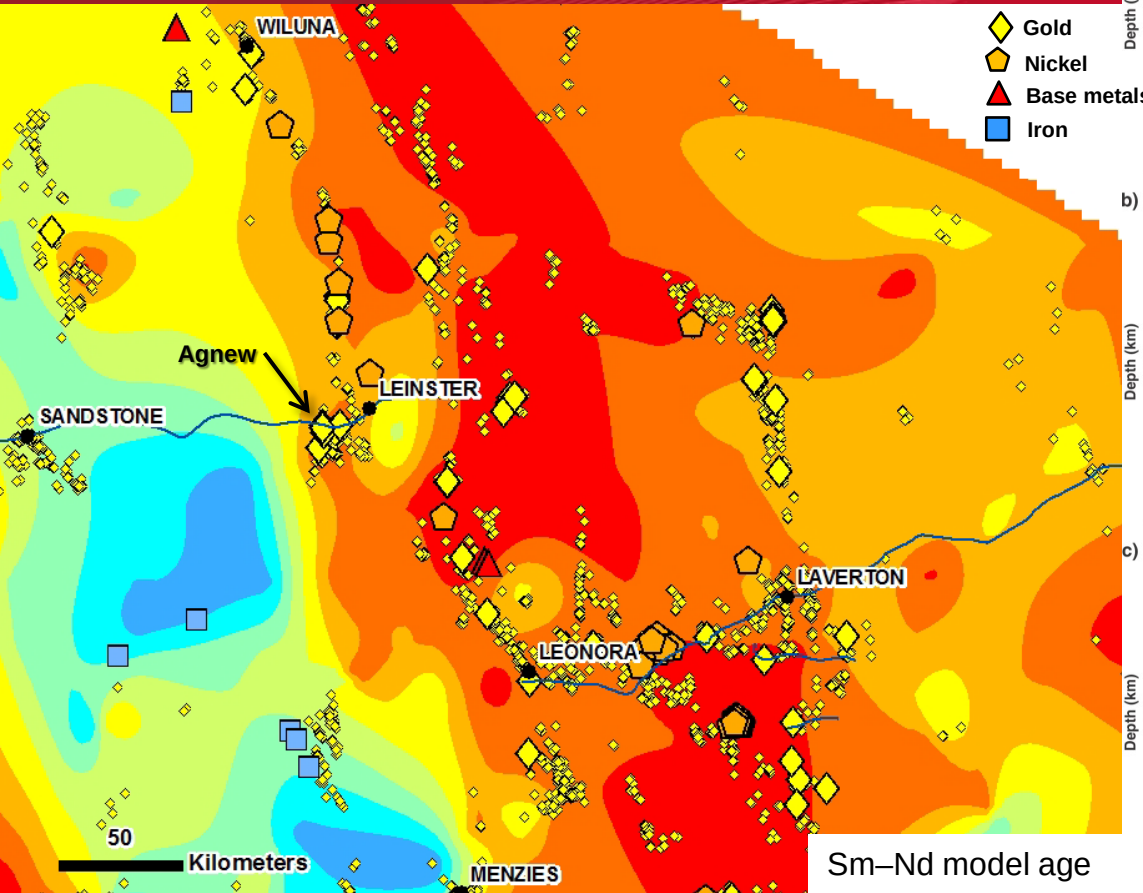
Agnew region

314 t Au (MINEDEX 2016)

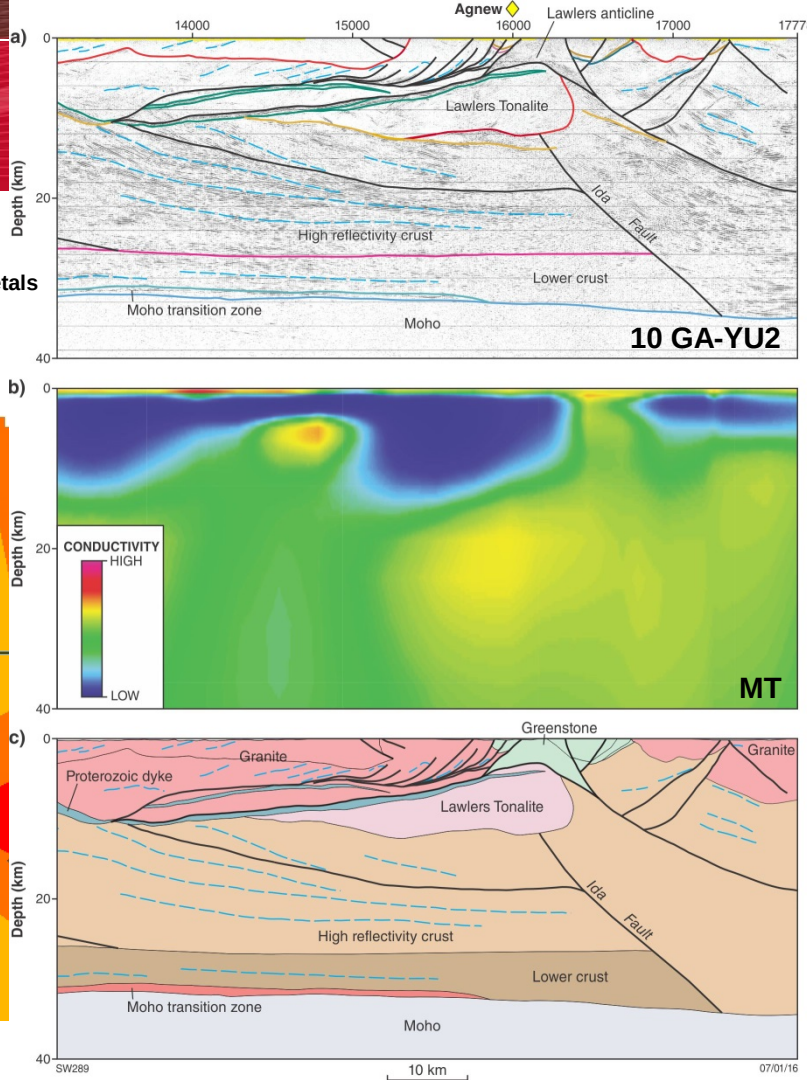


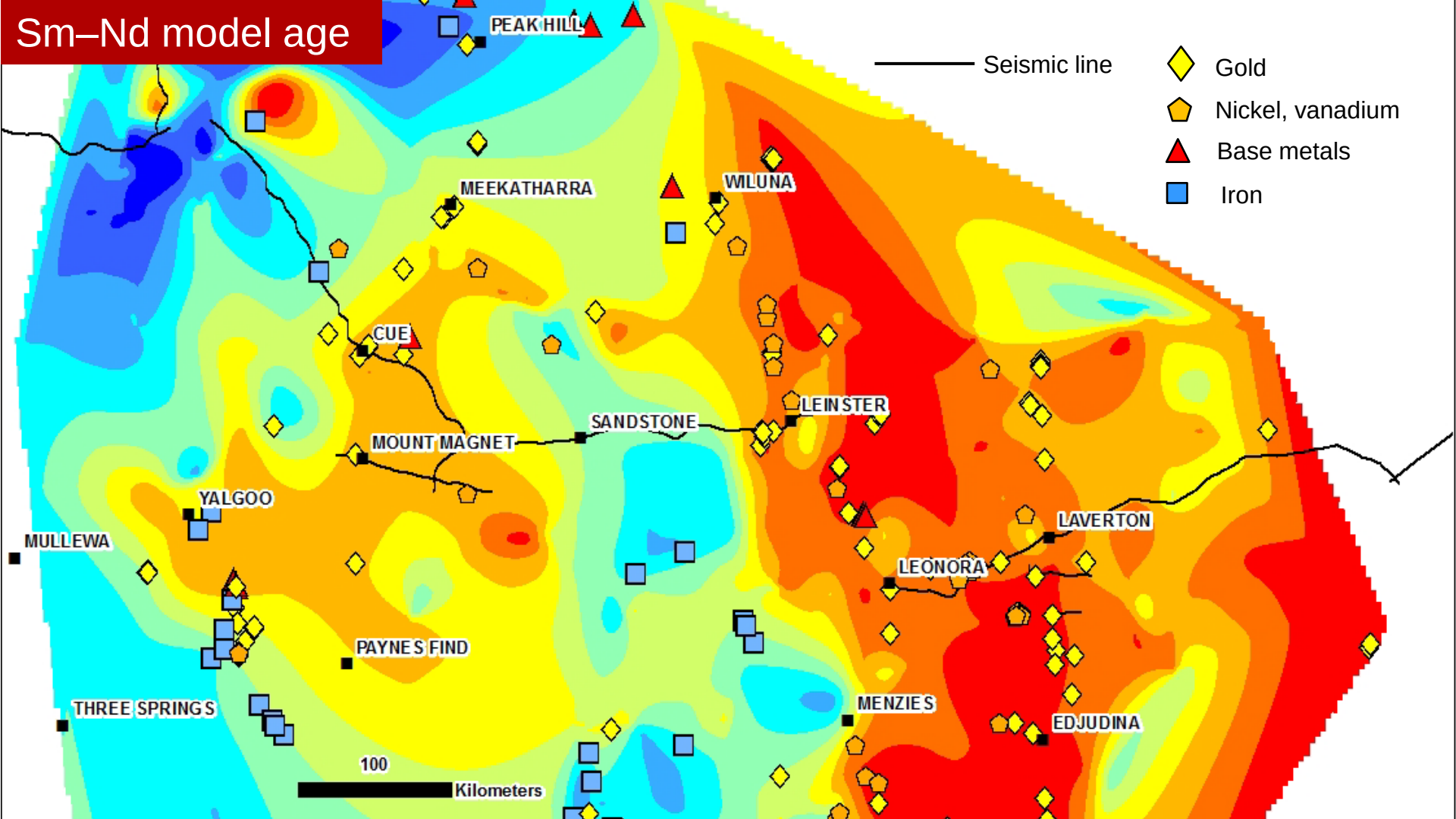


Agnew region

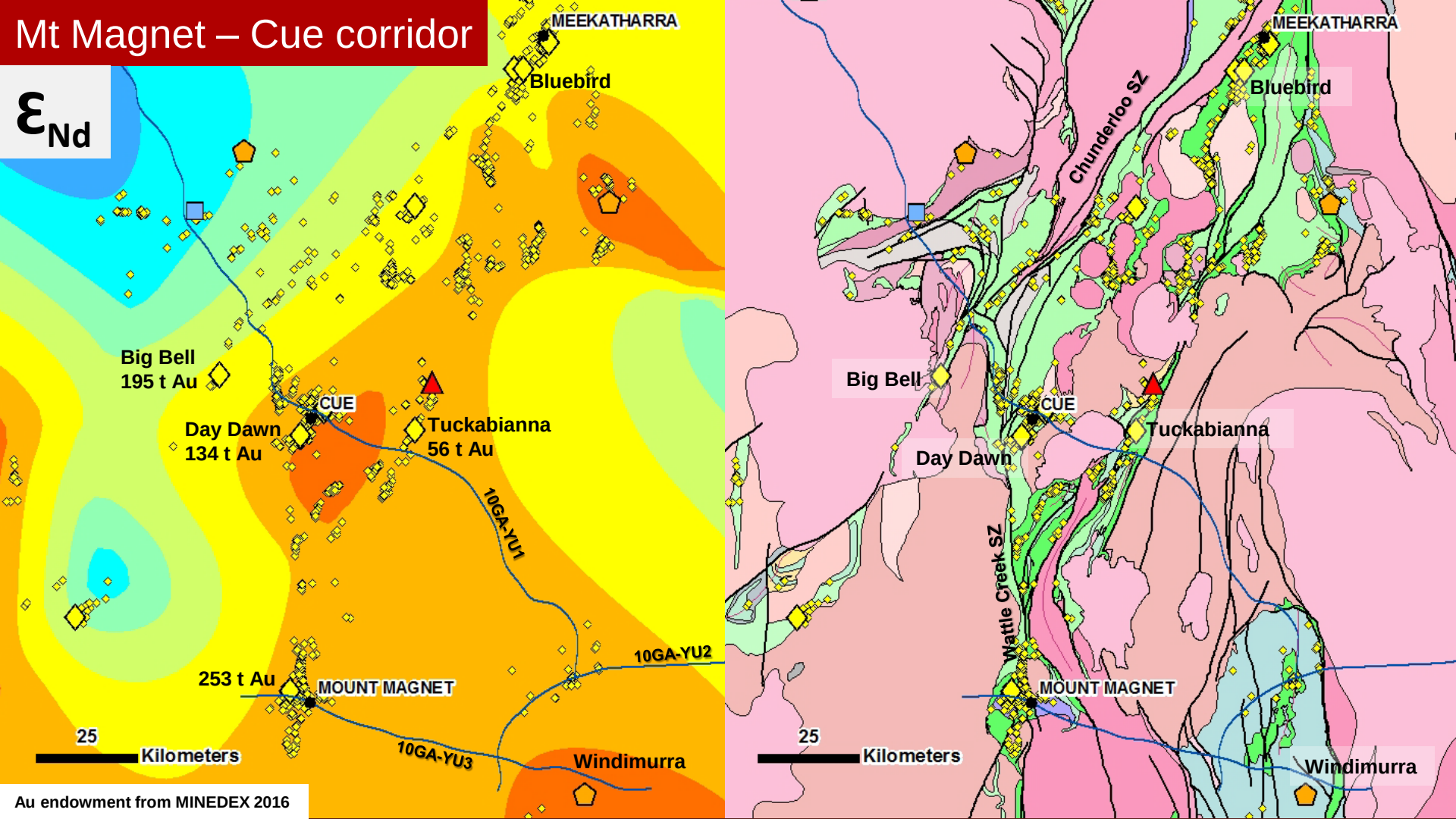


Sm–Nd model age



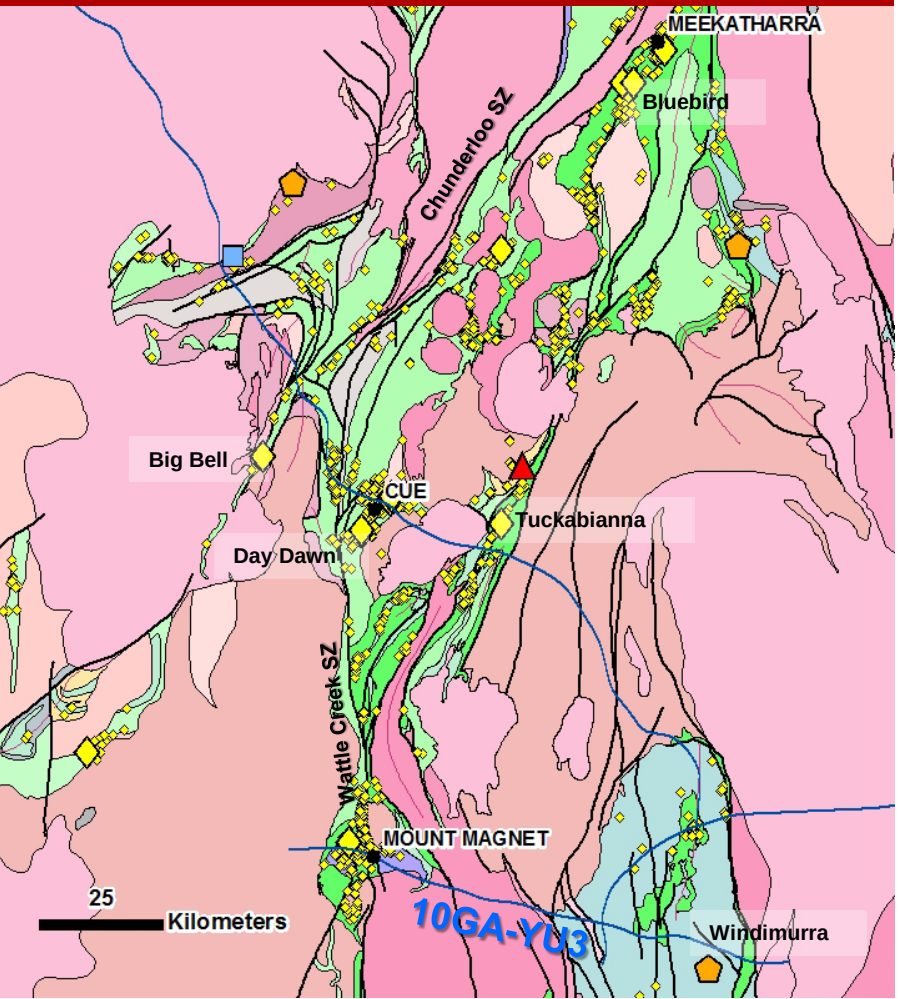

Sm–Nd model age
Seismic line
Gold
Nickel, vanadium
Base metals
Iron
PEAK HILL
MEEKATHARRA
WILUNA
CUE
LEINSTER
SANDSTONE
MOUNT MAGNET
YALGOO
MULLEWA
LAVERTON
LEONORA
PAYNES FIND
THREE SPRINGS
MENZIES
EDJUDINA
100
Kilometers

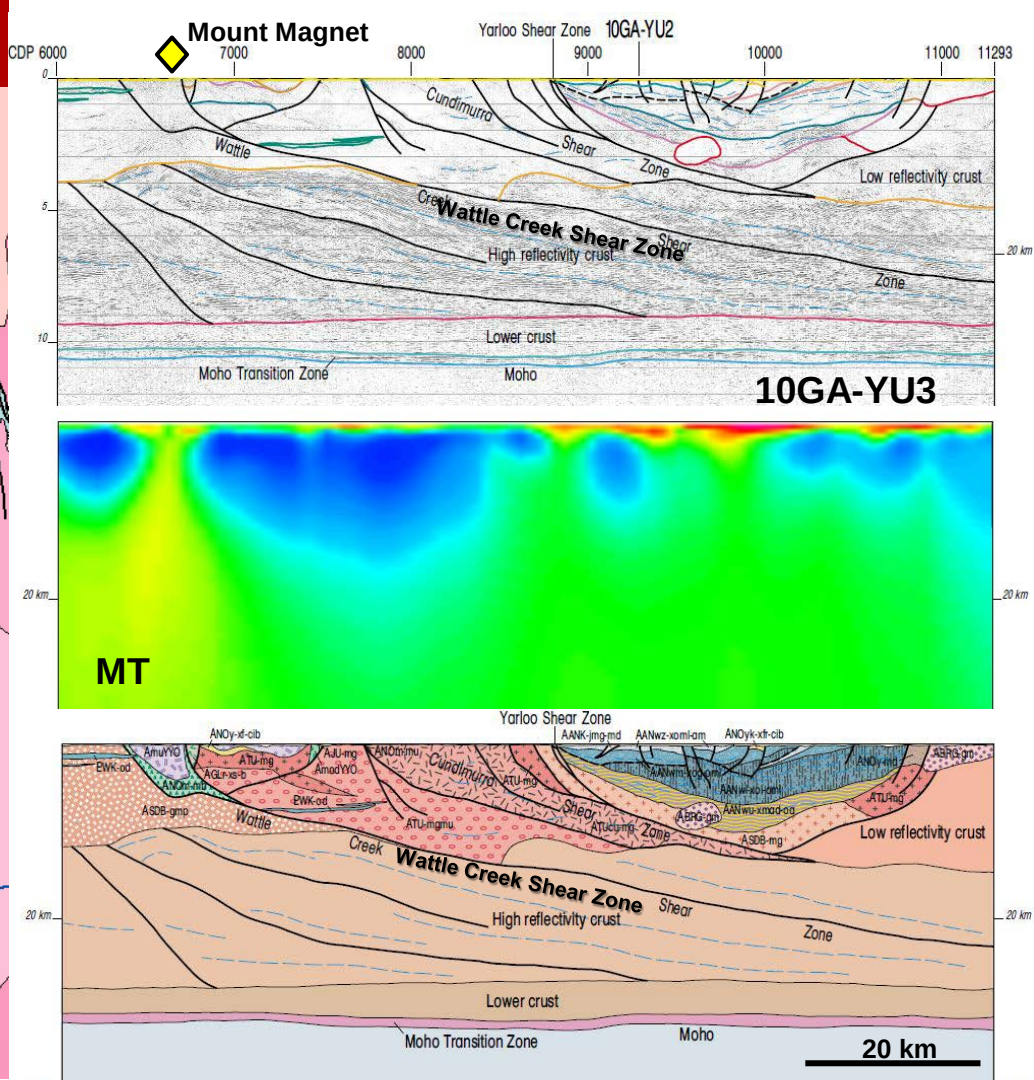
Mt Magnet – Cue corridor



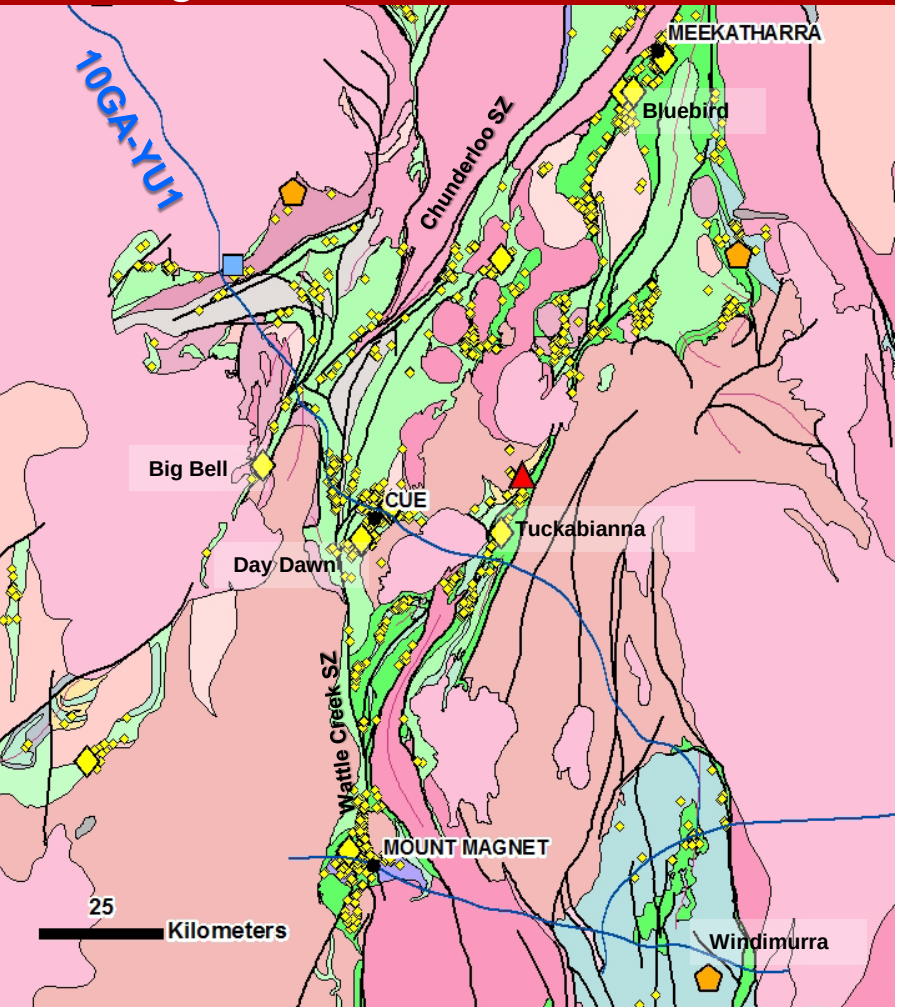
Au endowment from MINEDEX 2016

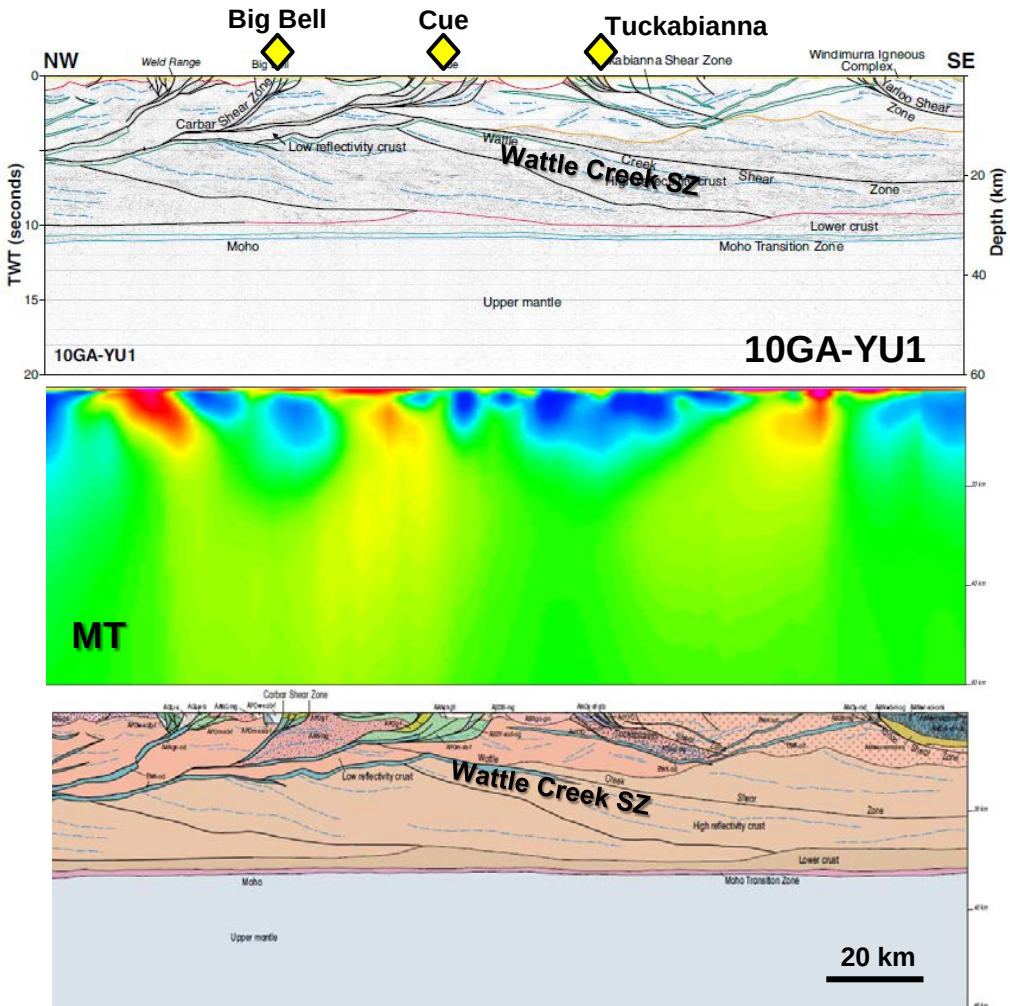
Mt Magnet – Cue corridor

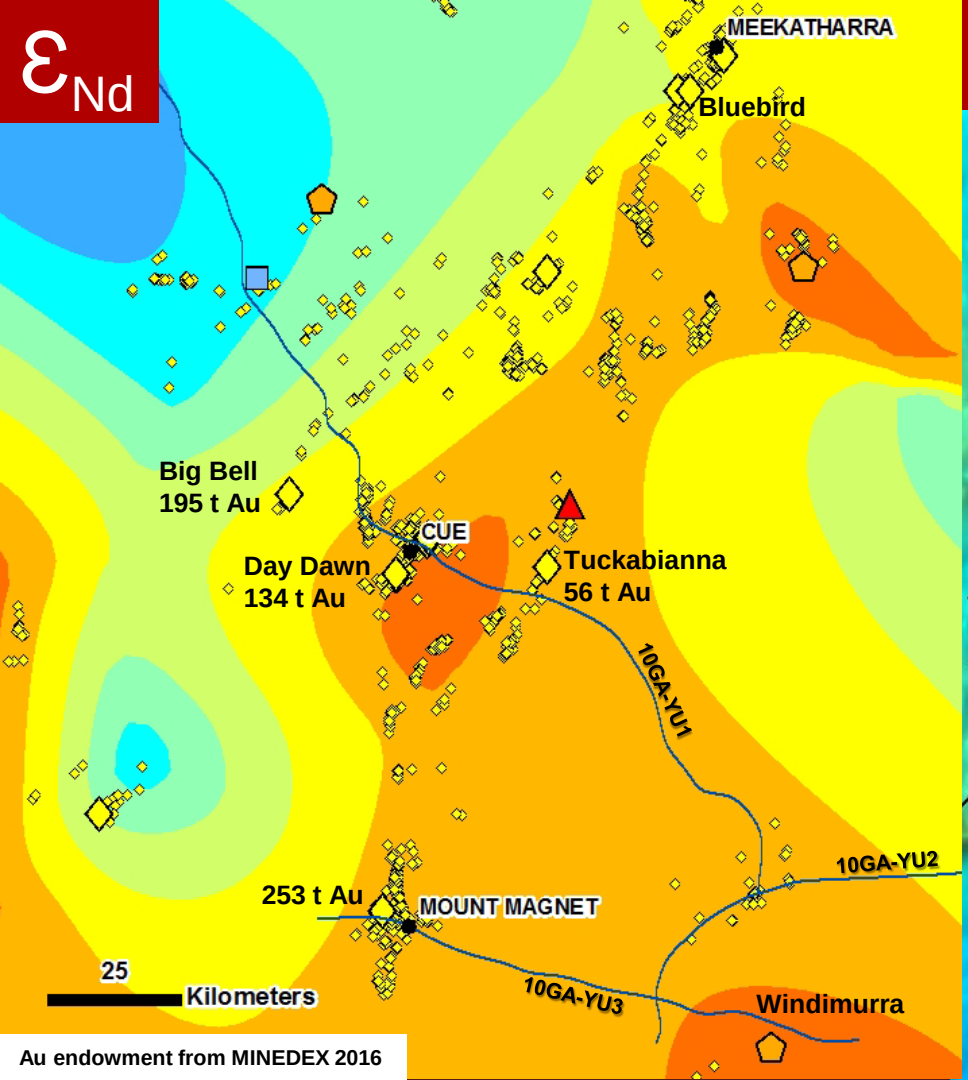


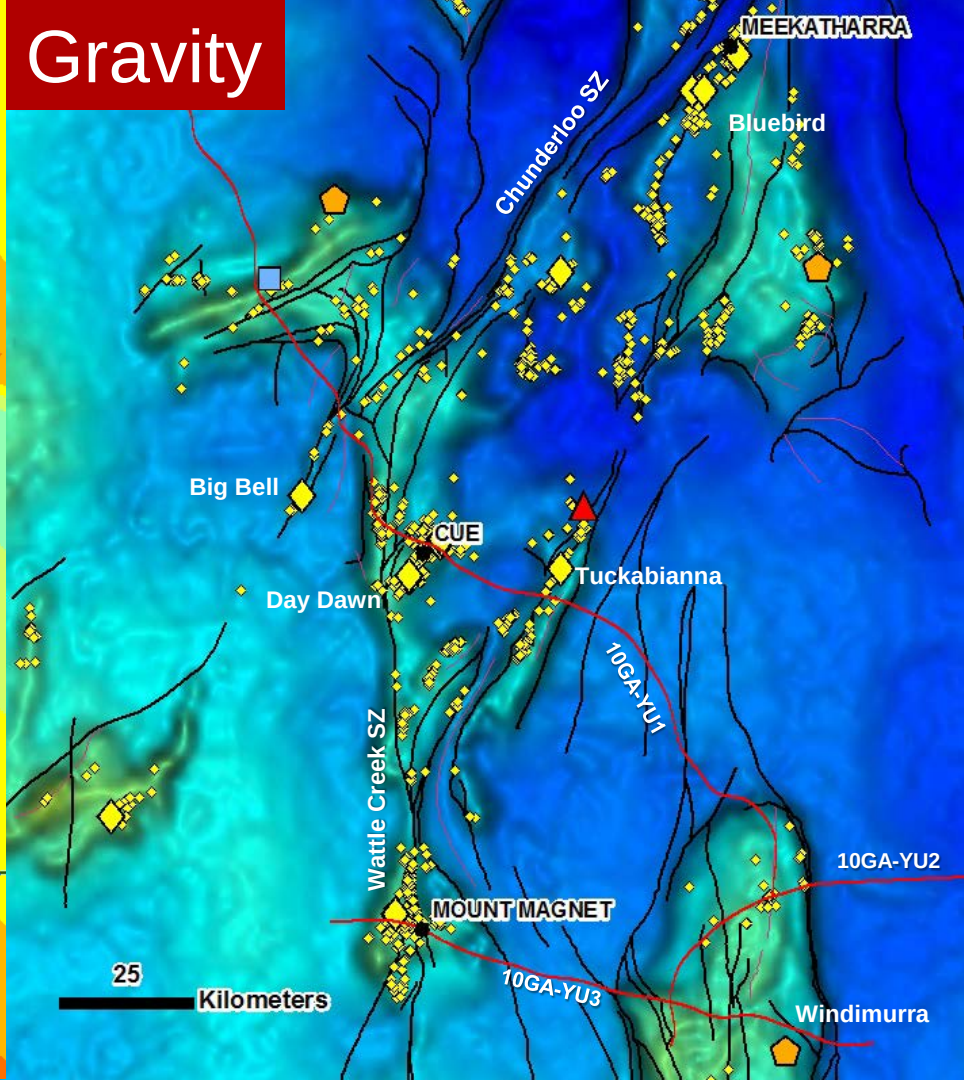


Mt Magnet – Cue corridor

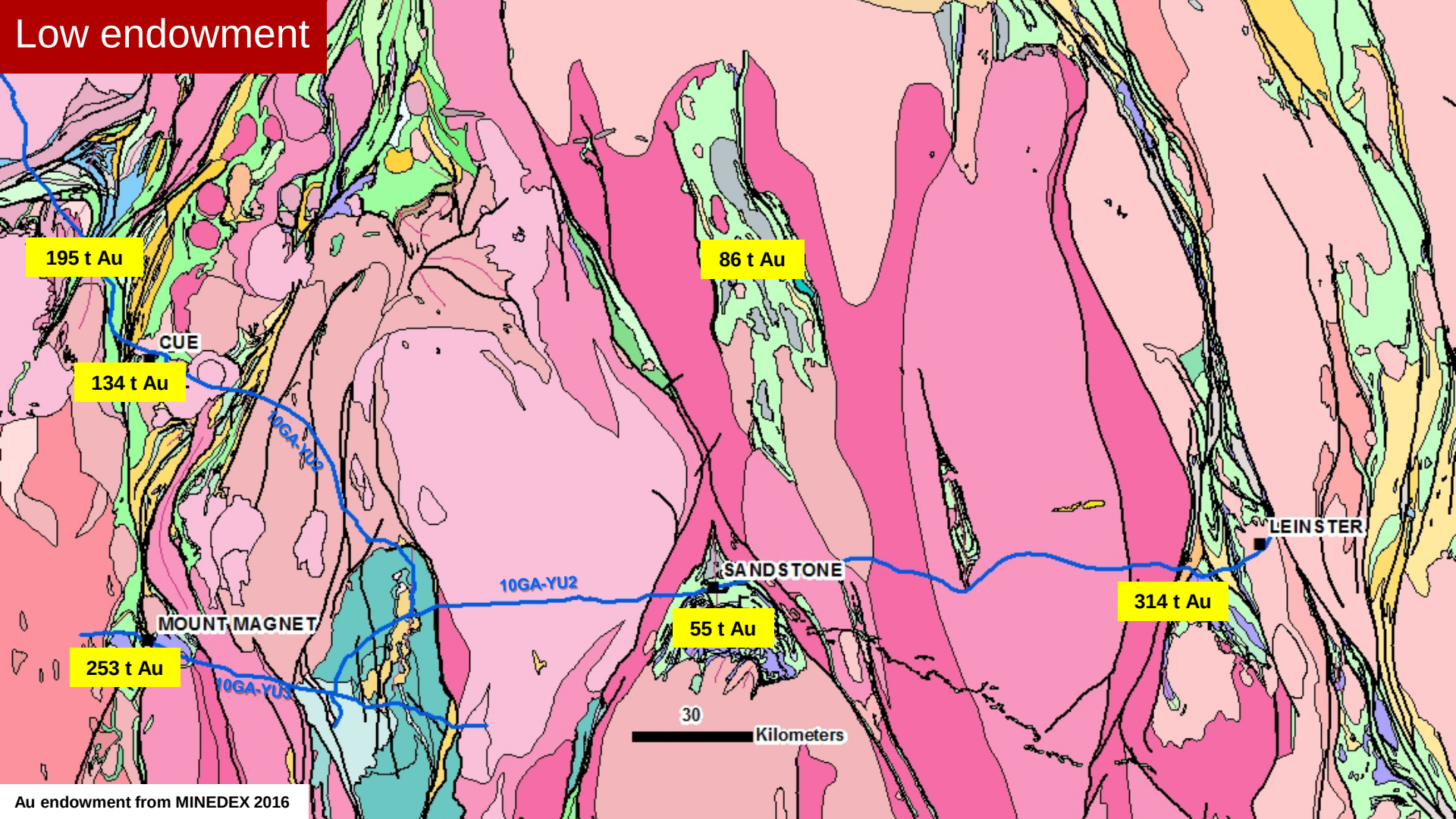


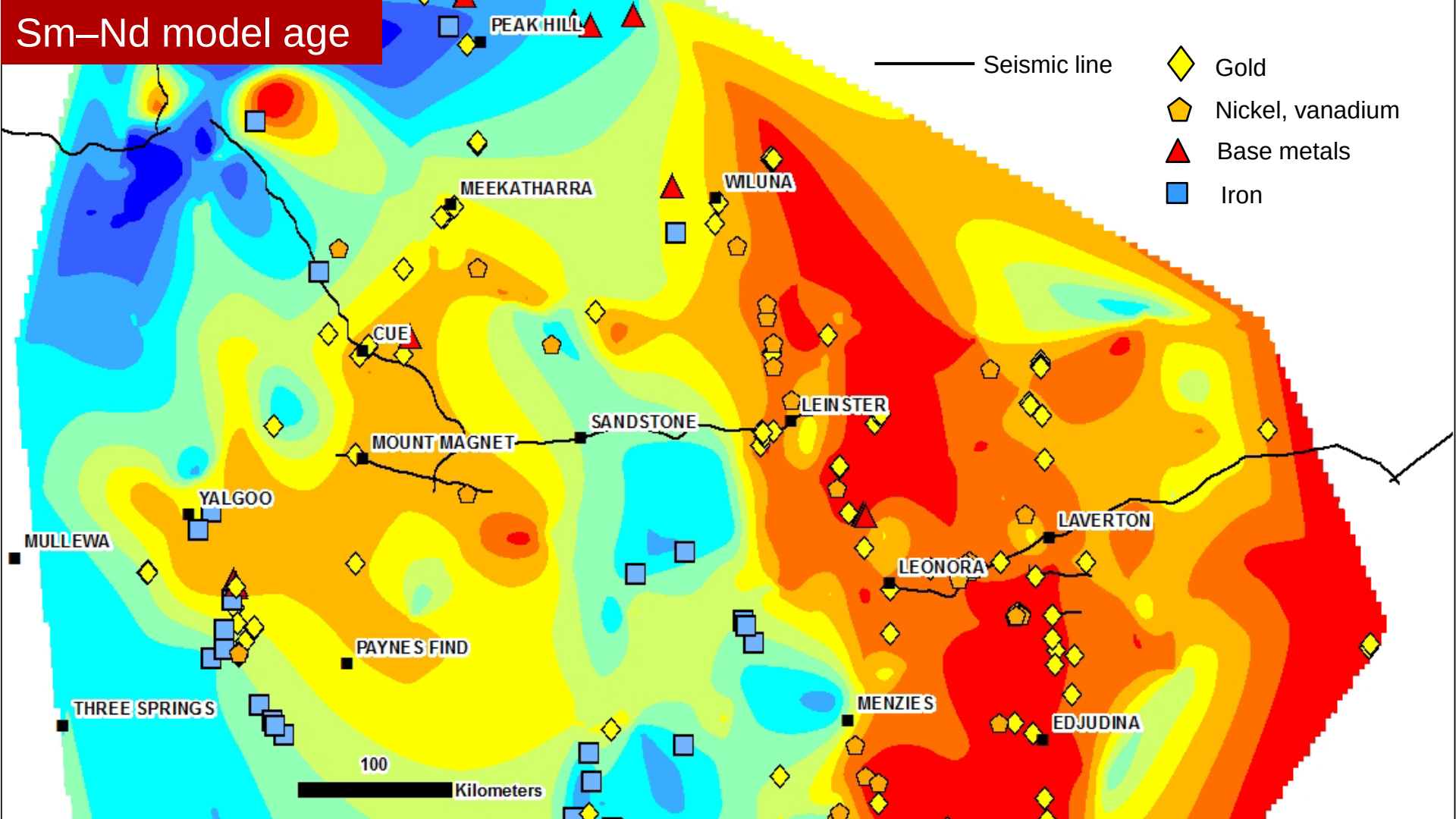


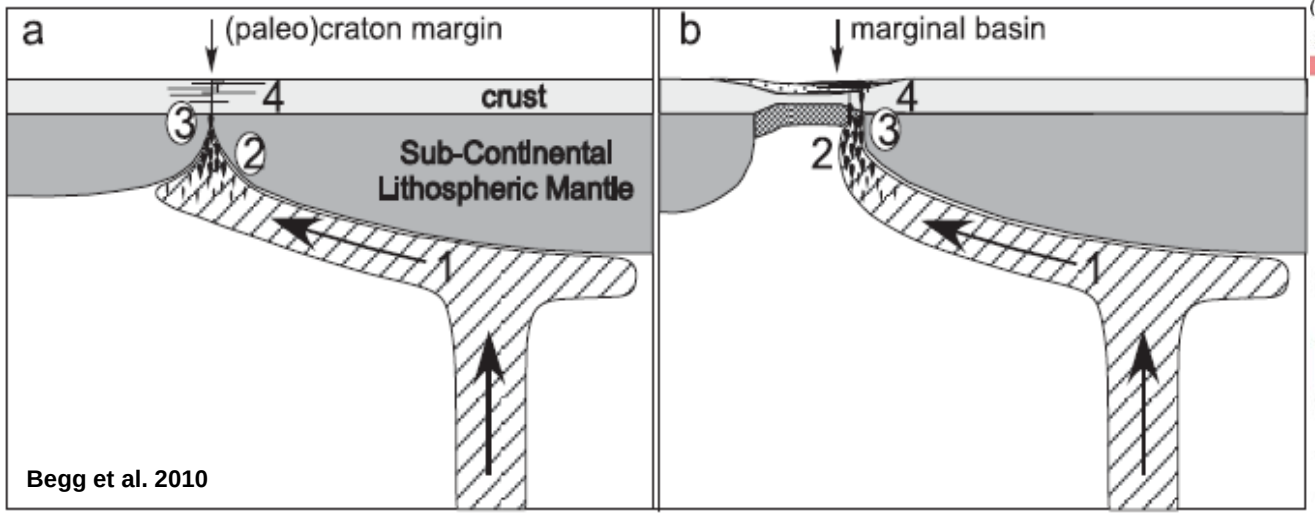




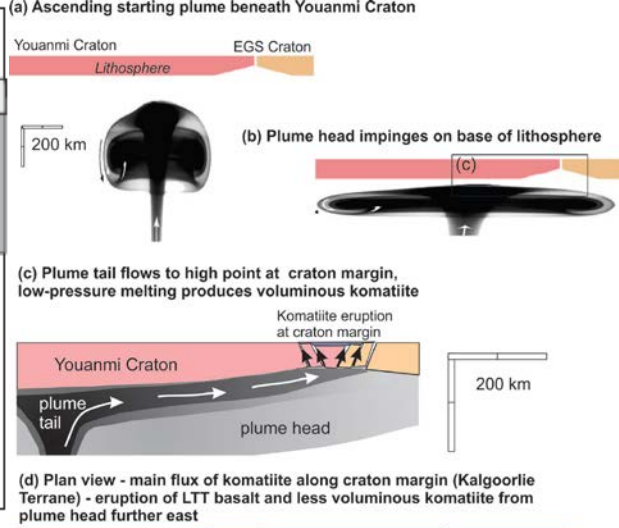
Au endowment from MINEDEX 2016

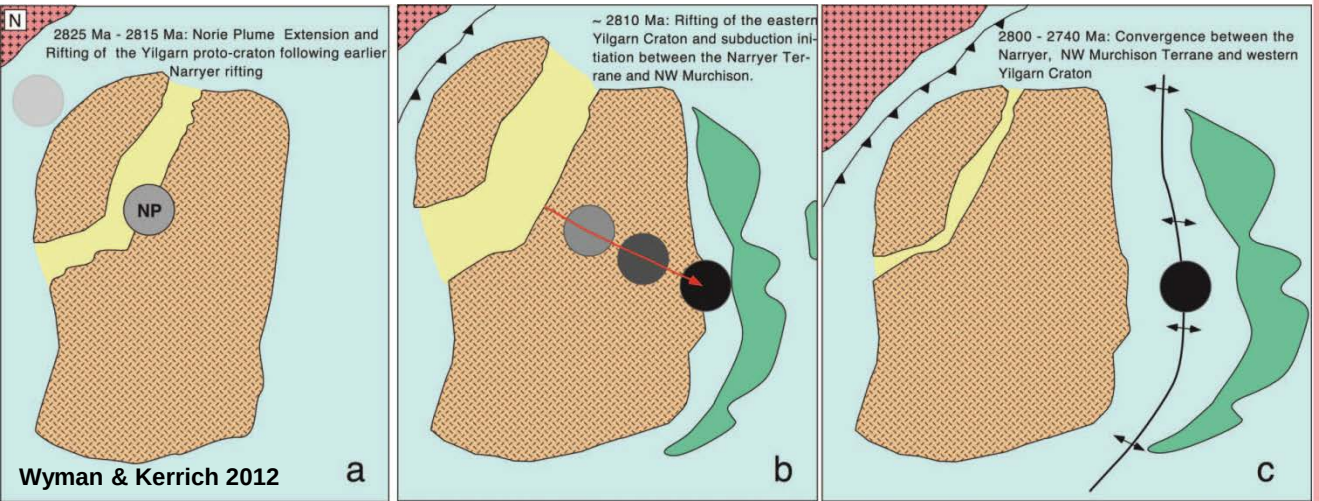

Low endowment
195 t Au
86 t Au
CUE
134 t Au
10GA-YU2
LEINSTER
SANDSTONE
10GA-YU2
314 t Au
MOUNT MAGNET
55 t Au
253 t Au
10GA-YU3
30
Kilometers
Au endowment from MINEDEX 2016


Sm–Nd model age
Seismic line
Gold
Nickel, vanadium
Base metals
Iron
PEAK HILL
MEEKATHARRA
WILUNA
CUE
LEINSTER
SANDSTONE
MOUNT MAGNET
YALGOO
MULLEWA
LAVERTON
LEONORA
PAYNES FIND
THREE SPRINGS
MENZIES
EDJUDINA
100
Kilometers

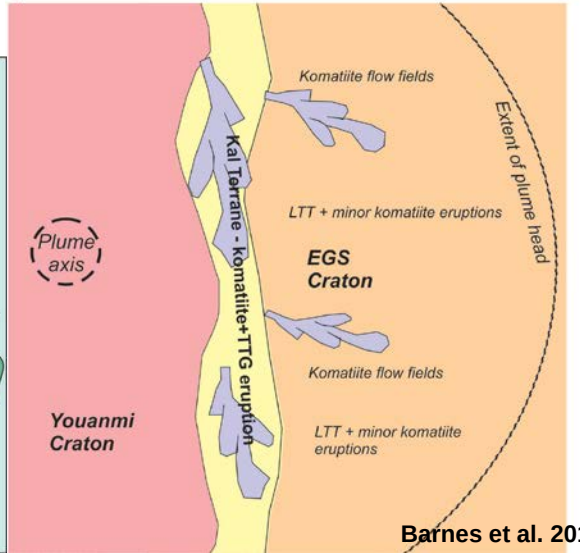


Begg et al. 2010





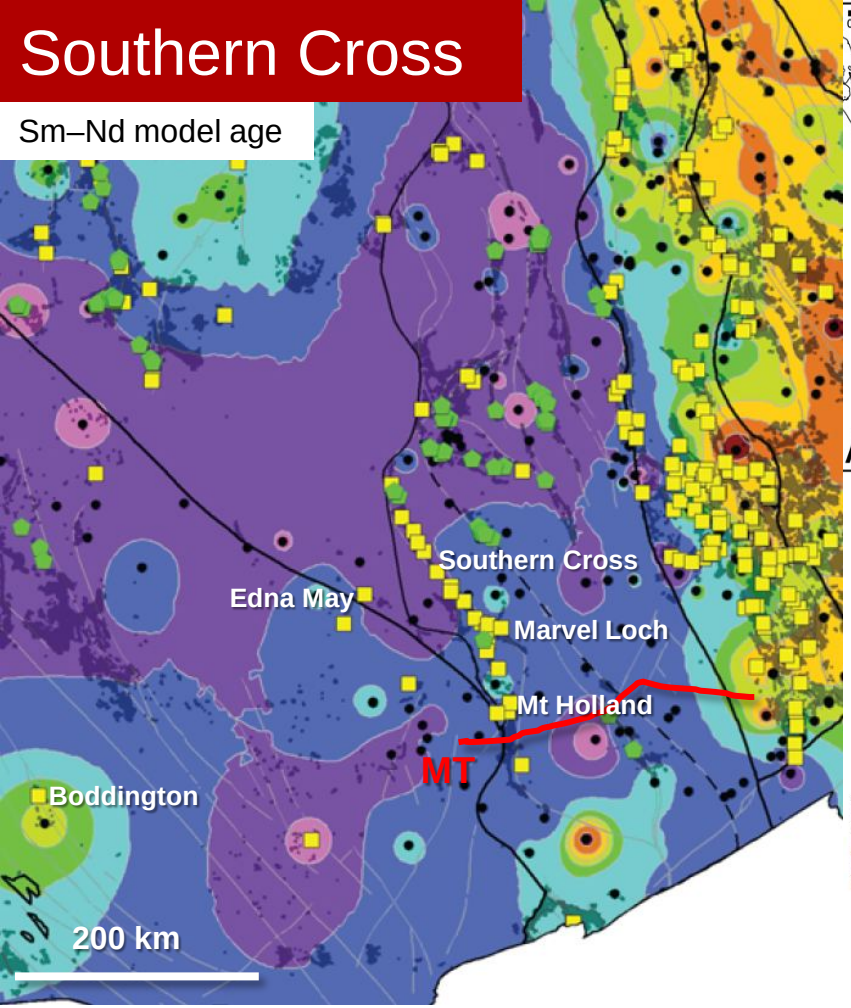
Wyman & Kerrich 2012



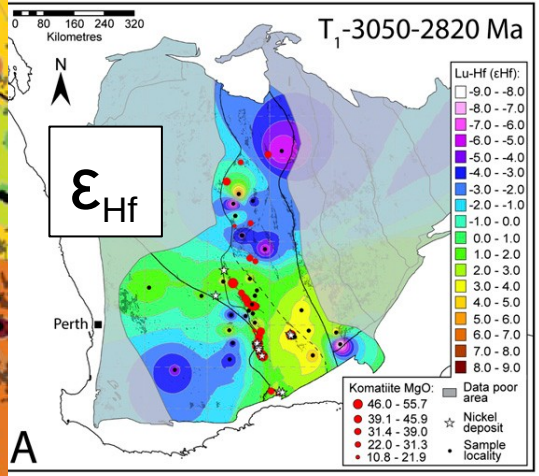
Barnes et al. 2012

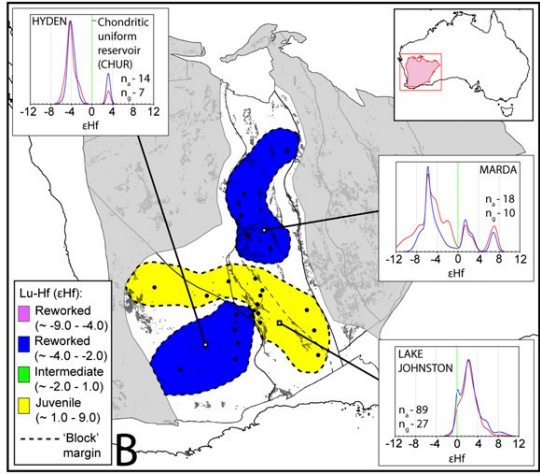
Southern Cross

Sm–Nd model age

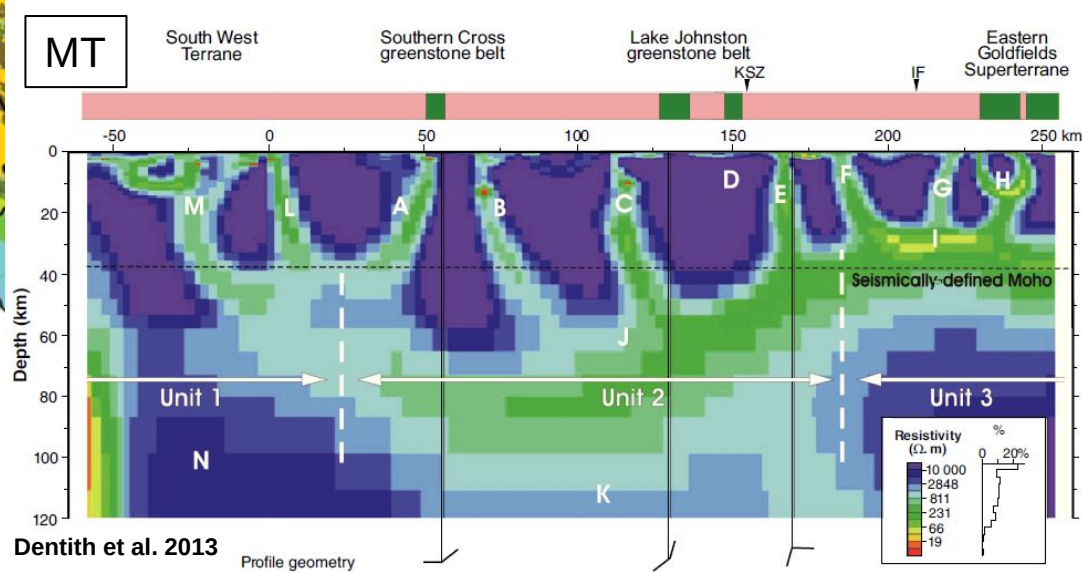


Mole et al. 2015





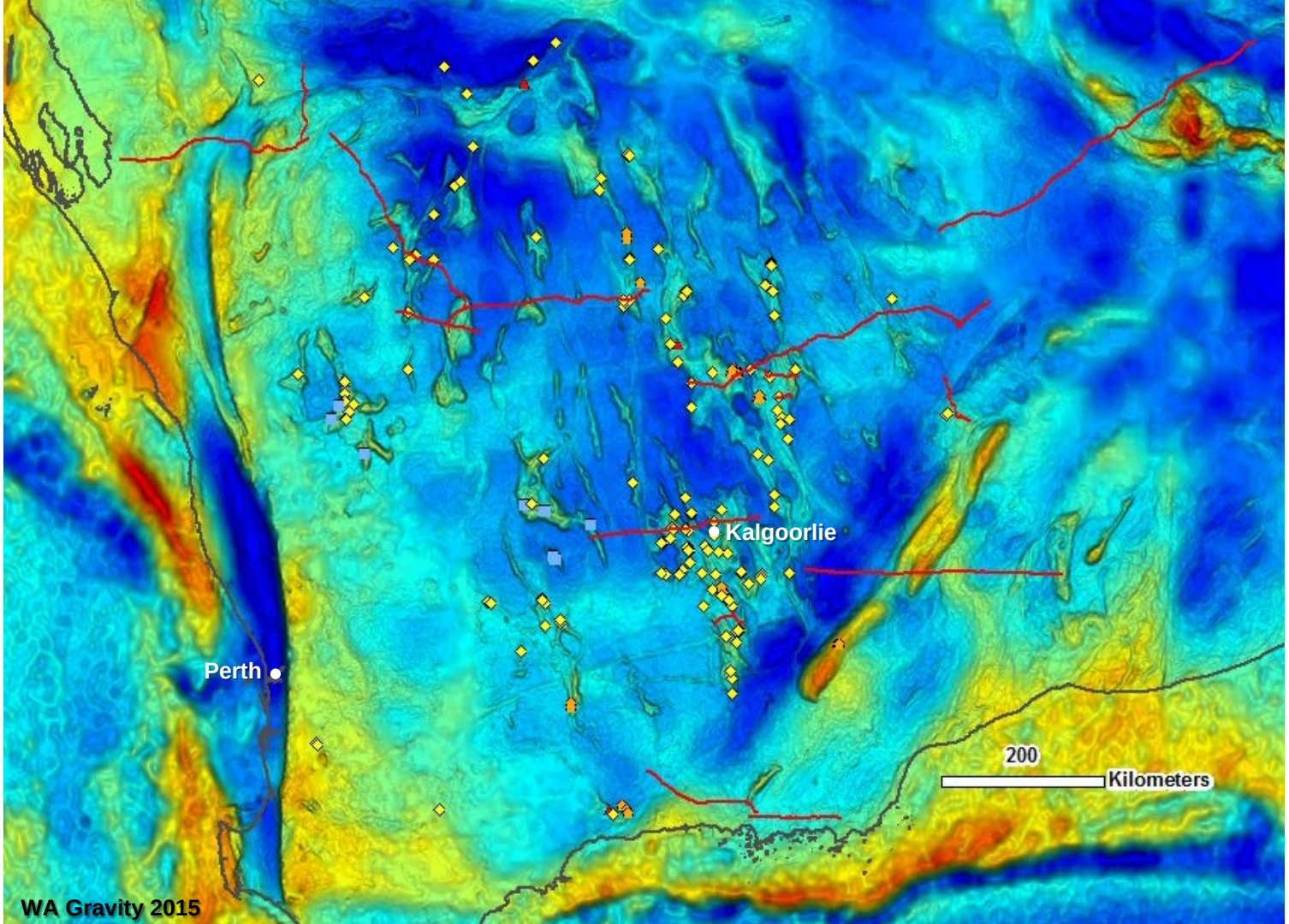
Mole et al. 2014



Dentith et al. 2013

Summary

- Craton history reflected in various large-scale datasets
- Gold (& other commodities) distribution controlled by fundamental craton-scale features
- Significant areas where we lack good data, e.g. SW and far eastern Yilgarn


Kalgoorlie
Perth
200
Kilometers
WA Gravity 2015