

Geological interpretation of the GOMA deep seismic reflection and magnetotelluric line (08GA-OM1)

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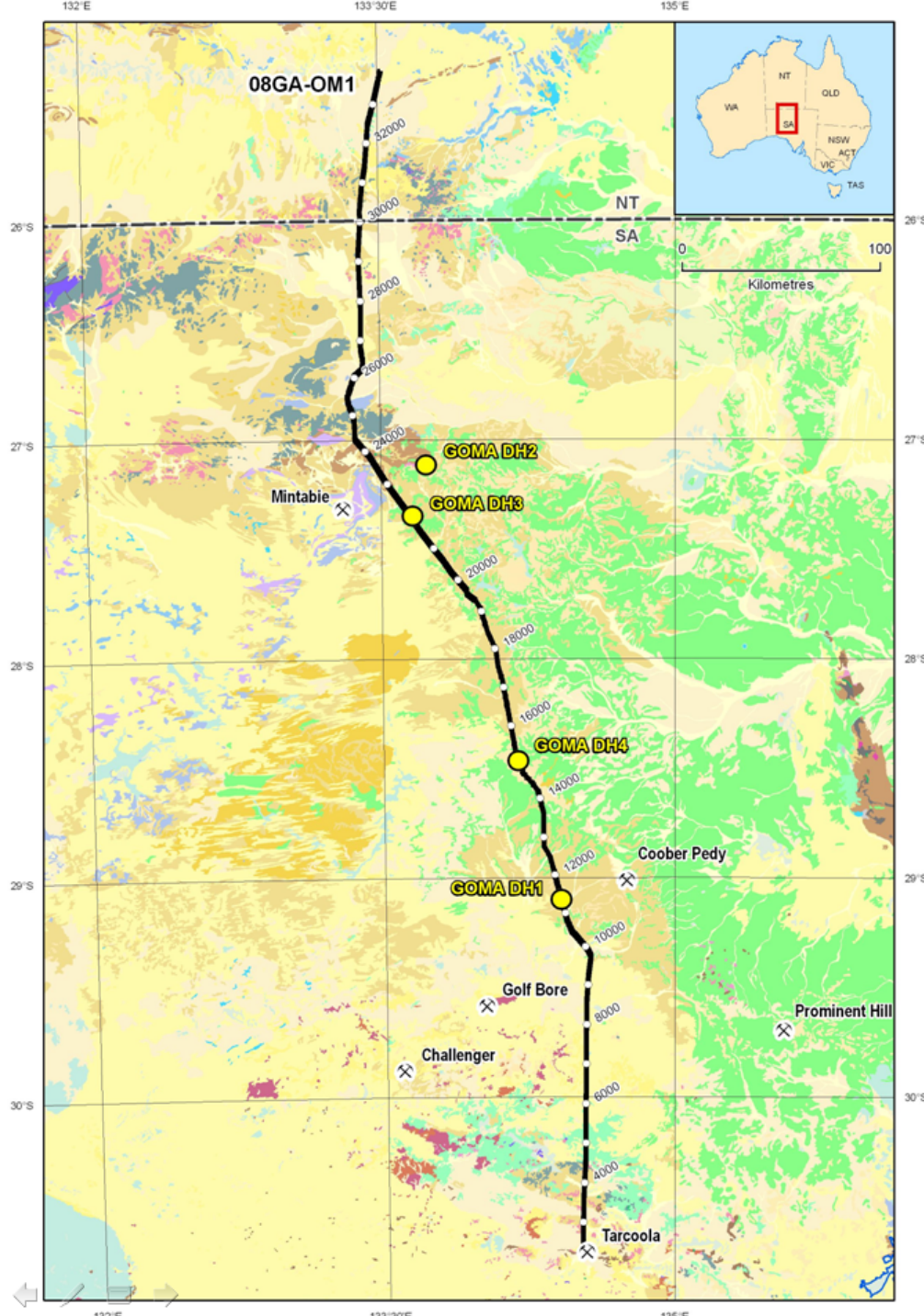
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AuScope (ANU, University of Adelaide, Monash University)

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Aims

- **Improve understanding of crustal architecture:**
 - **Basement:** northern Gawler Craton, eastern Musgrave Province
 - **Basins:** eastern Officer, western Arckaringa, southern Amadeus Basins
- **Improve understanding of the geodynamic evolution of the region**
- **Identify crustal geometries with a high mineral and energy potential:**
 - **iron oxide copper-gold (IOCG) potential**
 - **Geothermal (northern extension of the South Australia Heat Flow Anomaly)**



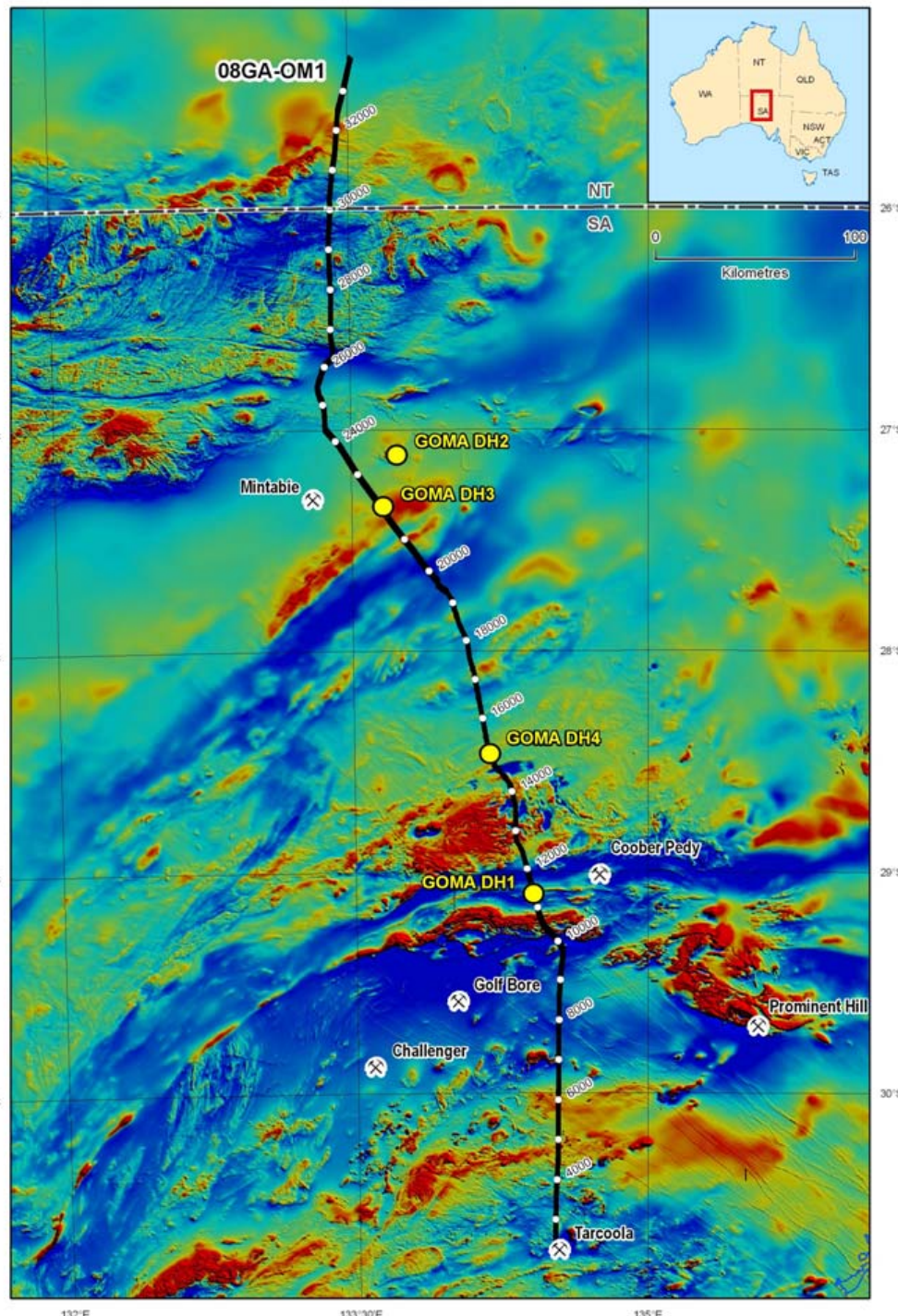
GOMA seismic line (08GA-OM1)

- Sparse basement outcrop
- Mostly Cenozoic and Mesozoic cover
- Geological control poor



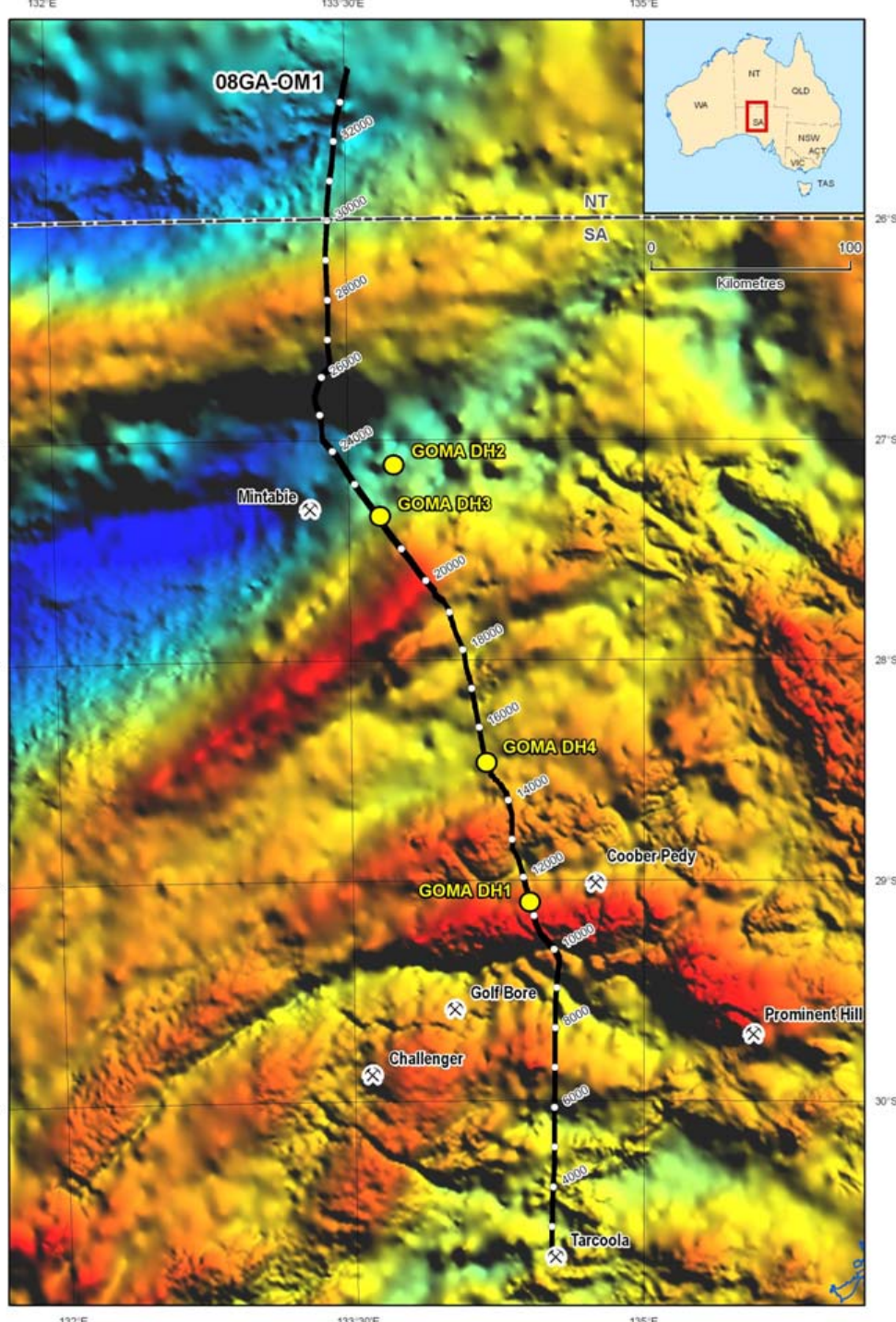
GOMA Seismic Line (08GA-OM1)

Regional aeromagnetic image



GOMA Seismic Line (08GA-OM1)

Regional gravity image



GOMA Seismic Line (08GA-OM1)

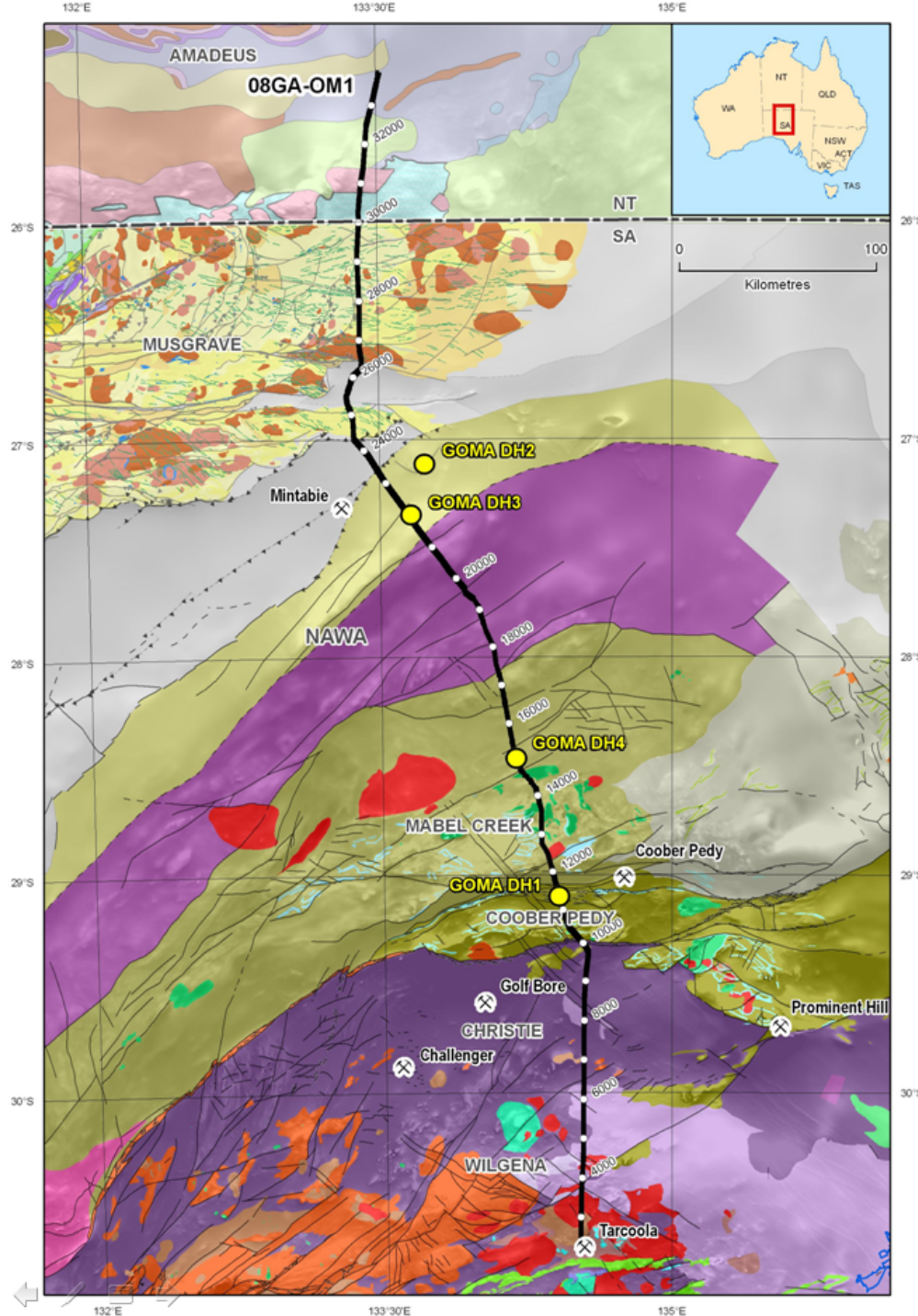
Interpretation based on
gravity, magnetics, limited
outcrop and drilling data



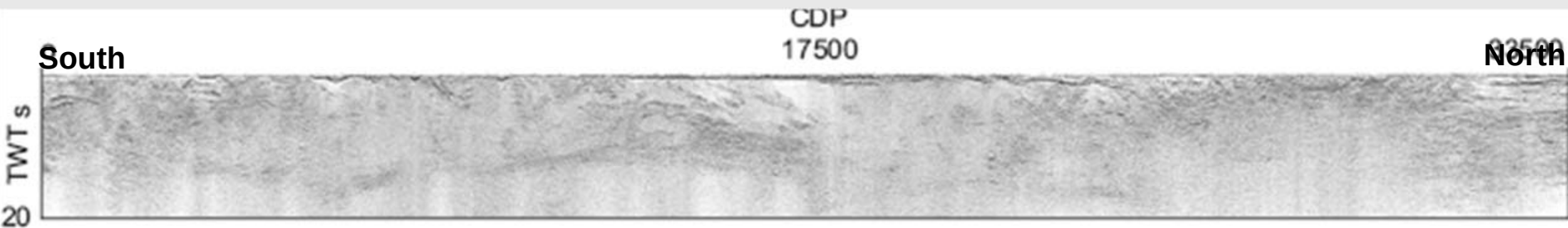
Solid geology
(on 1VD of magnetics)

● GOMA drillholes

SA – Cowley (2006a, b)
NT – Ahmad (2002)



GOMA seismic line (08GA-OM1)



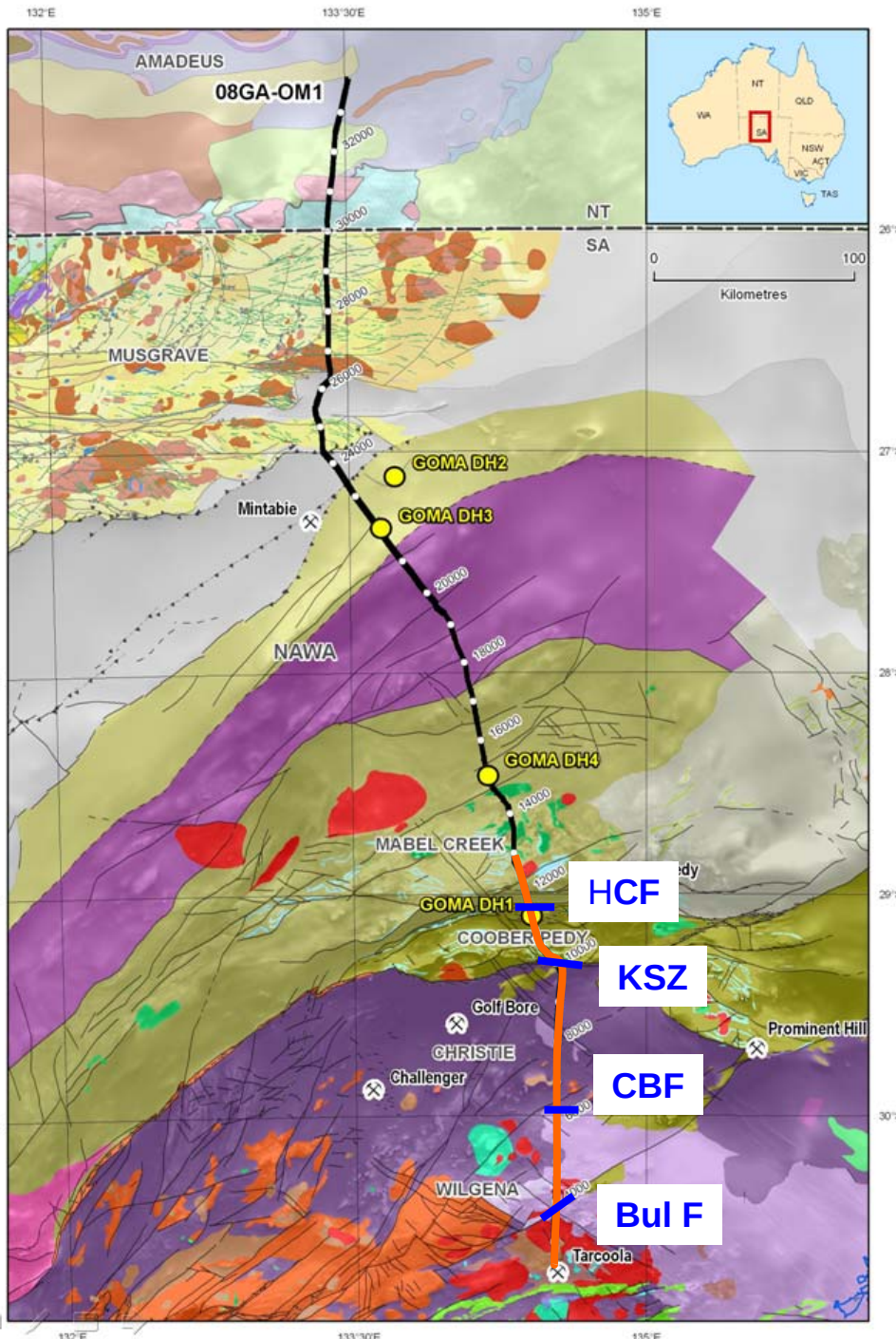
634 km line length
20 s TWT (~60 km depth)
 $V:H = 1$ (at 6 kms^{-1})

Variable depth to Moho
Variable reflectivity of crust

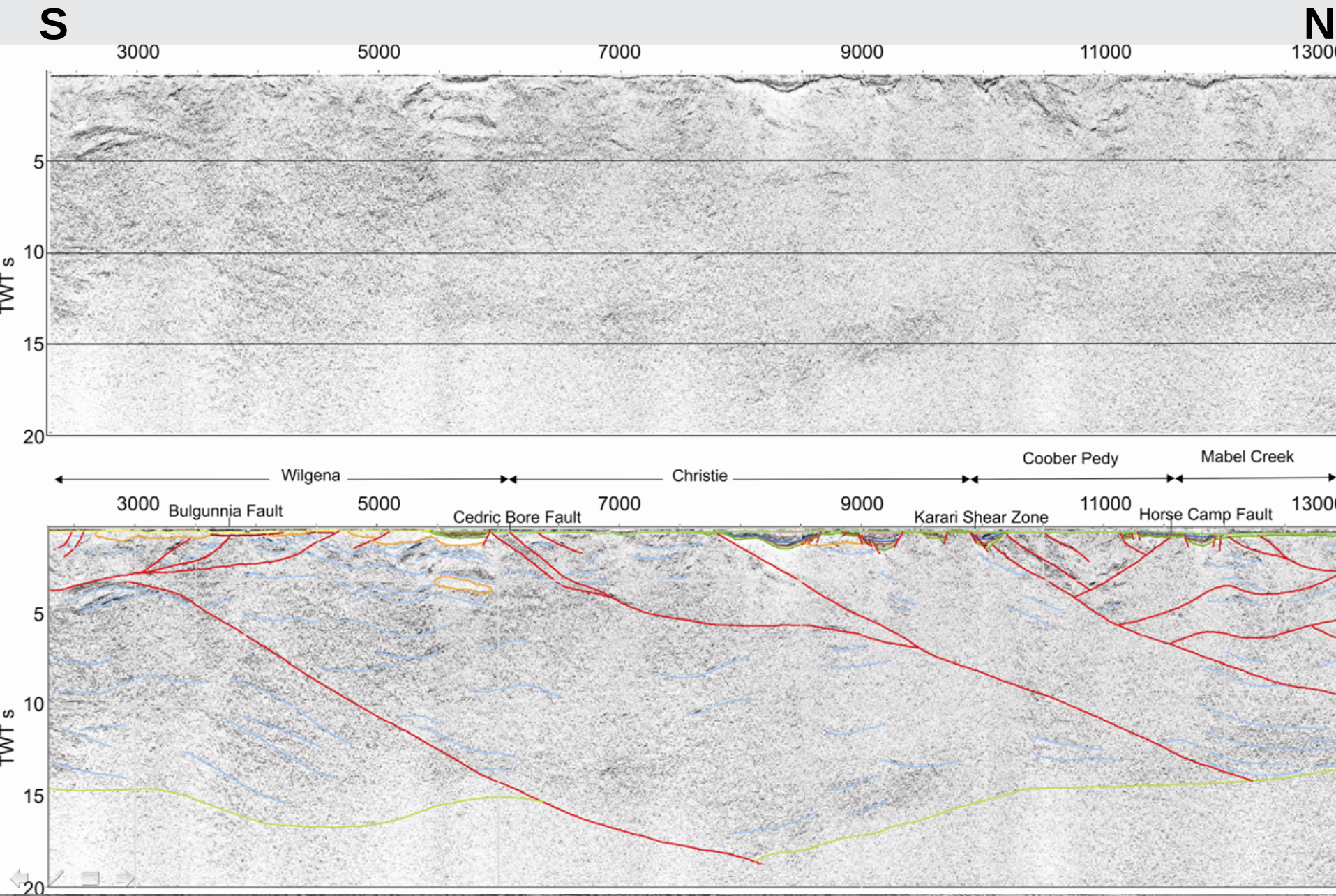
(work through line from south to north)

GOMA seismic line: southern section

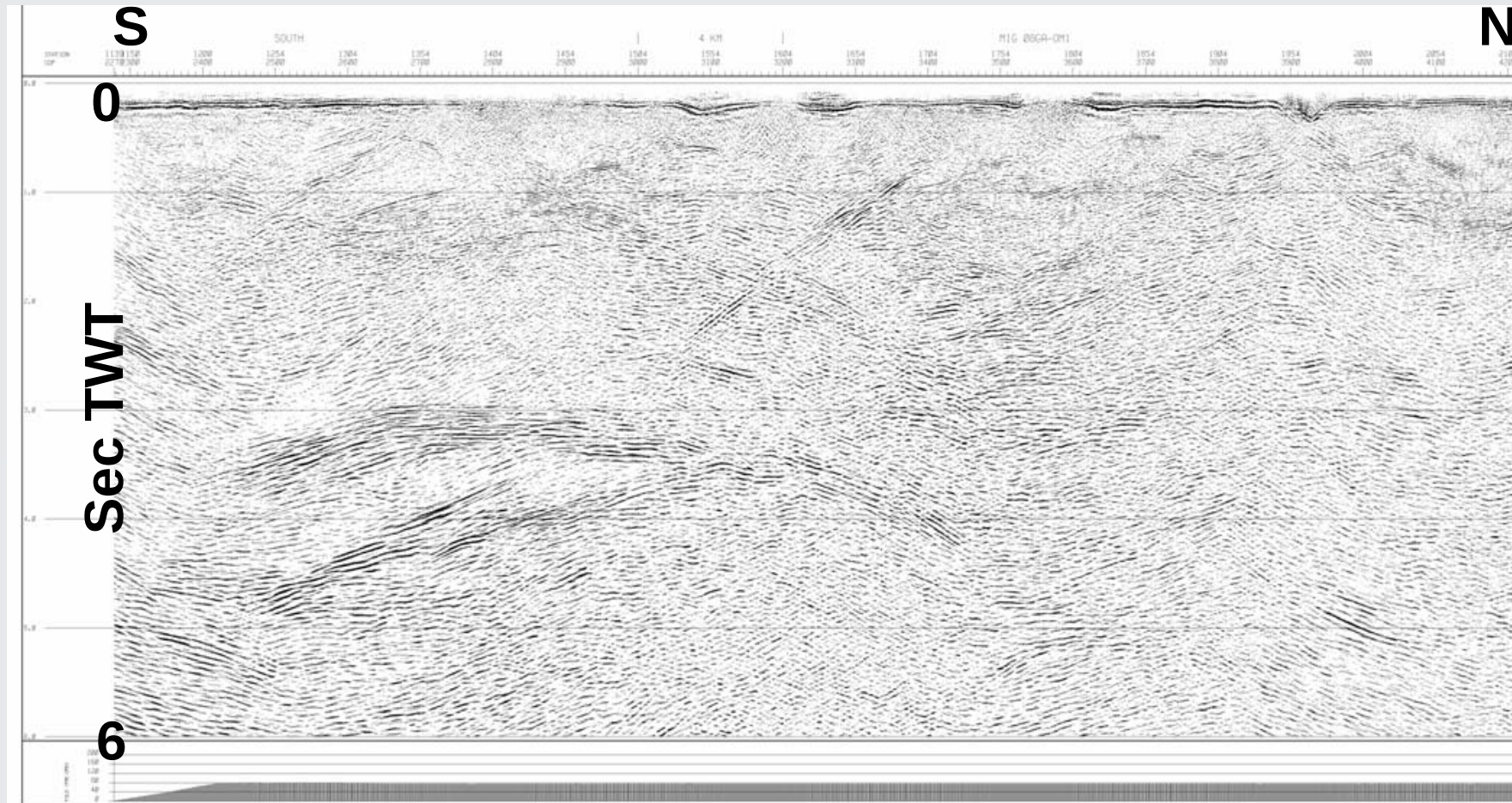
Mabel Creek Domain
Horse Camp Fault
Coober Pedy Domain
Karari Shear Zone
Christie Domain
Cedric Bore Fault
Wilgena Domain
Bulgunnia Fault



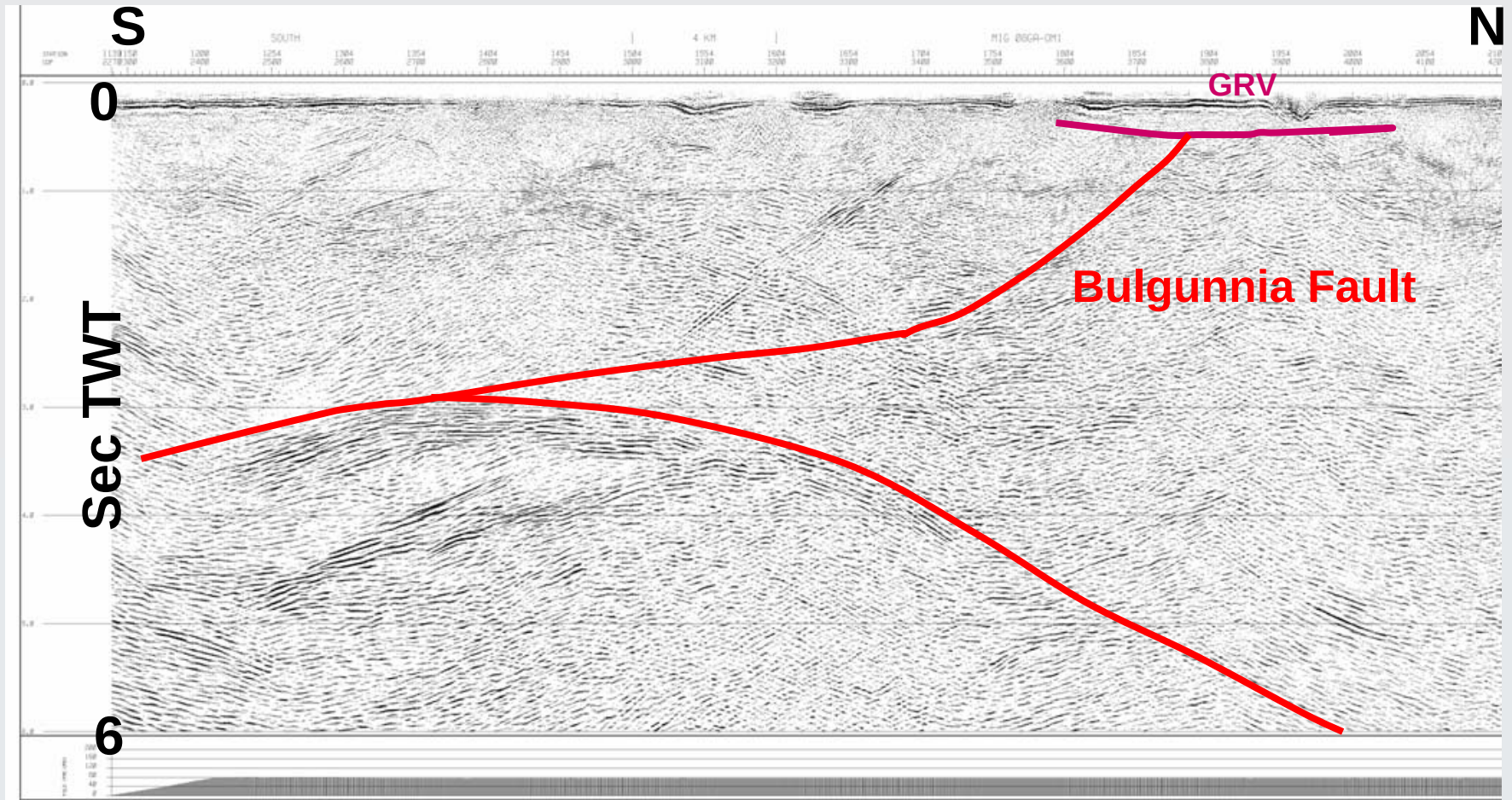
GOMA seismic line: southern section



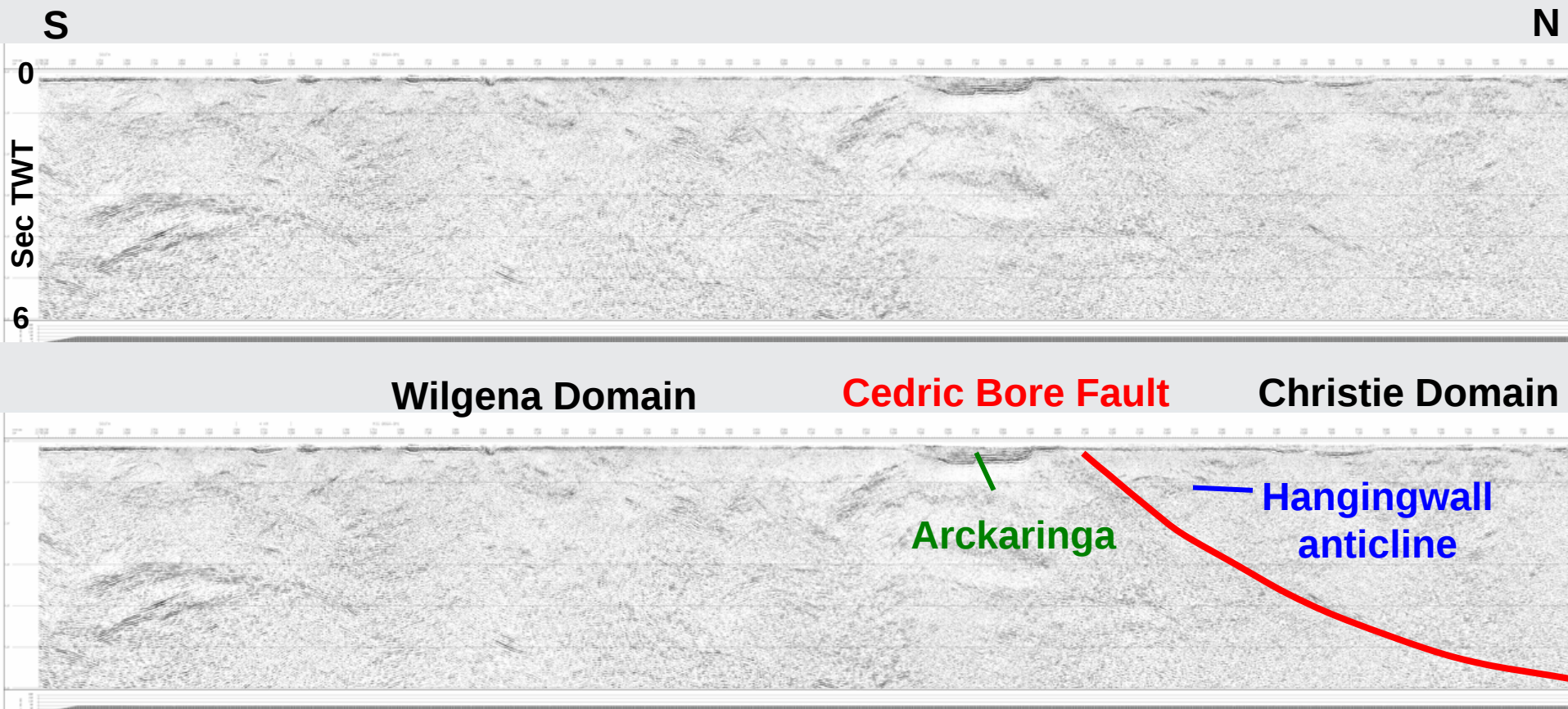
Wilgena Domain and Bulgunnia Fault



Wilgena Domain and Bulgunnia Fault



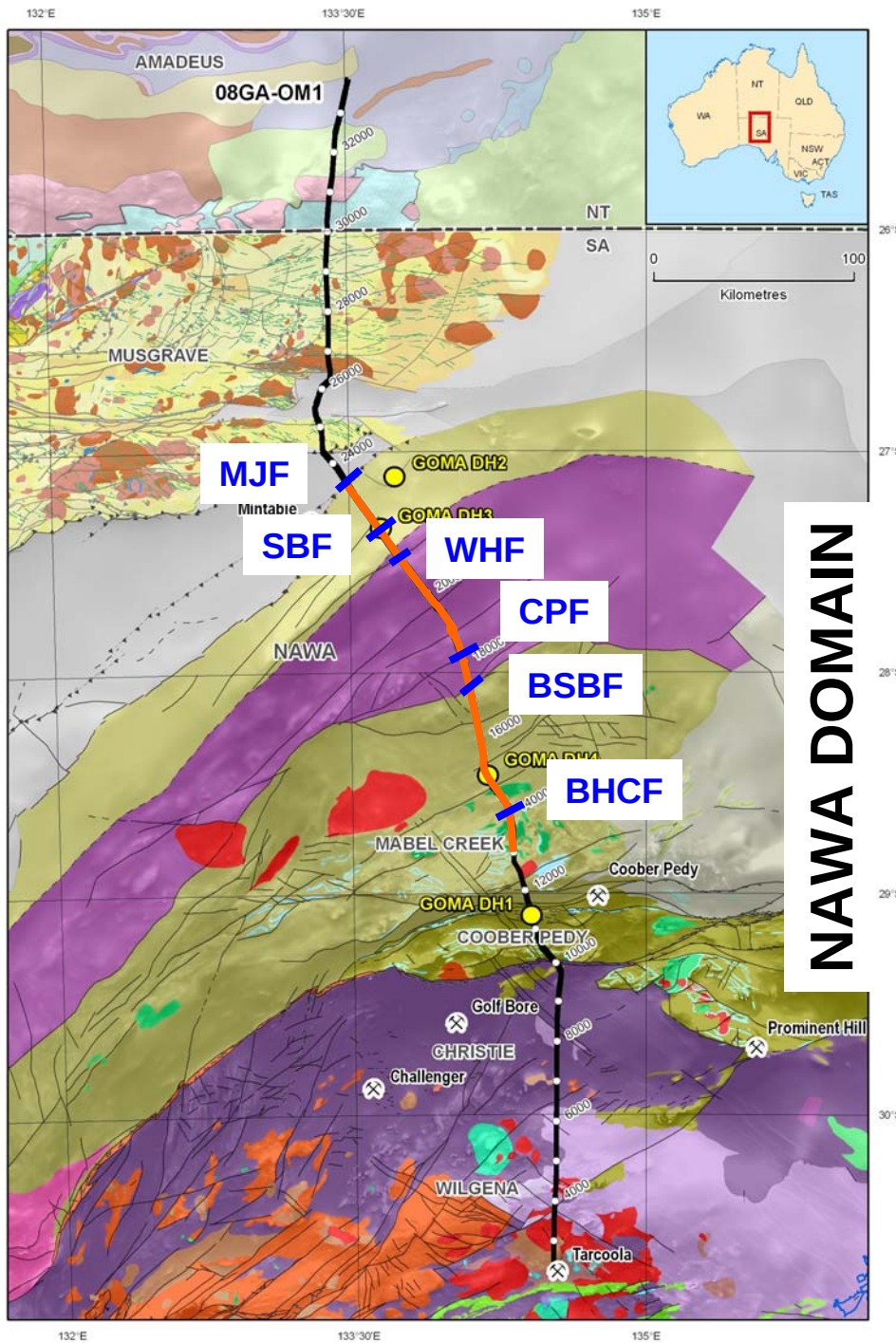
Wilgena to Christie Domains



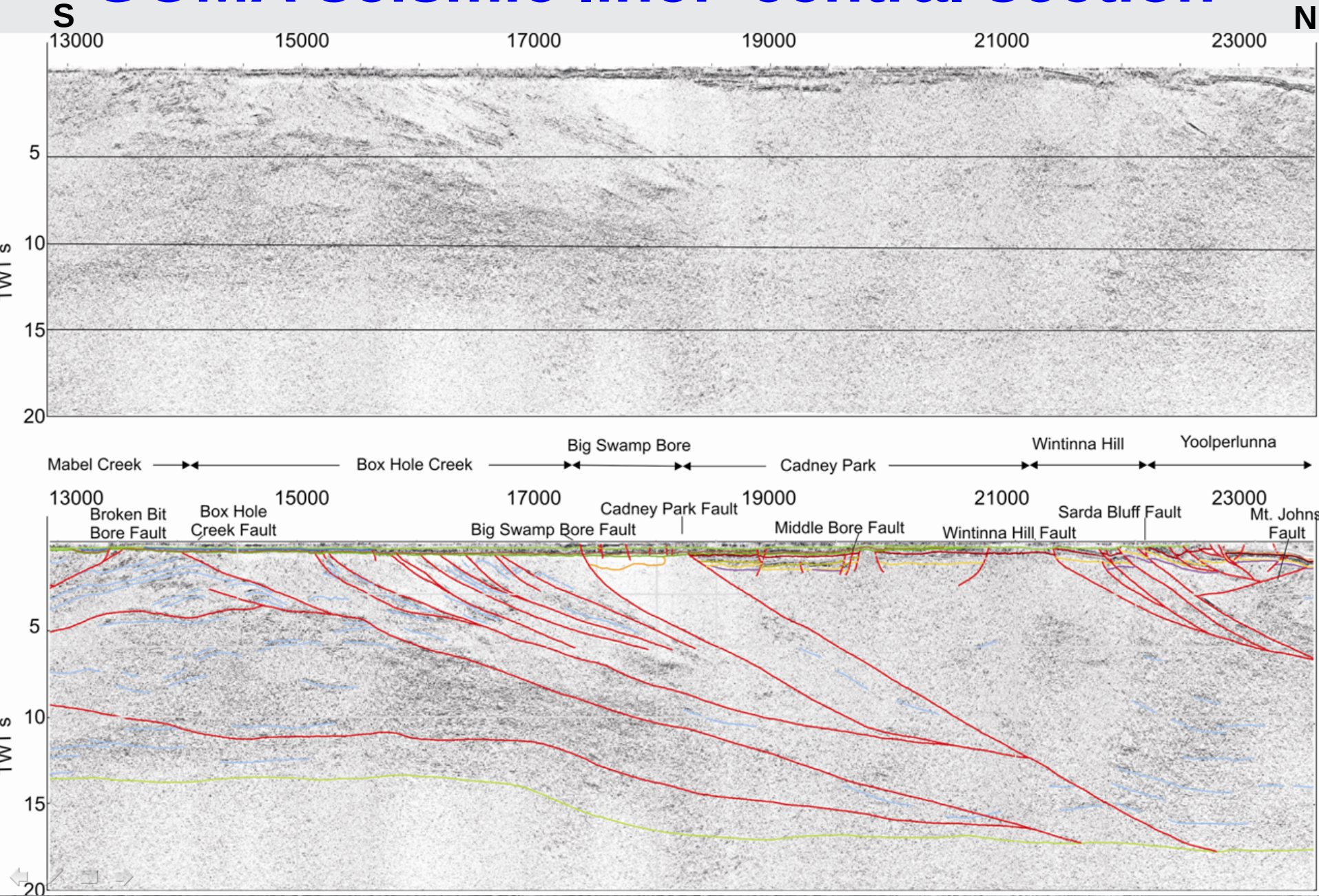
Similar reflectivity between Wilgena and Christie Domains
(both have late Neoarchean in upper crust)

GOMA seismic line: central section

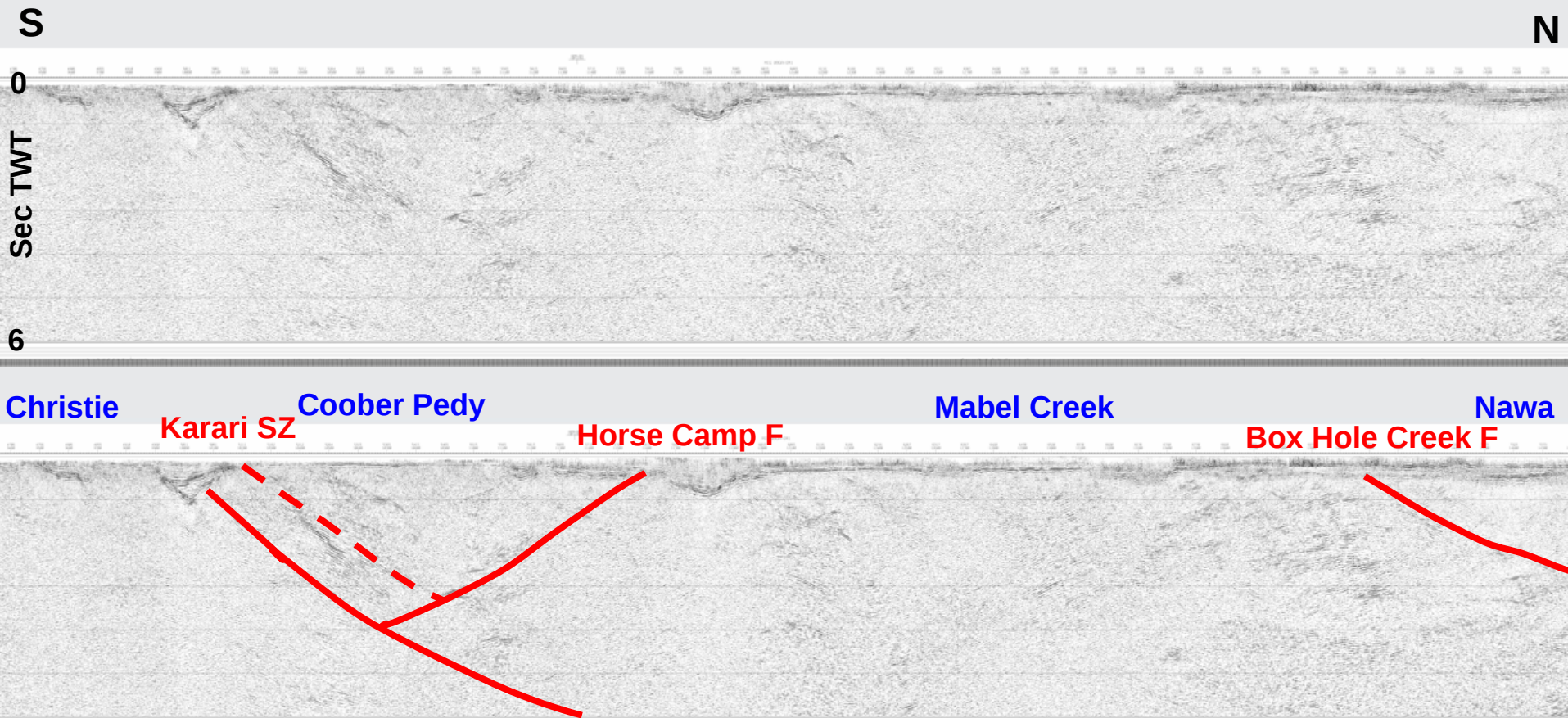
Mt Johns Fault
Yoolperlunna Inlier
Sarda Bluff Fault
Wintinna Hill S-Subdomain
Wintinna Hill Fault
Cadney Park S-Subdomain
Cadney Park Fault
Big Swamp Bore S-Subdomain
Big Swamp Bore Fault
Box Hole Creek S-Subdomain
Box Hole Creek Fault
Mabel Creek Domain



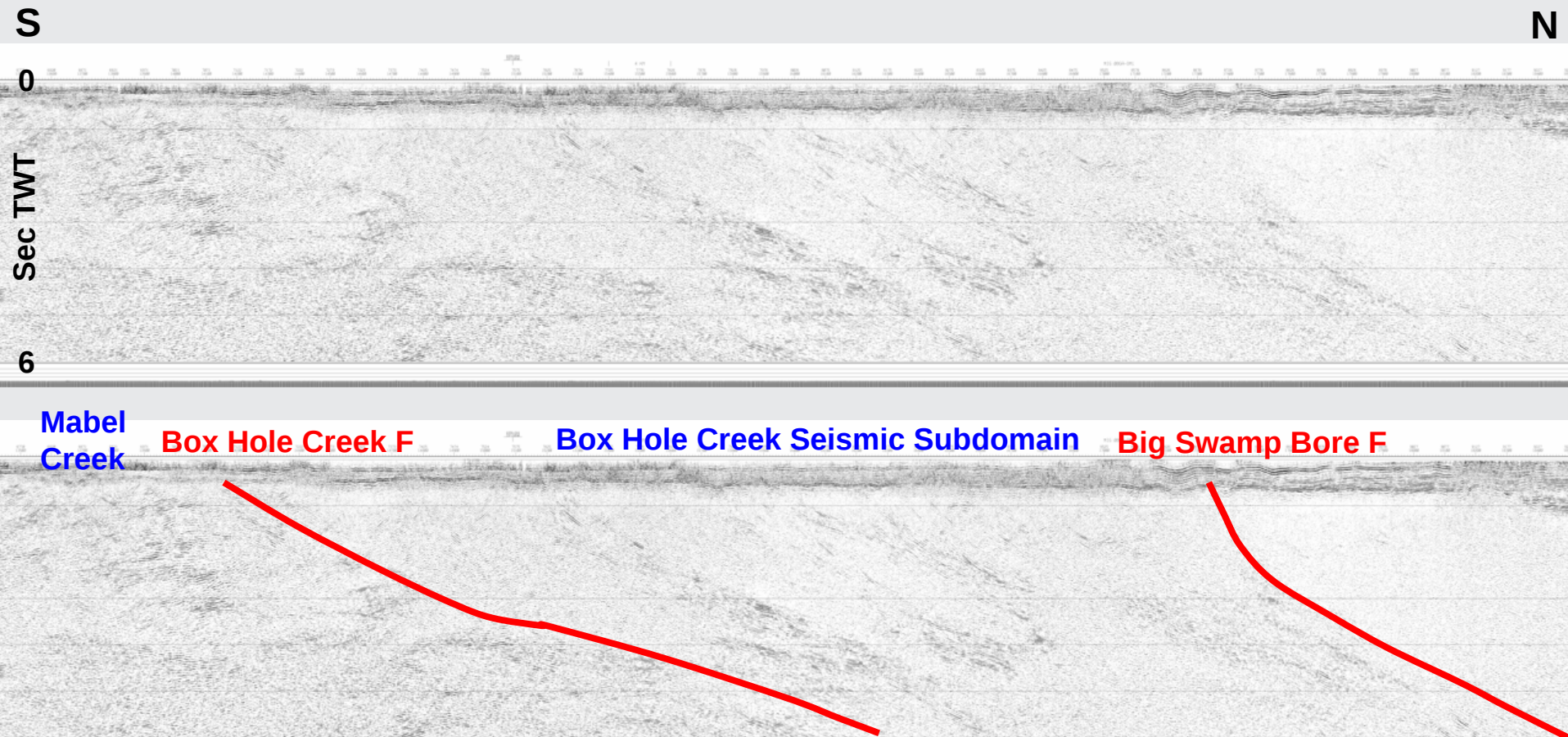
GOMA seismic line: central section



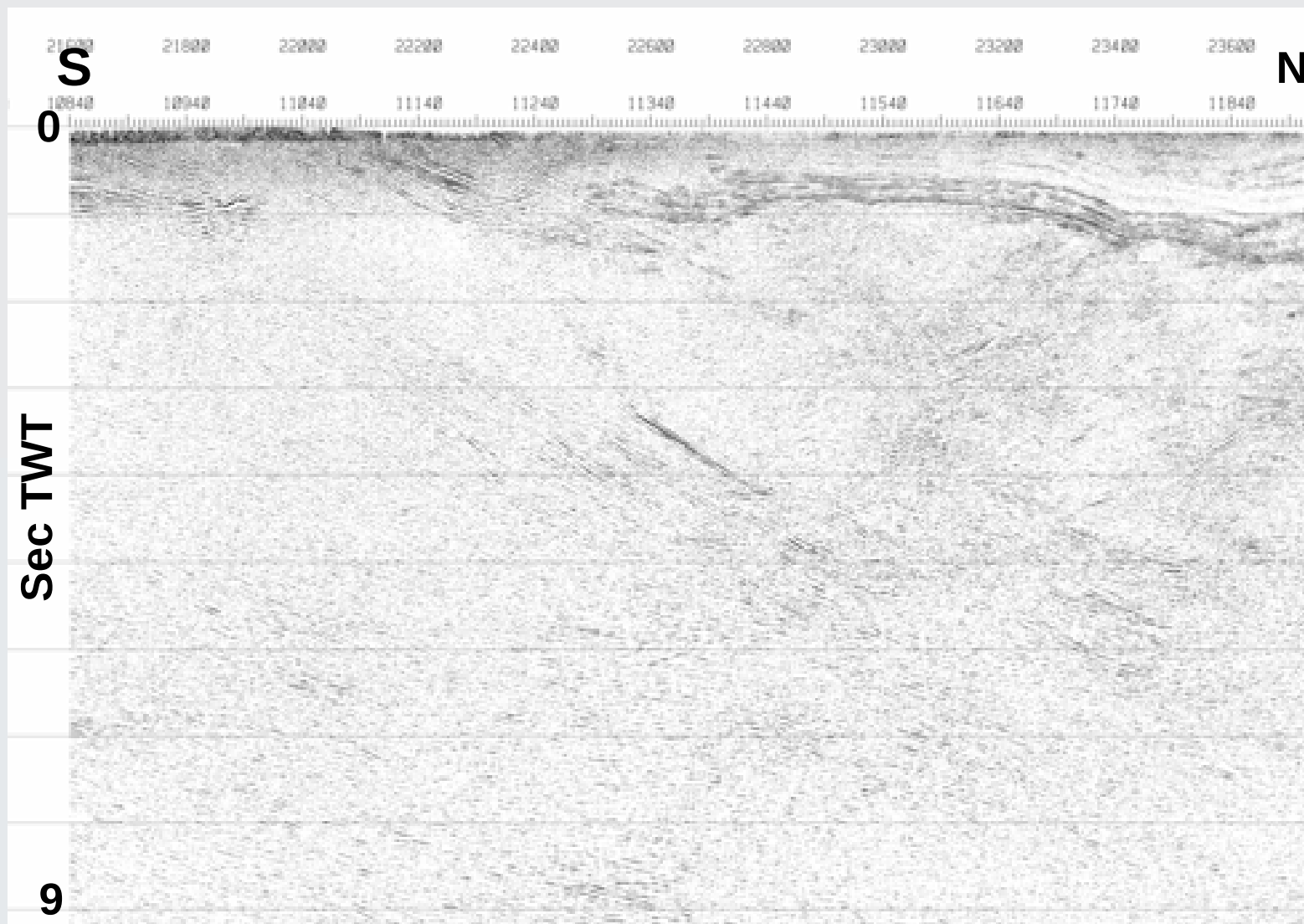
Coober Pedy and Mabel Creek Domains



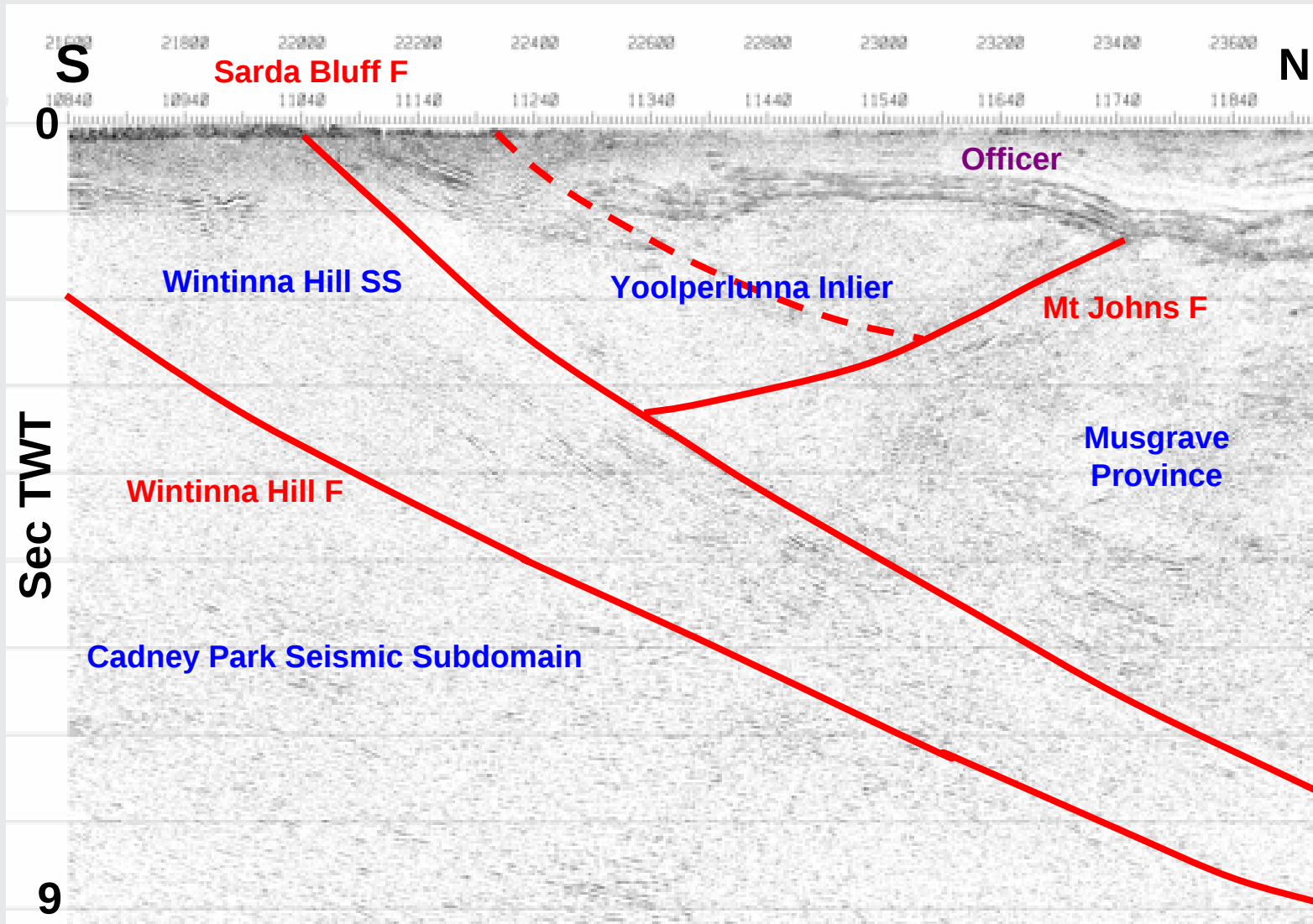
Mabel Creek to Nawa Domains

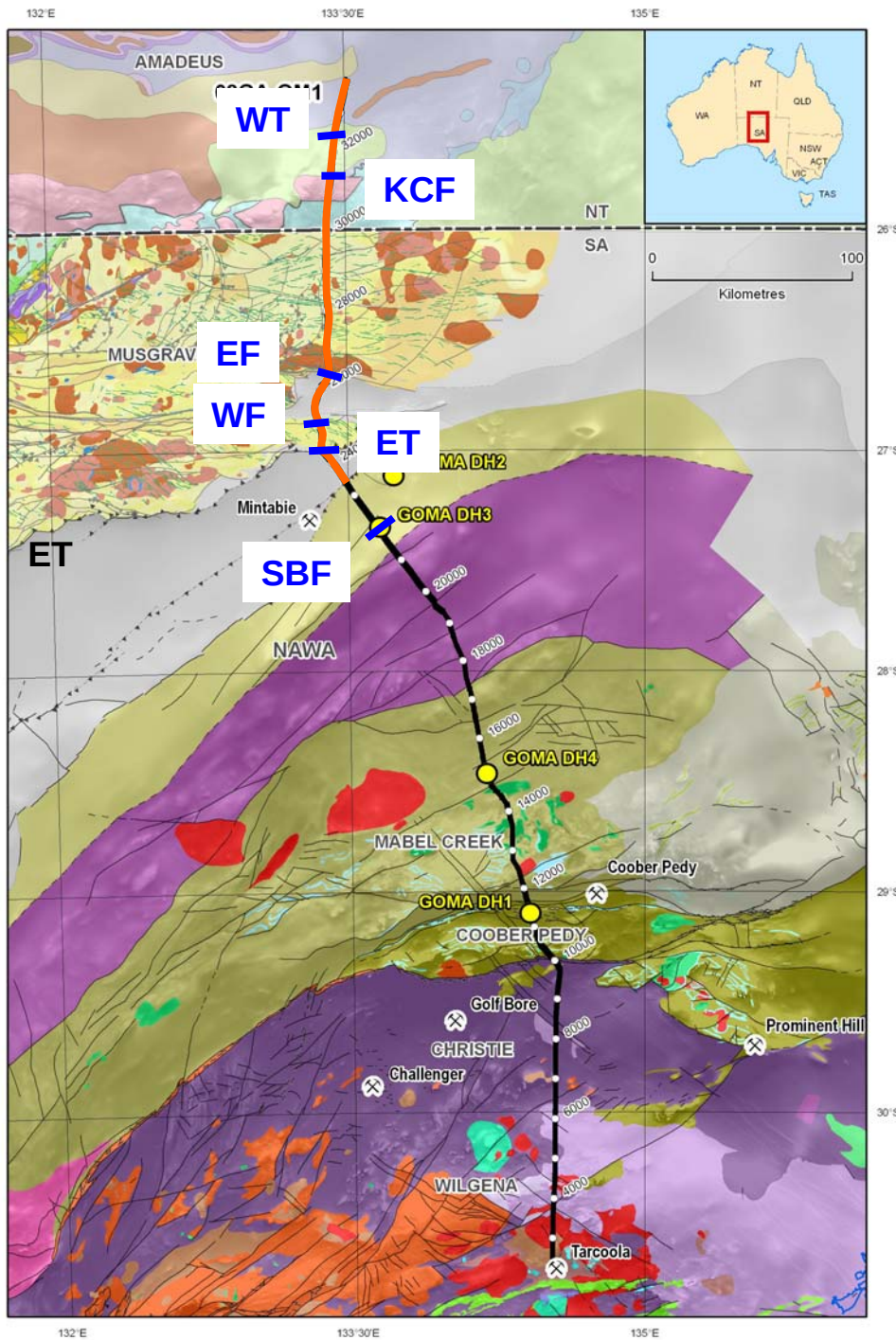


Yoolperlunna Inlier



Yoolperlunna Inlier





GOMA seismic line: northern section

(Amadeus Basin)

Warumpi Province

Woodroffe Thrust

Musgrave Province

Kalamurta Creek Fault

Echo Fault

(Moorilyanna Graben)

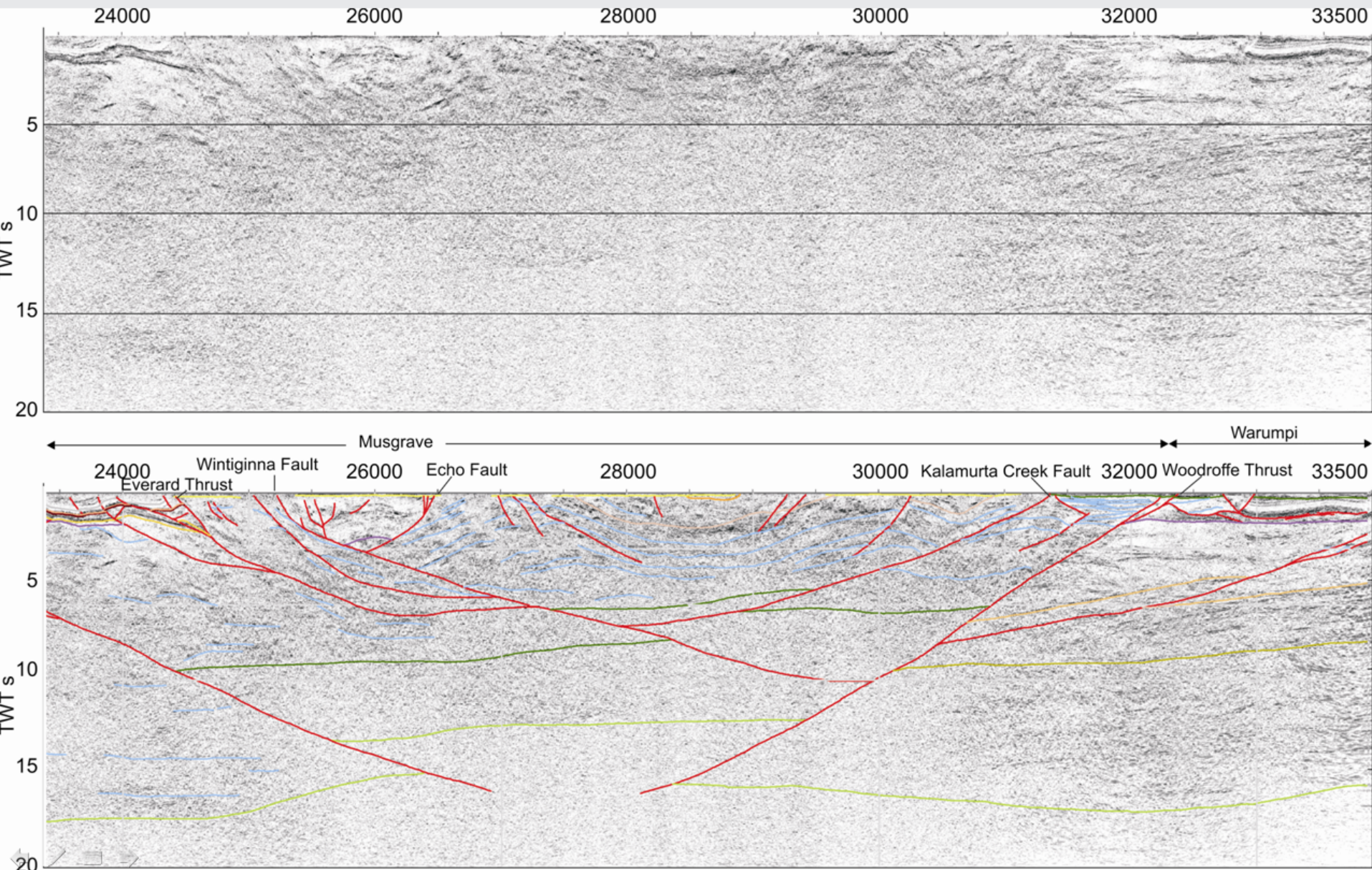
Wintiginna Fault

Musgrave Province

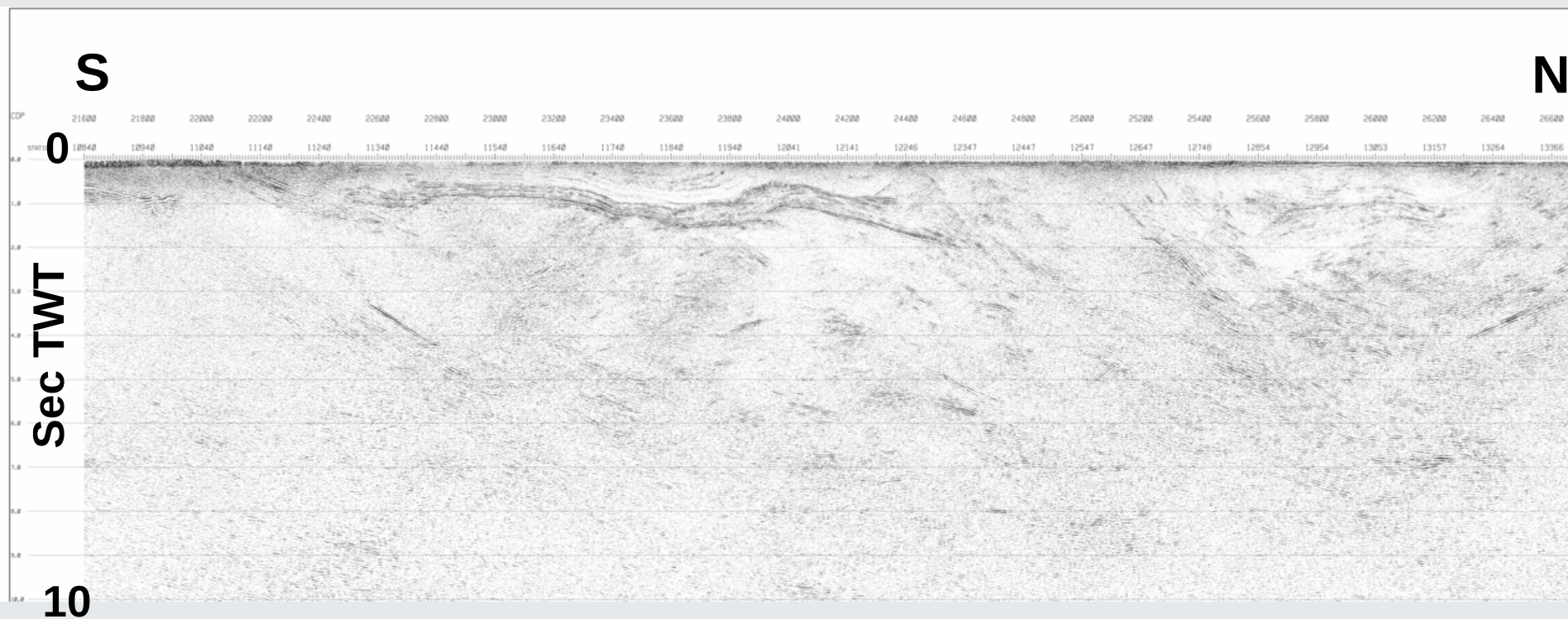
Everard Thrust

Sarda Bluff Fault

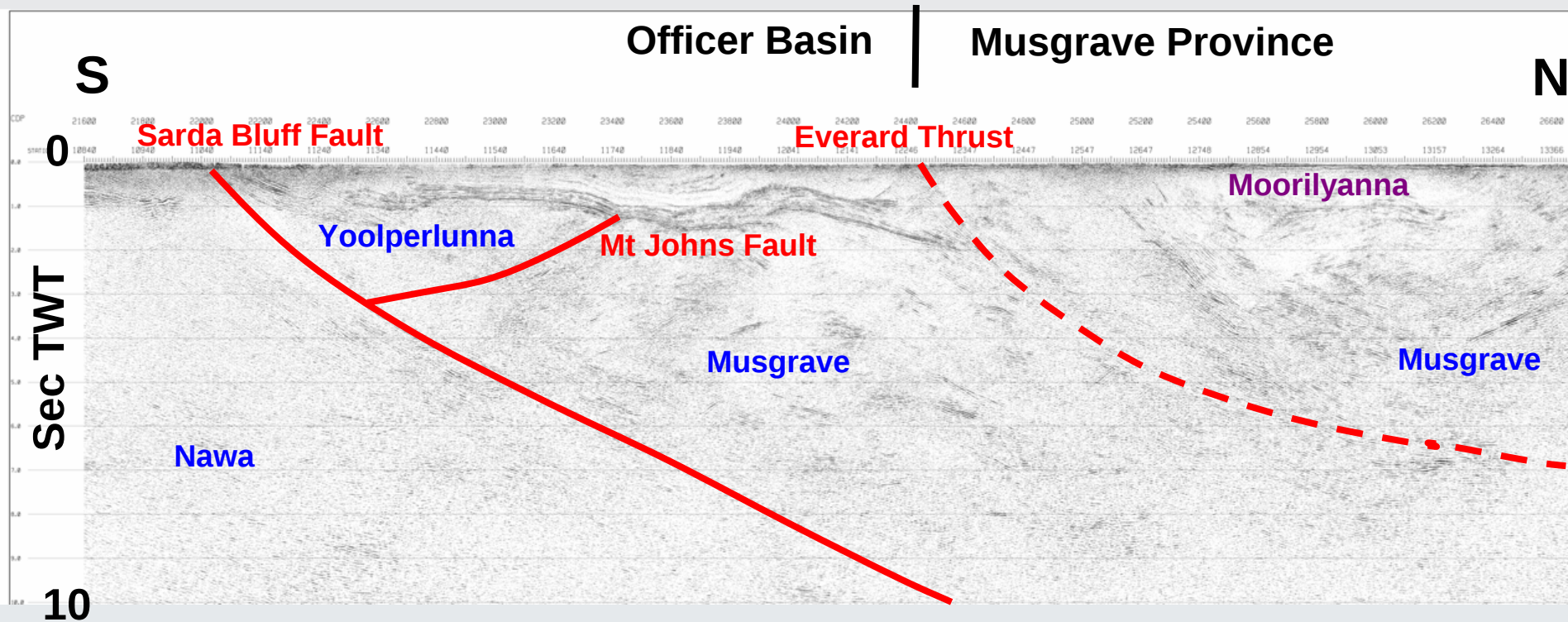
GOMA seismic line: northern section



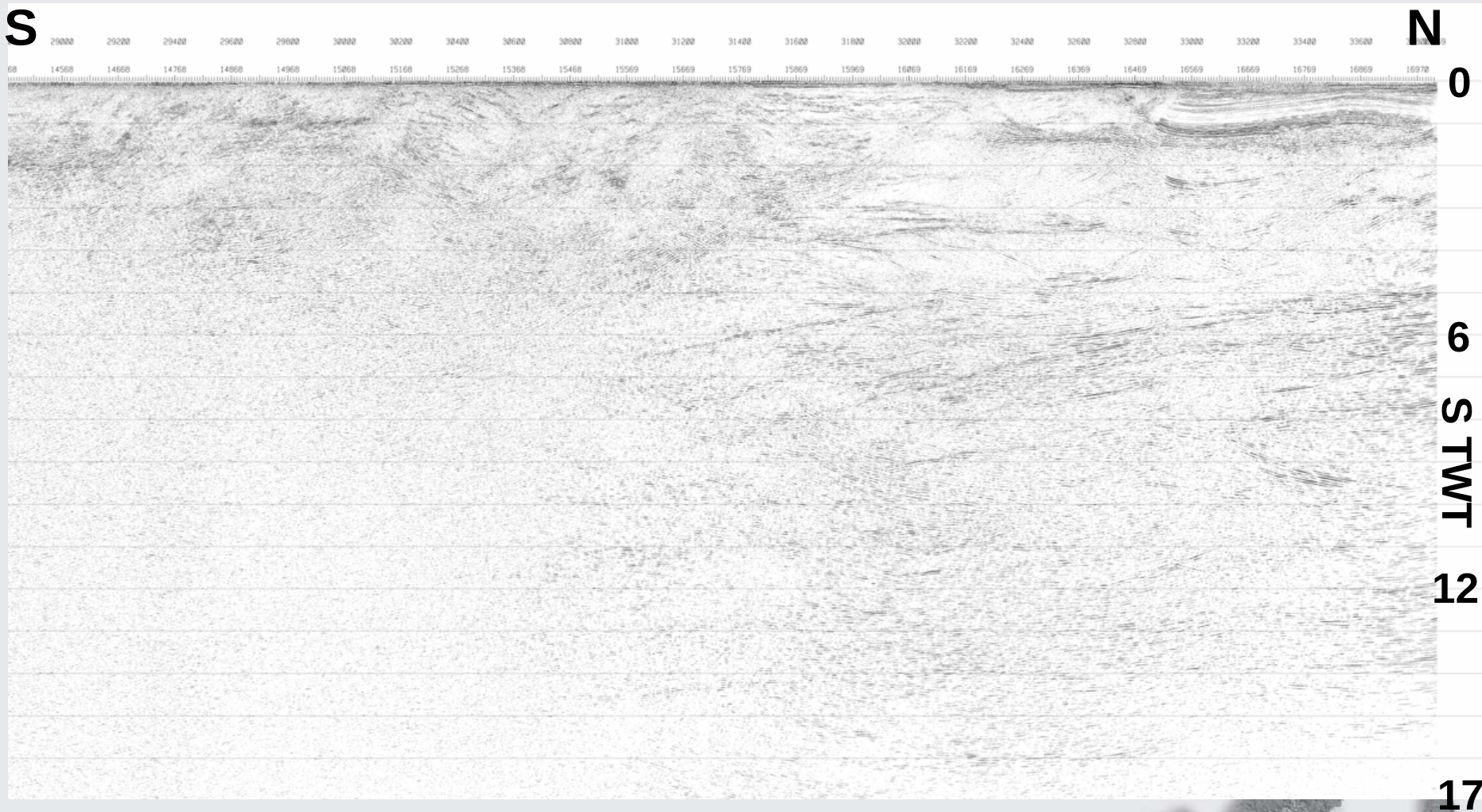
Nawa Domain to Musgrave Province



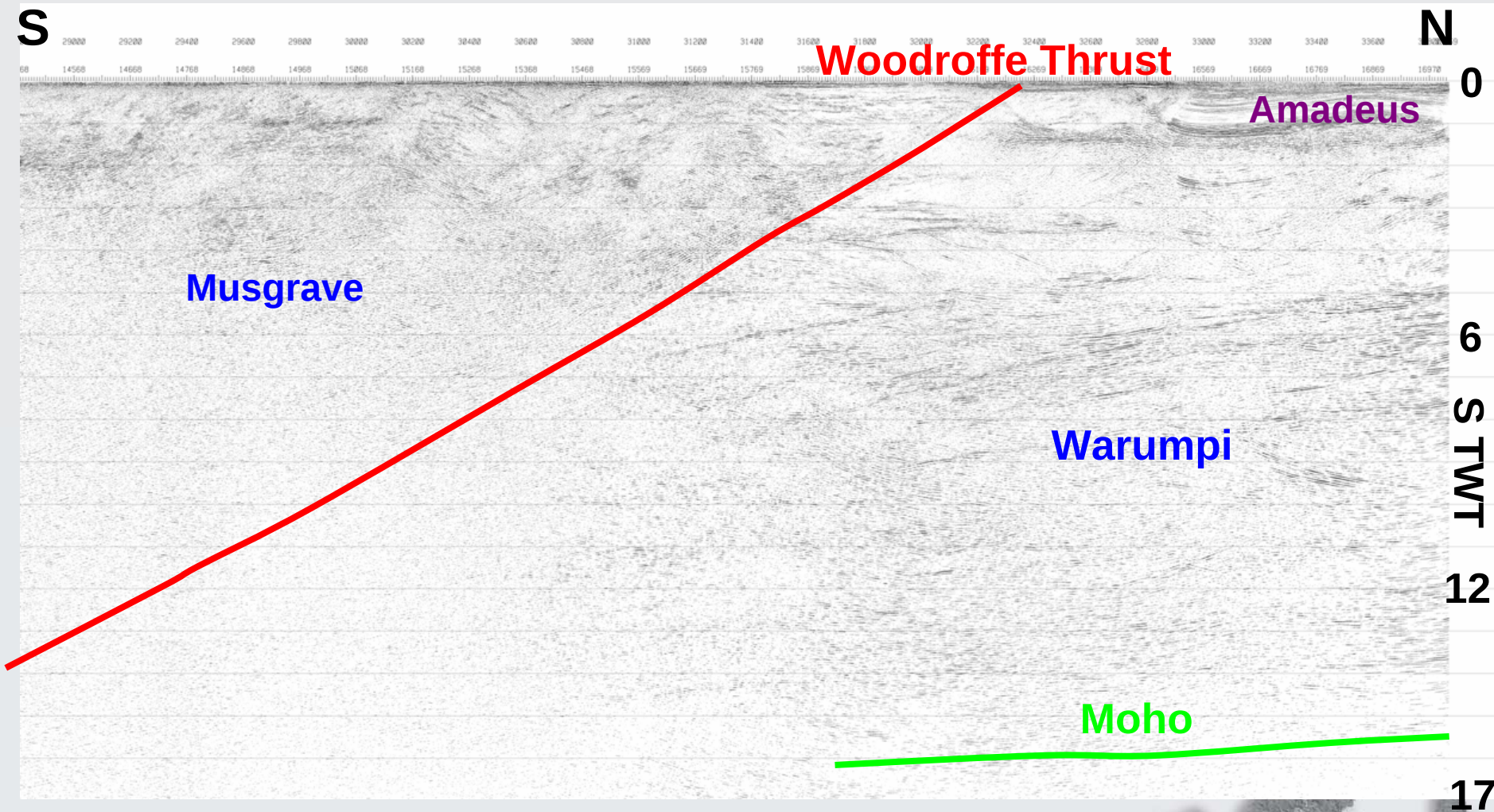
Nawa Domain to Musgrave Province



Musgrave to Warumpi Provinces



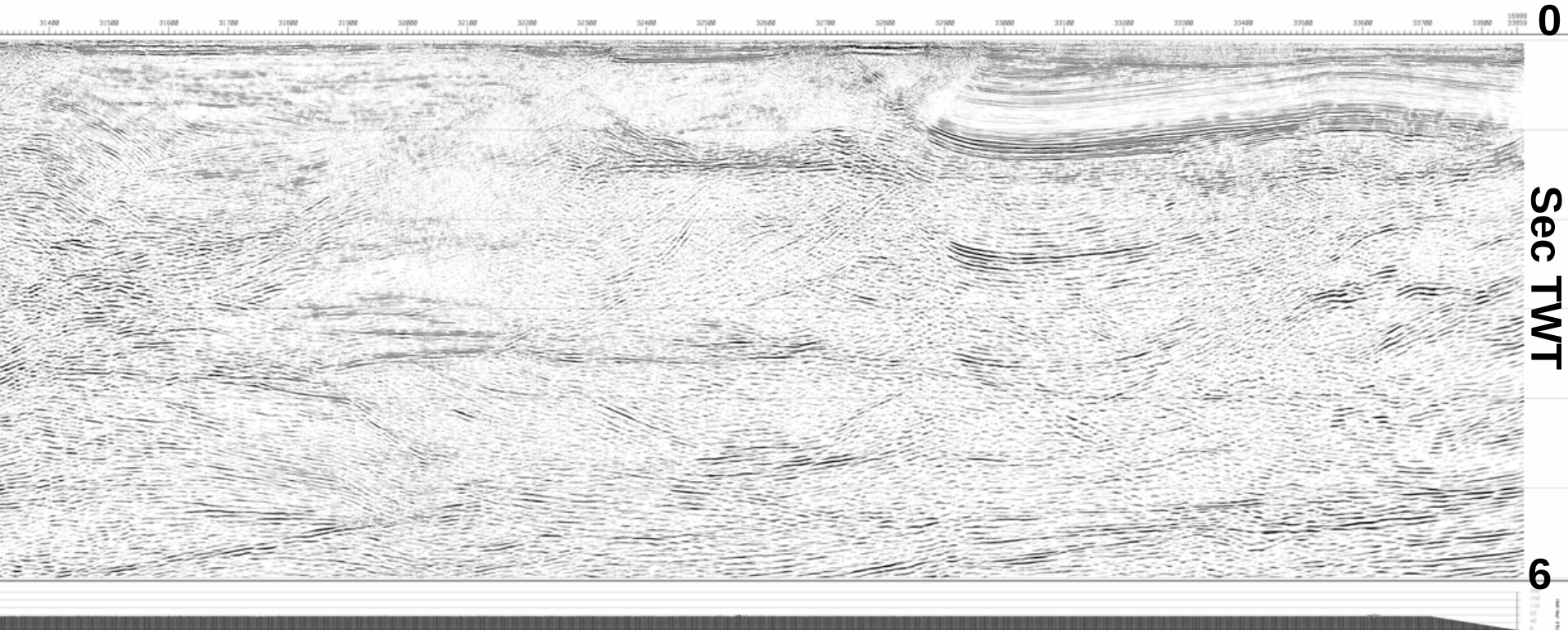
Musgrave to Warumpi Provinces



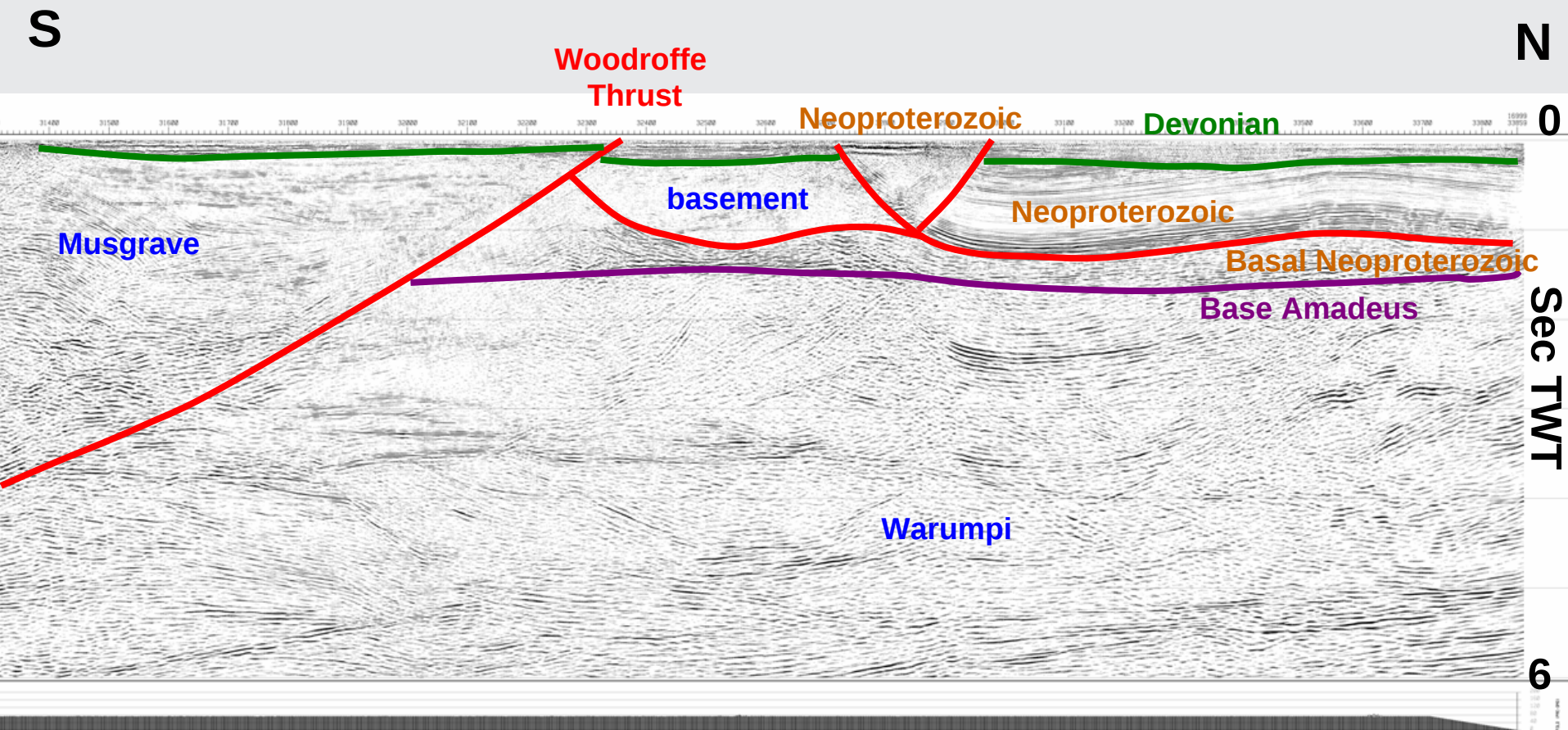
Amadeus Basin

S

N

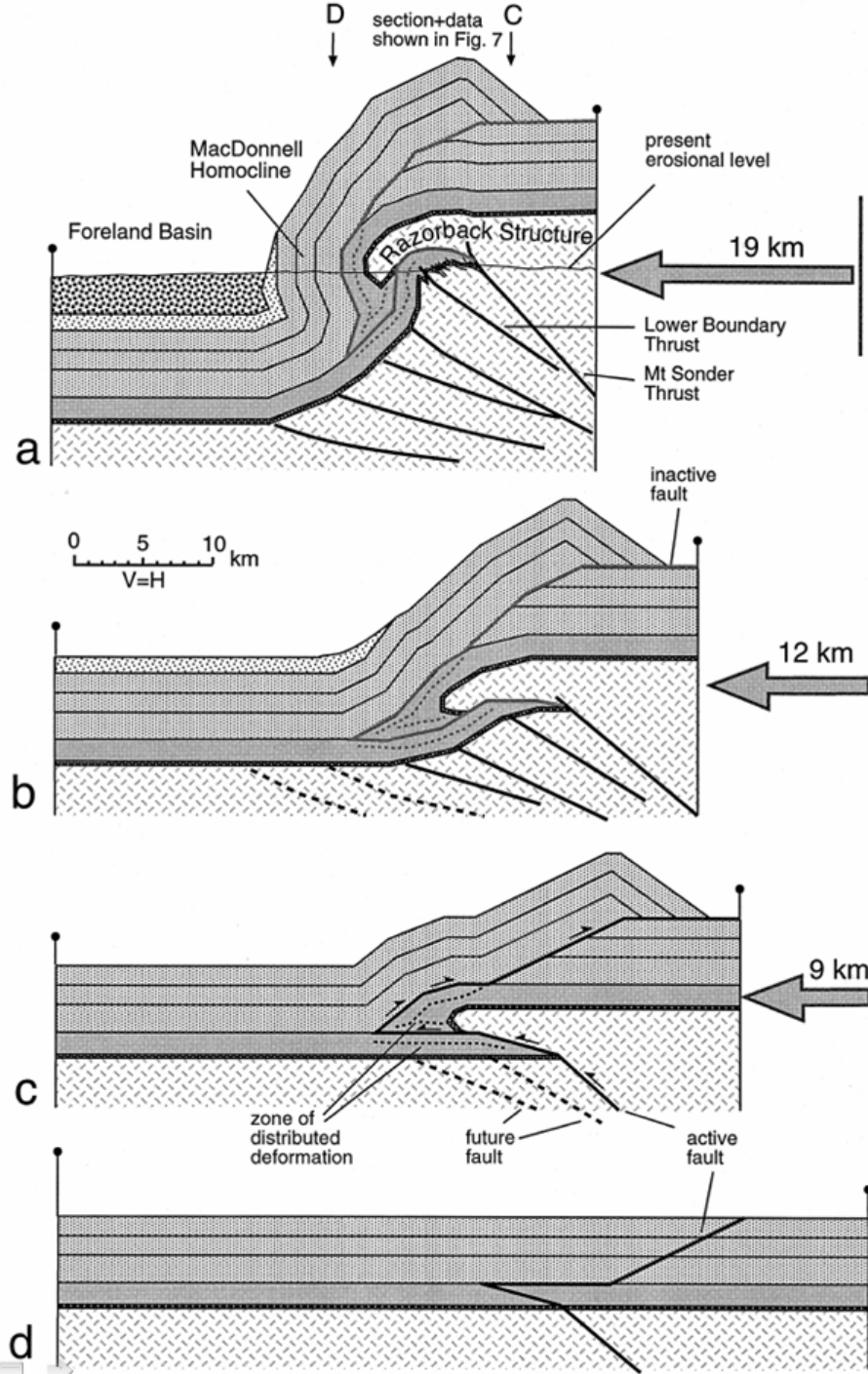


Amadeus Basin

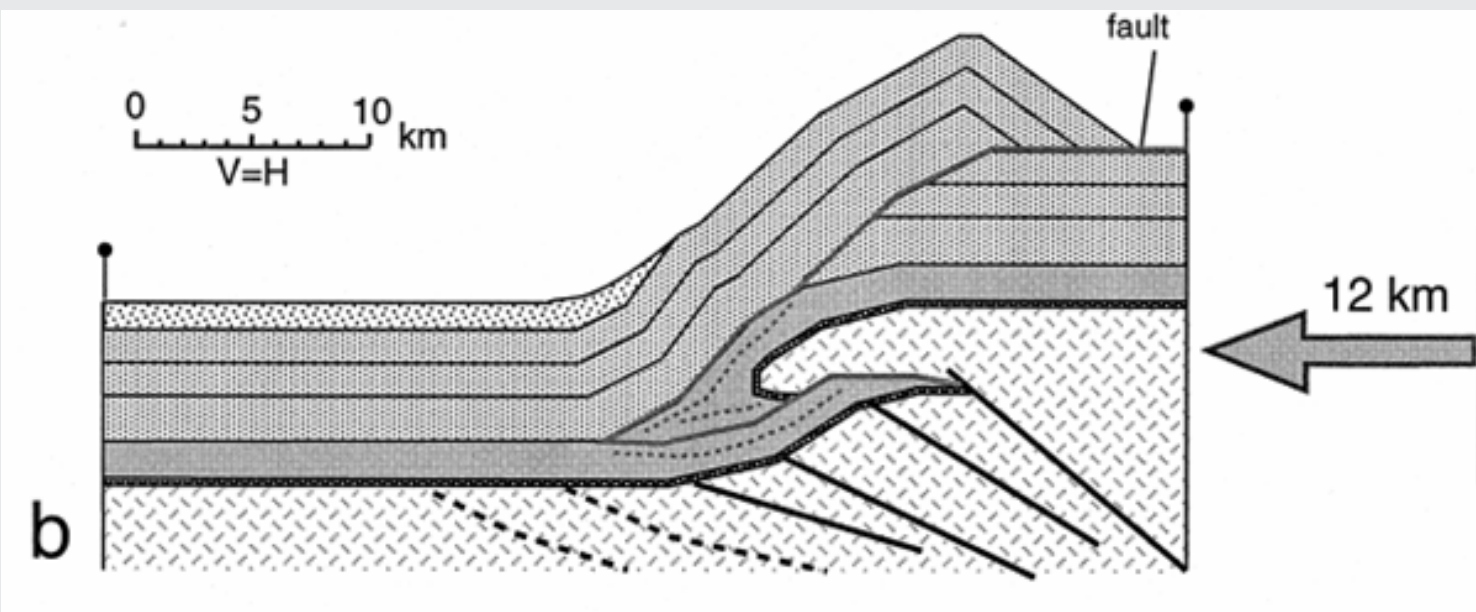
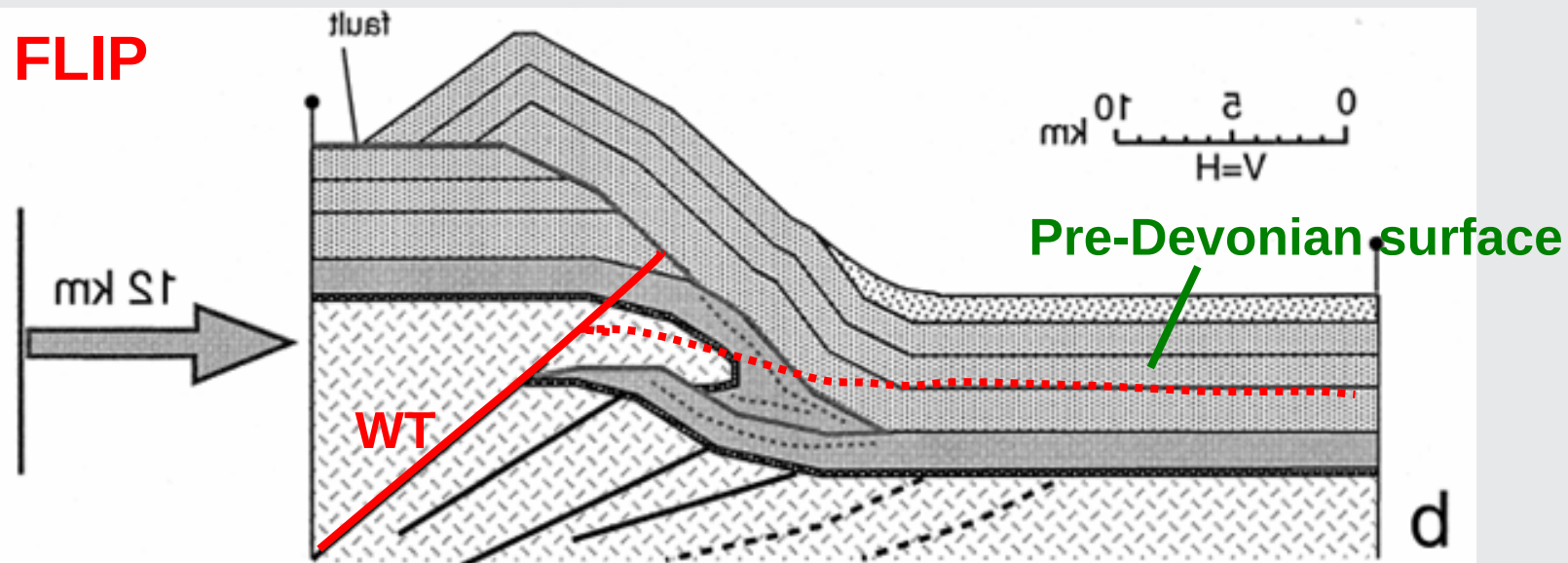


~3800 m thick at north end of GOMA line
Detachment at Bitter Springs level (salt)
Basement above lowest Amadeus units

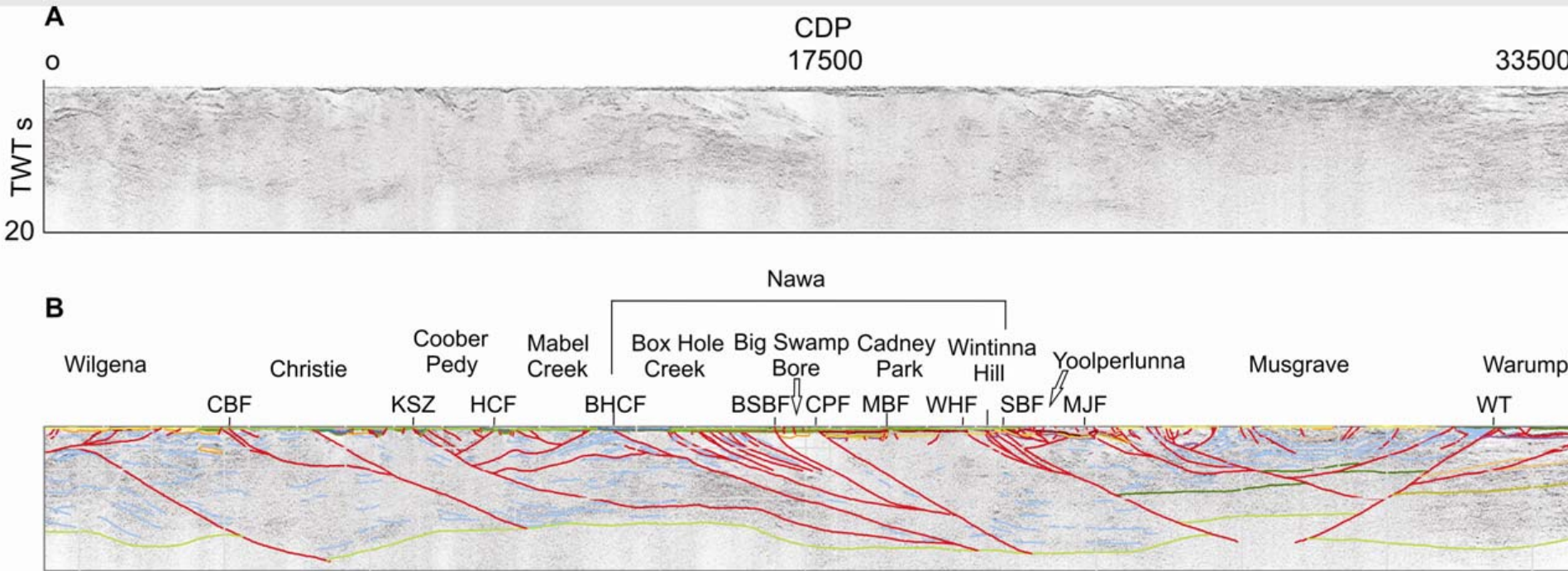
**Flöttmann & Hand,
(1999, JSG, 21, 399-412)**



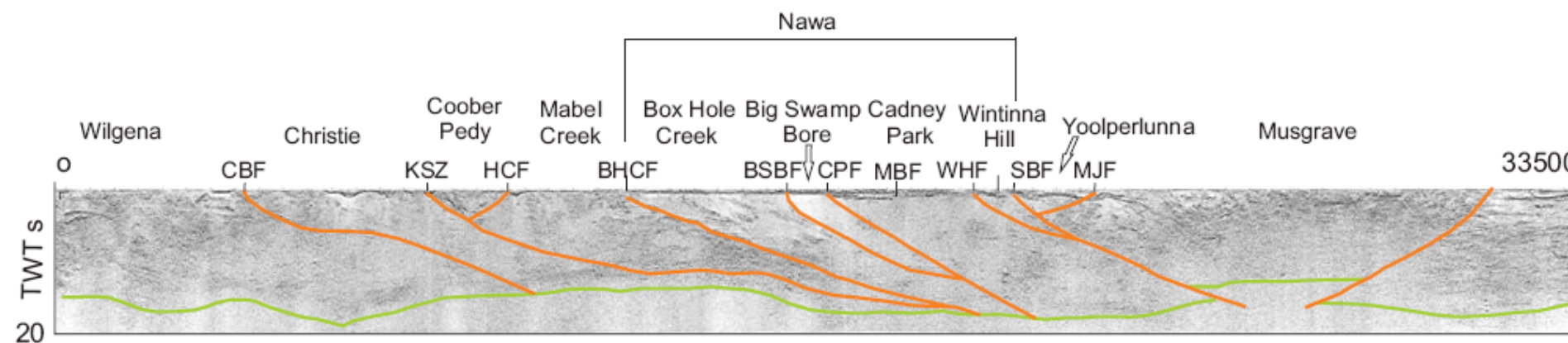
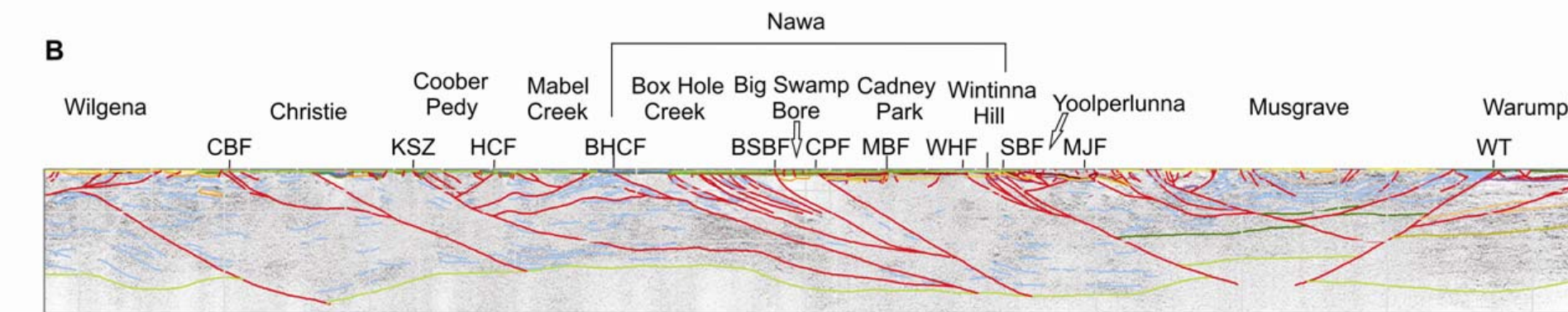
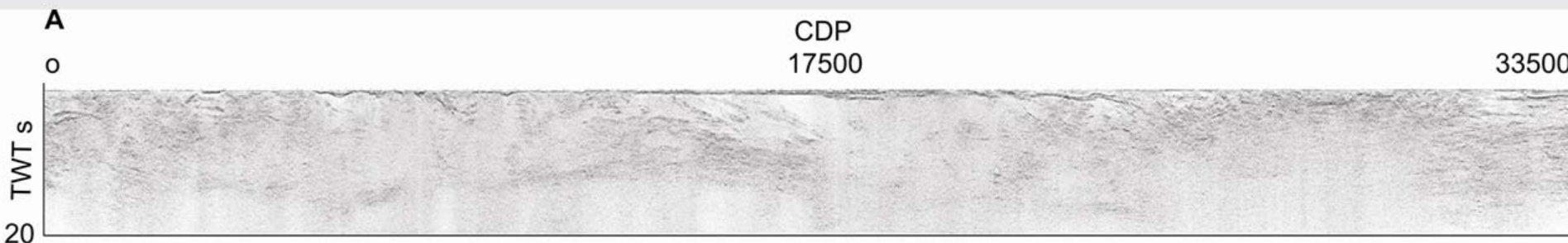
FLIP



GOMA seismic line – Interpretation



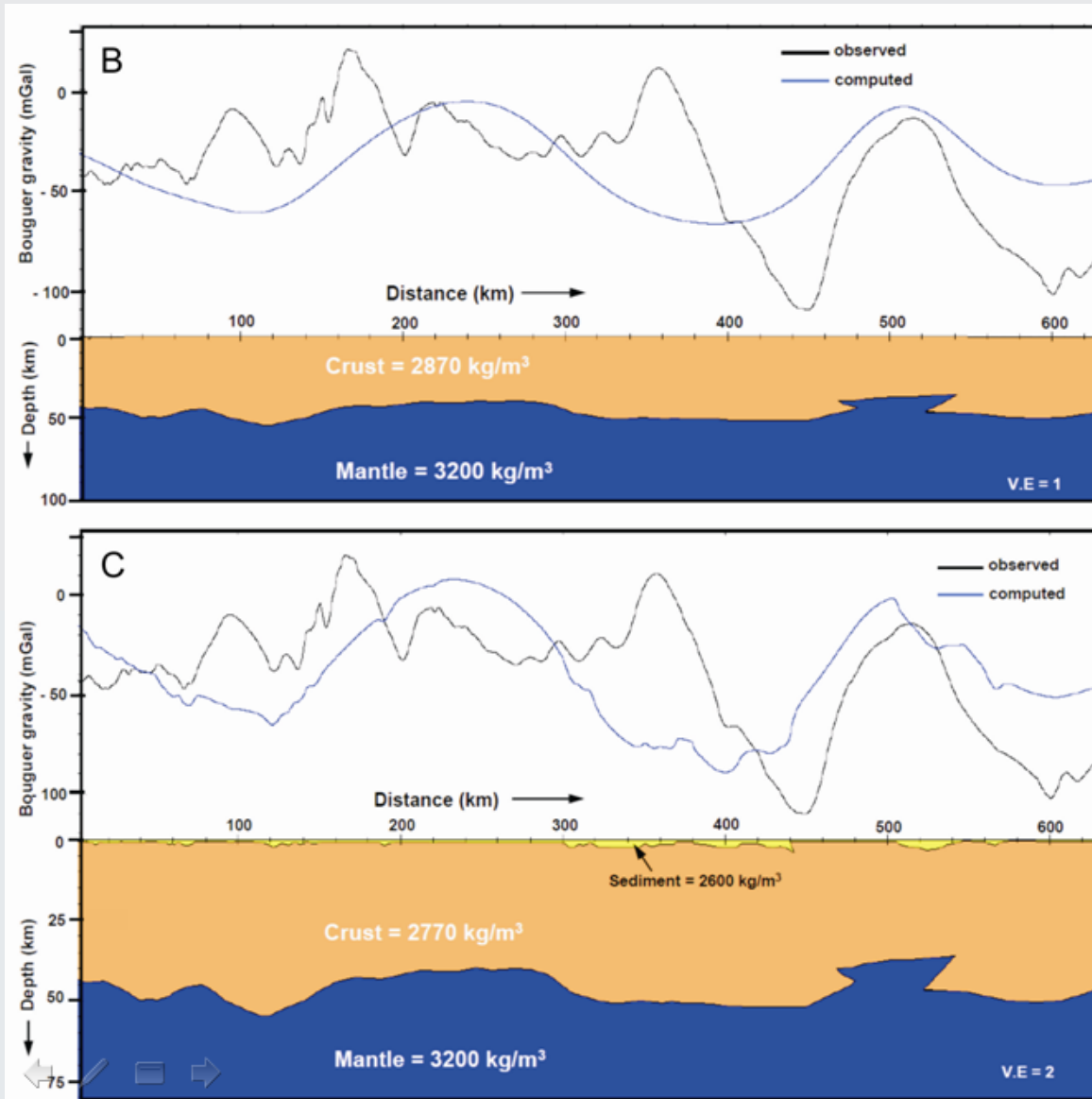
GOMA seismic line – Provinces and Domains



Gravity forward modelling 1

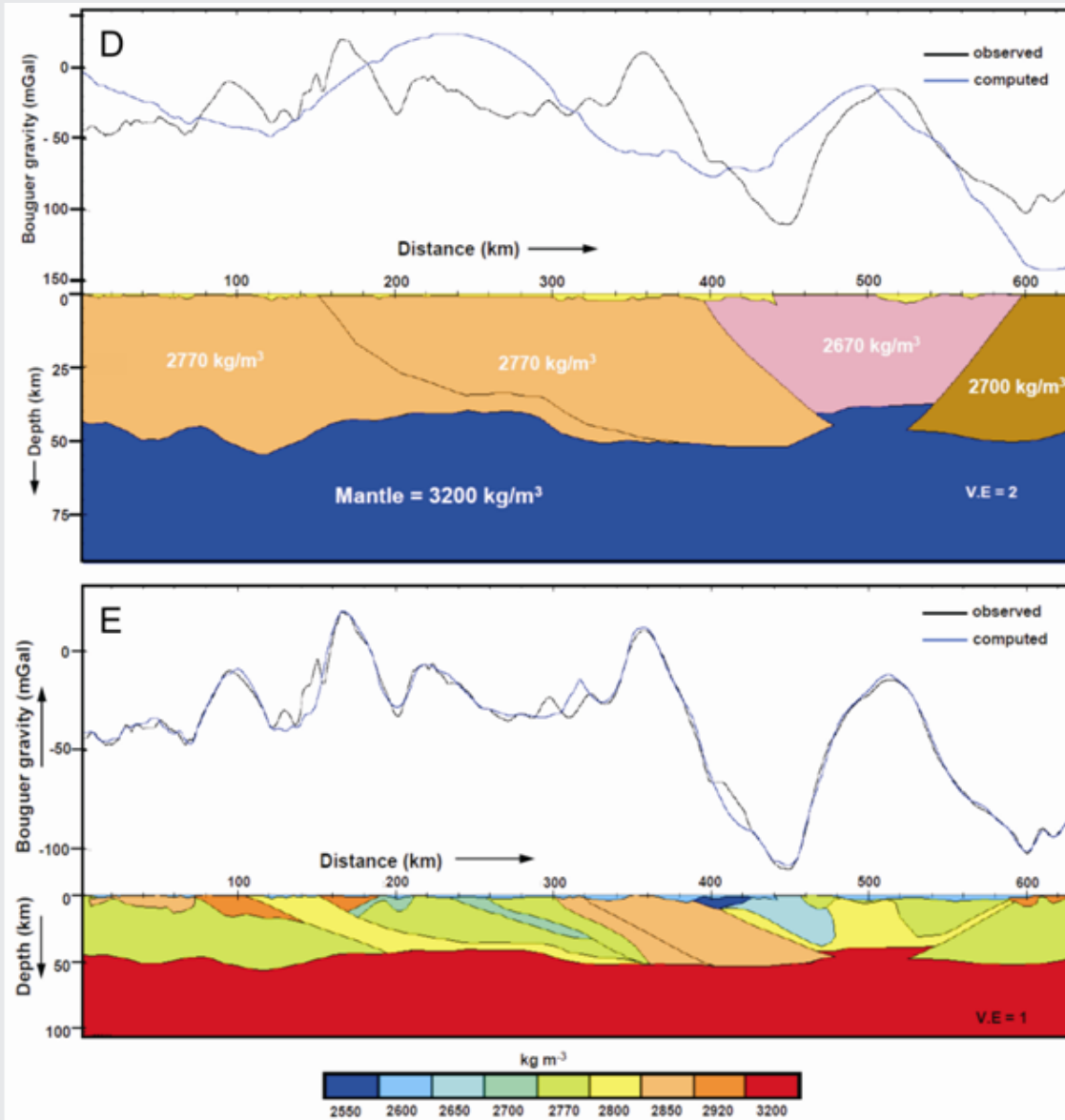
Simple two layer model (Moho from seismic)

Simple two layer model, plus sedimentary basins

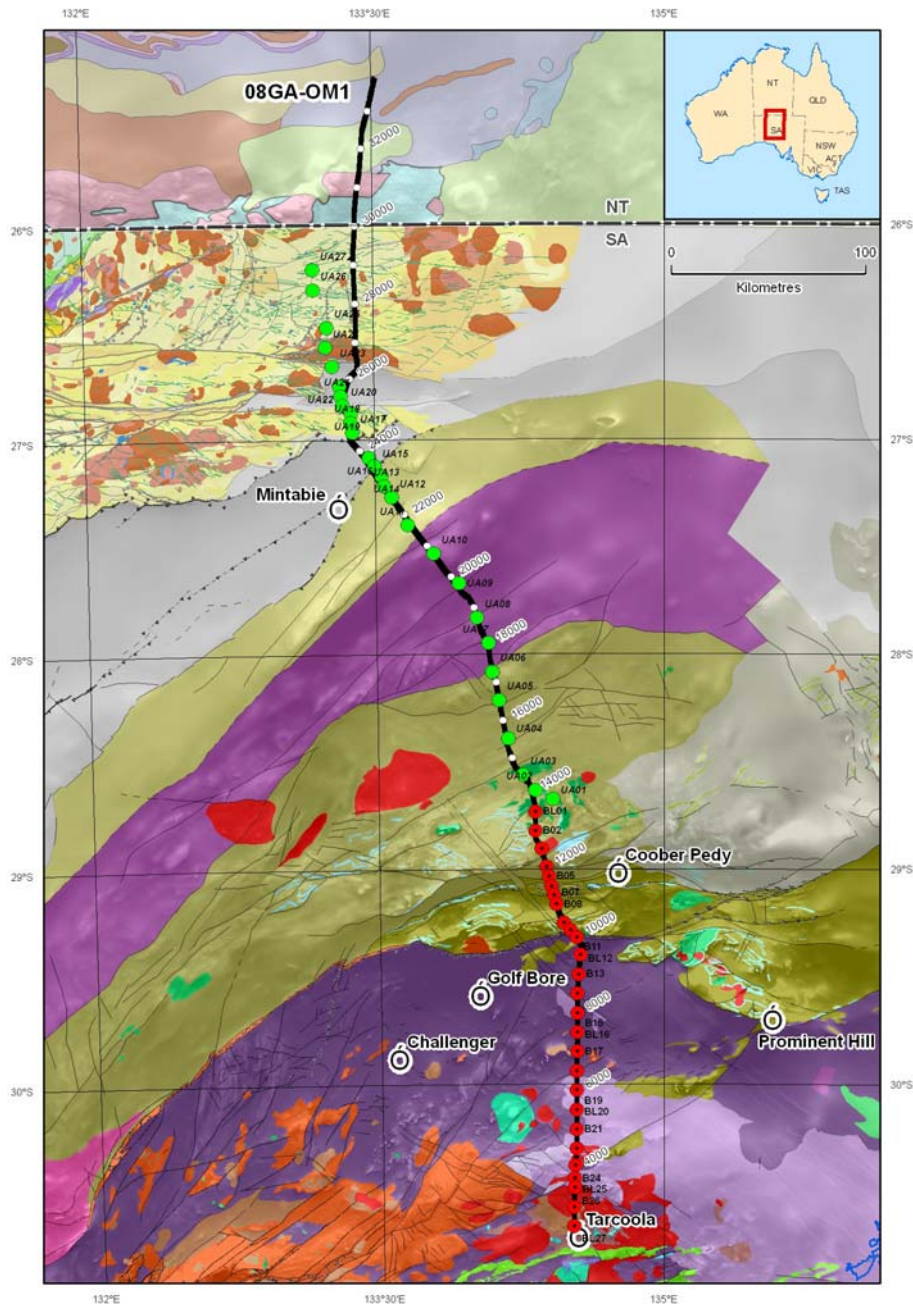


Gravity forward modelling 2

Simple model,
sedimentary basins,
plus provinces



Density variations within
and between provinces
(using seismic
interpretation)

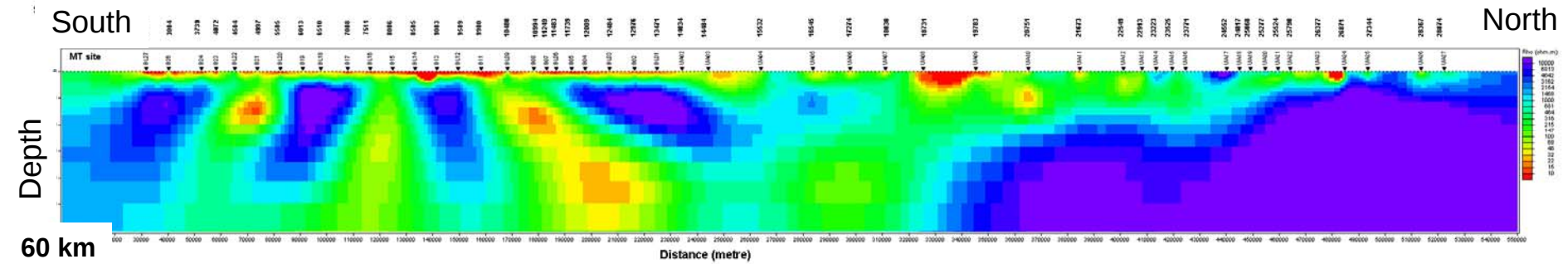


Magnetotellurics

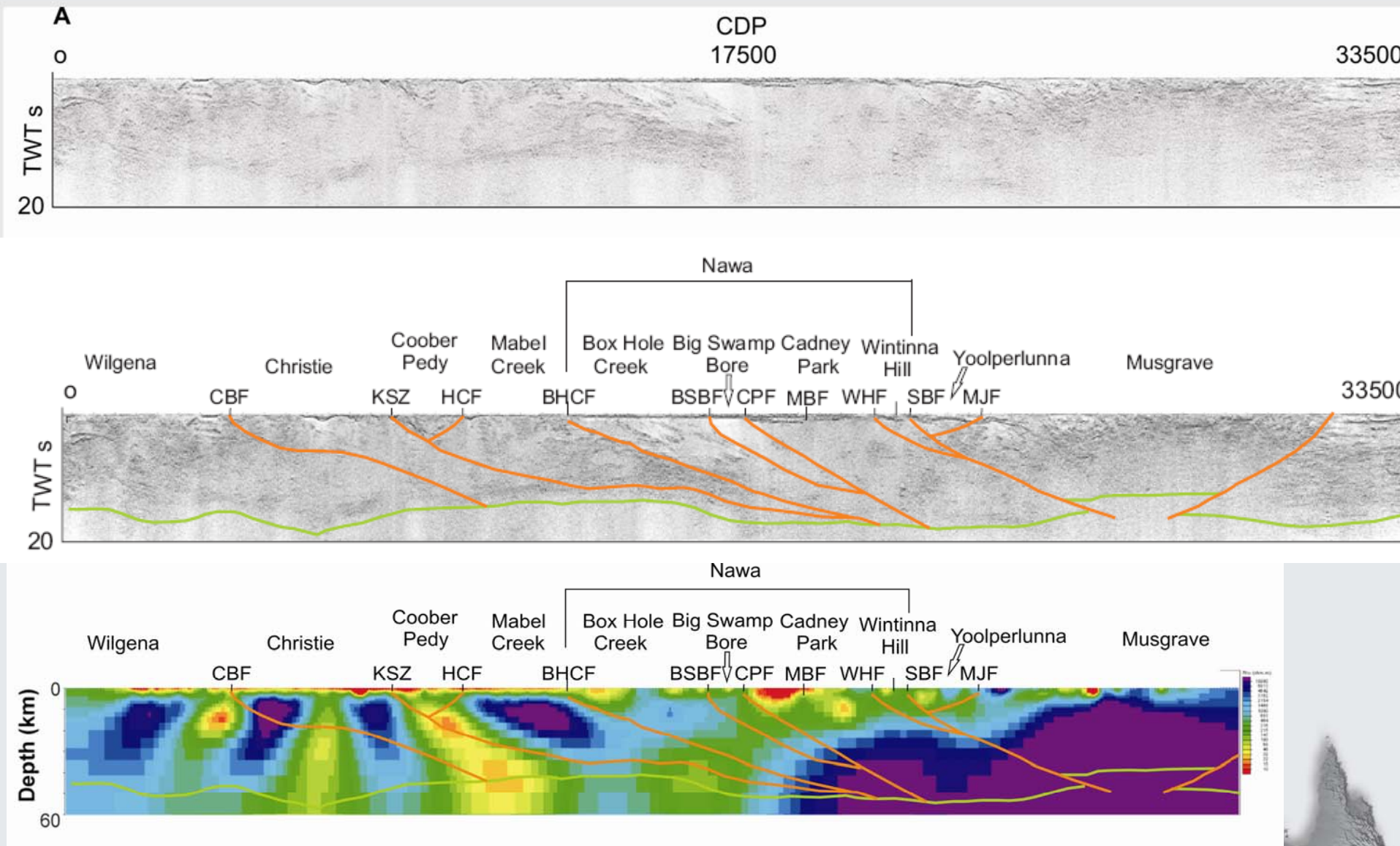
GOMA profile - location of MT stations

Note slight vergence away from
seismic line in north, and no
data at northernmost end

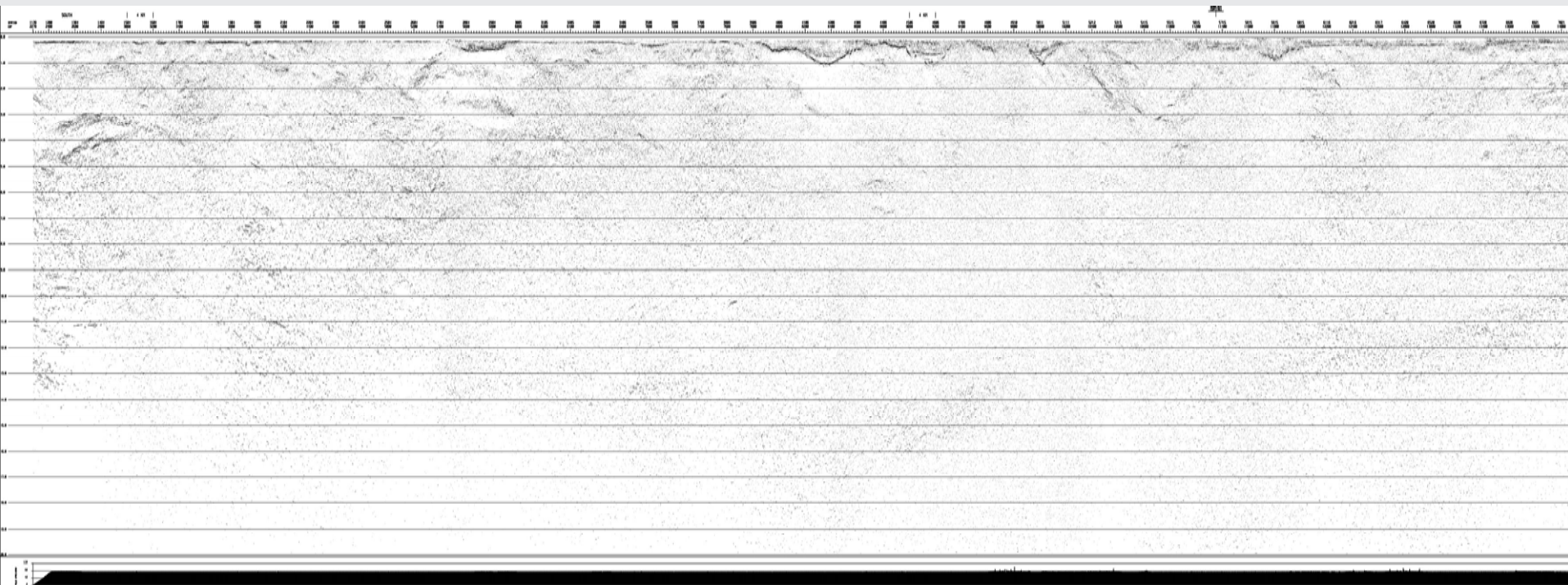
Preliminary MT model



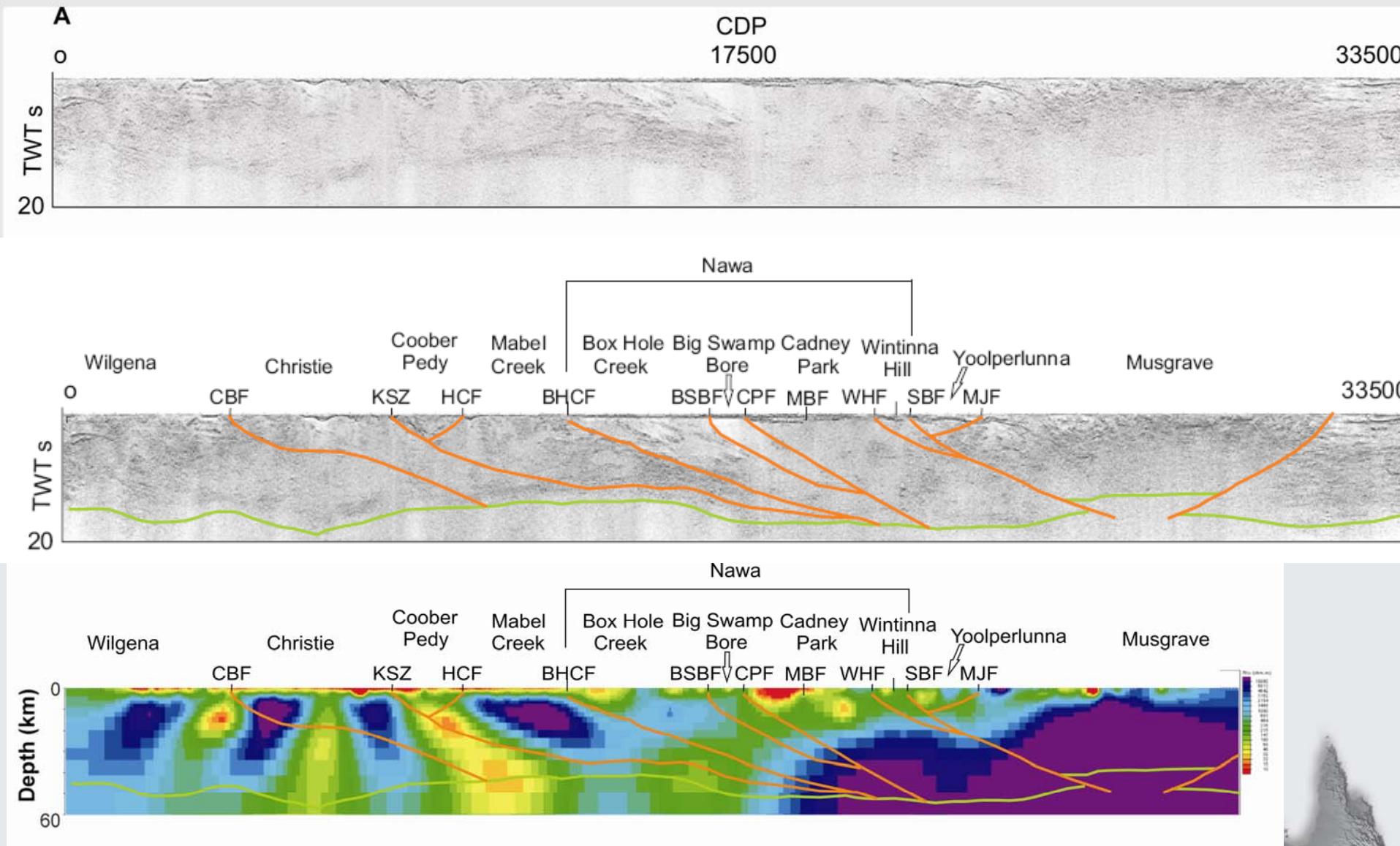
GOMA seismic and preliminary MT model



GOMA seismic line



Summary



Conclusions

- New 634 km long seismic profile: crustal image of area of almost no basement outcrop
- Moho – variable relief (~36 to ~54 km depth)
- Section dominated by crustal-scale, north-dipping structures
- Series of discrete crustal blocks with different reflective characteristics:
 - Wilgena-Christie Domains
 - Coober Pedy-Mabel Creek Domains
 - Nawa Domain (several seismic subdomains)
 - Musgrave Province
 - Warumpi Province
- Younger sedimentary basins:
 - Officer, Amadeus, Arckaringa & Eromanga basins

THANK YOU



Seismic data available at:

www.ga.gov.au/minerals/research/national/seismic/