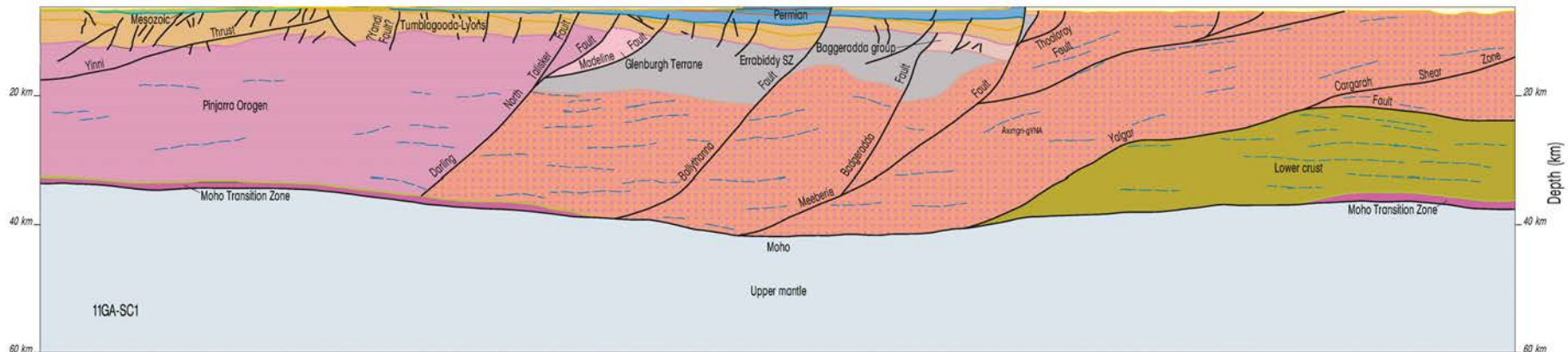




Geological interpretation of deep seismic reflection line 11GA-SC1: Narryer Terrane to Southern Carnarvon Basin

Russell Korsch, M. Doublier, S Romano, S. Johnson, A. Mory, L. Carr, Y. Zhan & R Blewett



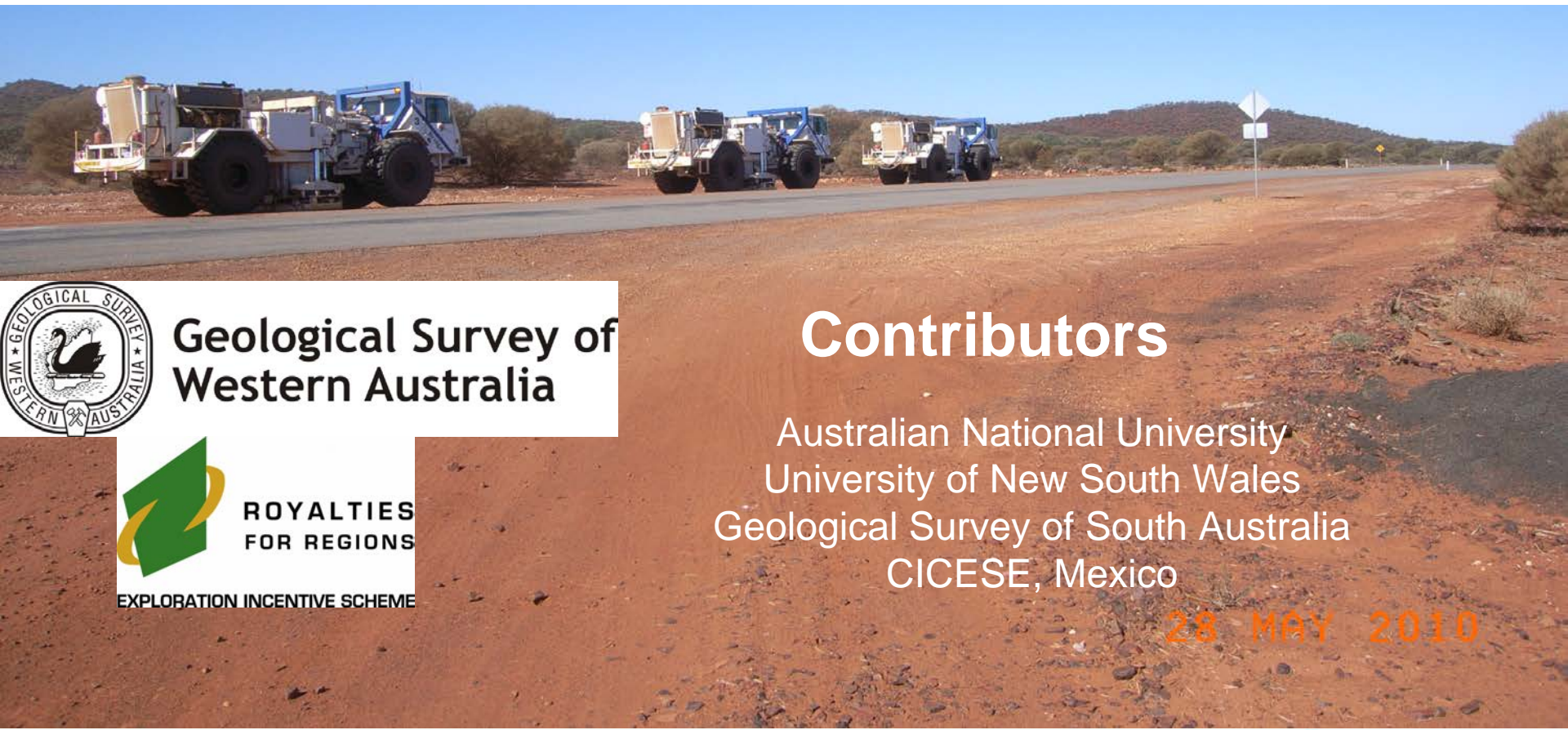
Project Partners



Government of **Western Australia**
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Western Australia**



**ROYALTIES
FOR REGIONS**

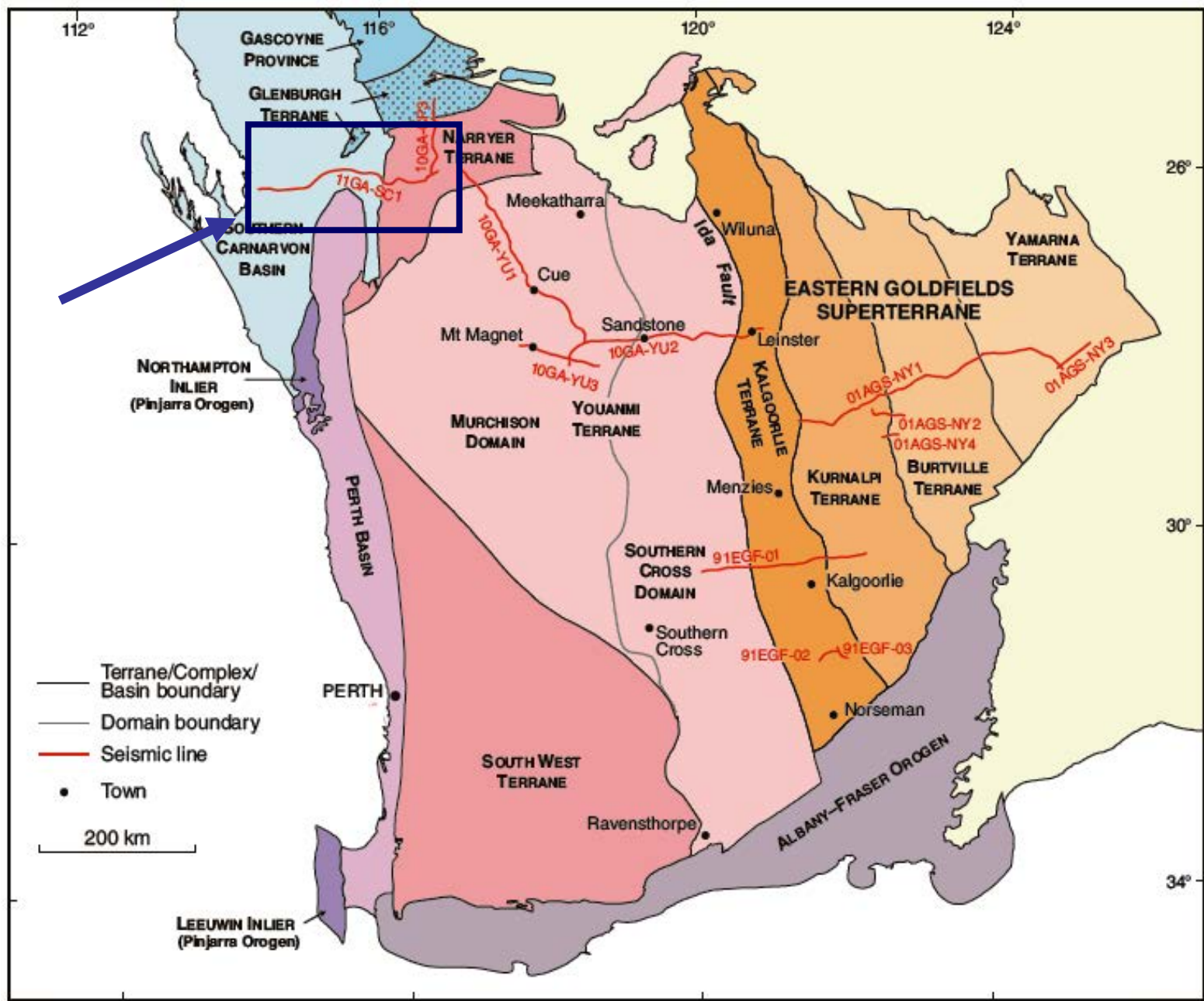
EXPLORATION INCENTIVE SCHEME

Contributors

Australian National University
University of New South Wales
Geological Survey of South Australia
CICESE, Mexico

28 MAY 2010





SW223c

12.02.13

Aims of the Southern Carnarvon seismic survey

Architecture of the Southern Carnarvon Basin

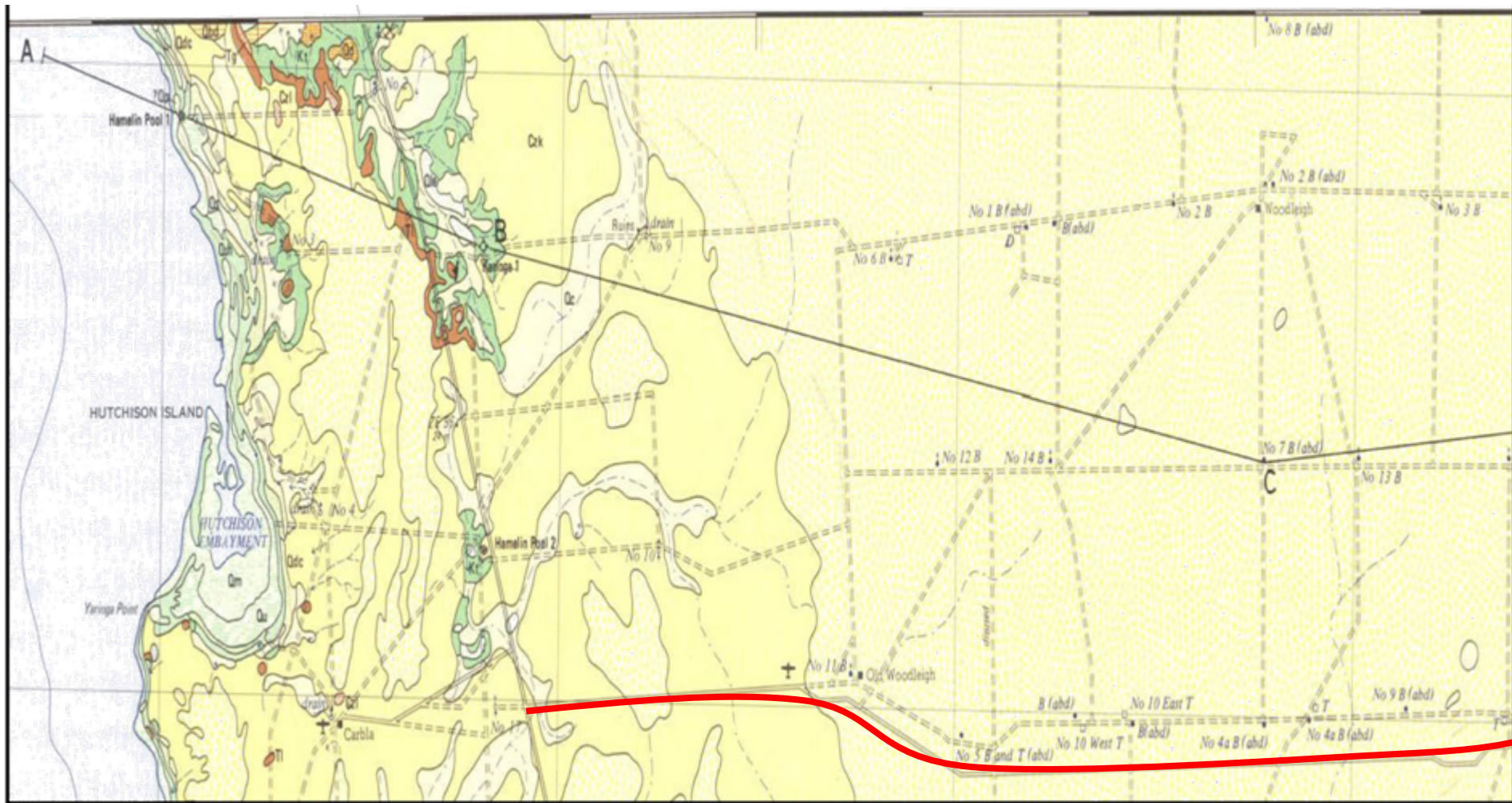
Potential of Byro Sub-basin for structural and stratigraphic hydrocarbon traps

Architecture and deep structure of Archean Narryer Terrane -
contains the oldest known rocks in Australia -
and detrital zircons up to 4404 Ma: oldest known terrestrial material on Earth

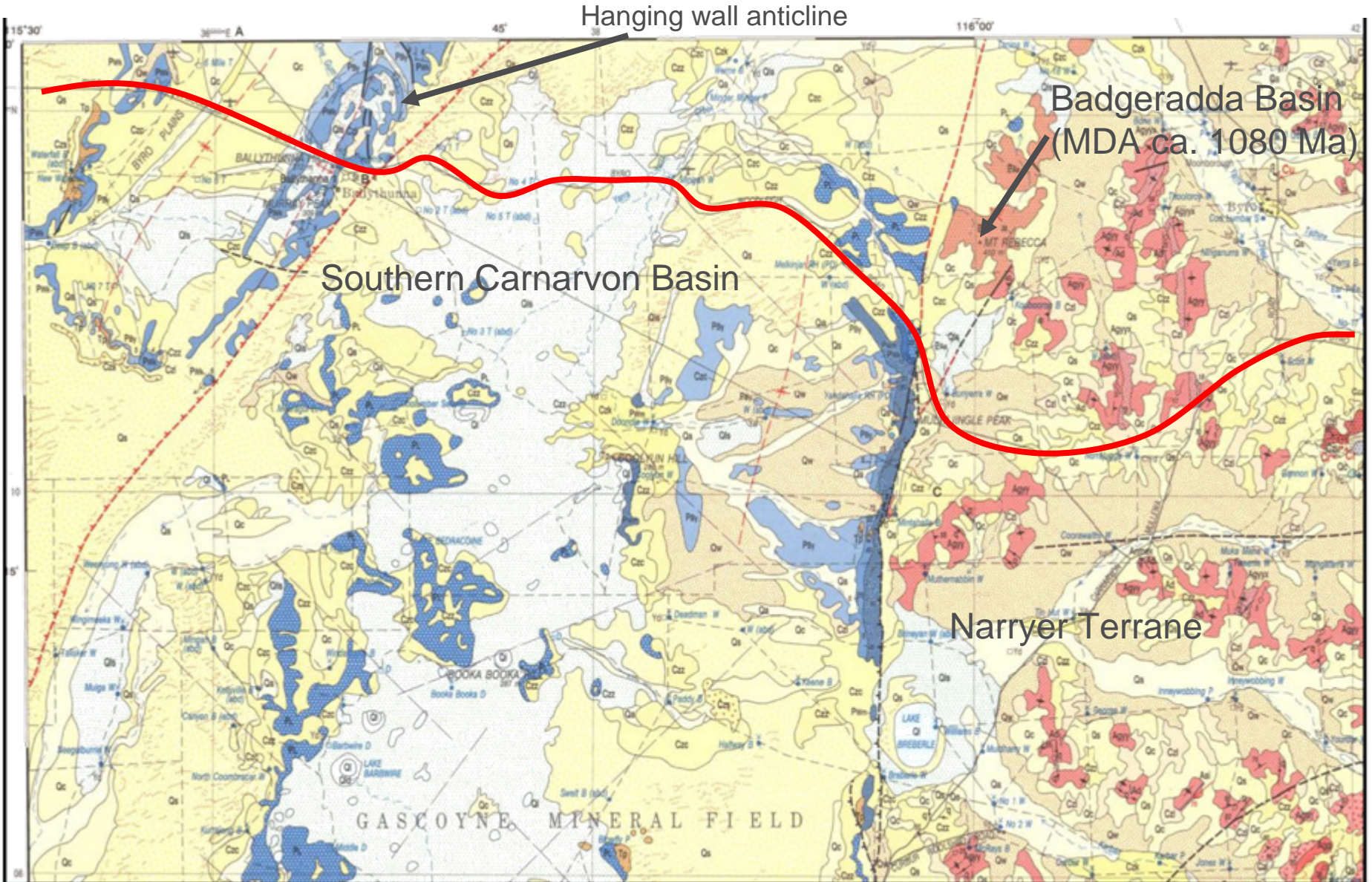
Relationships between basement units: Archean Narryer Terrane,
Archean to Proterozoic Glenburgh Terrane of the Gascoyne Province,
and Mesoproterozoic to Neoproterozoic Pinjarra Orogen

NOTE: Line acquired mostly on outcrops of Southern Carnarvon Basin and Narryer Terrane

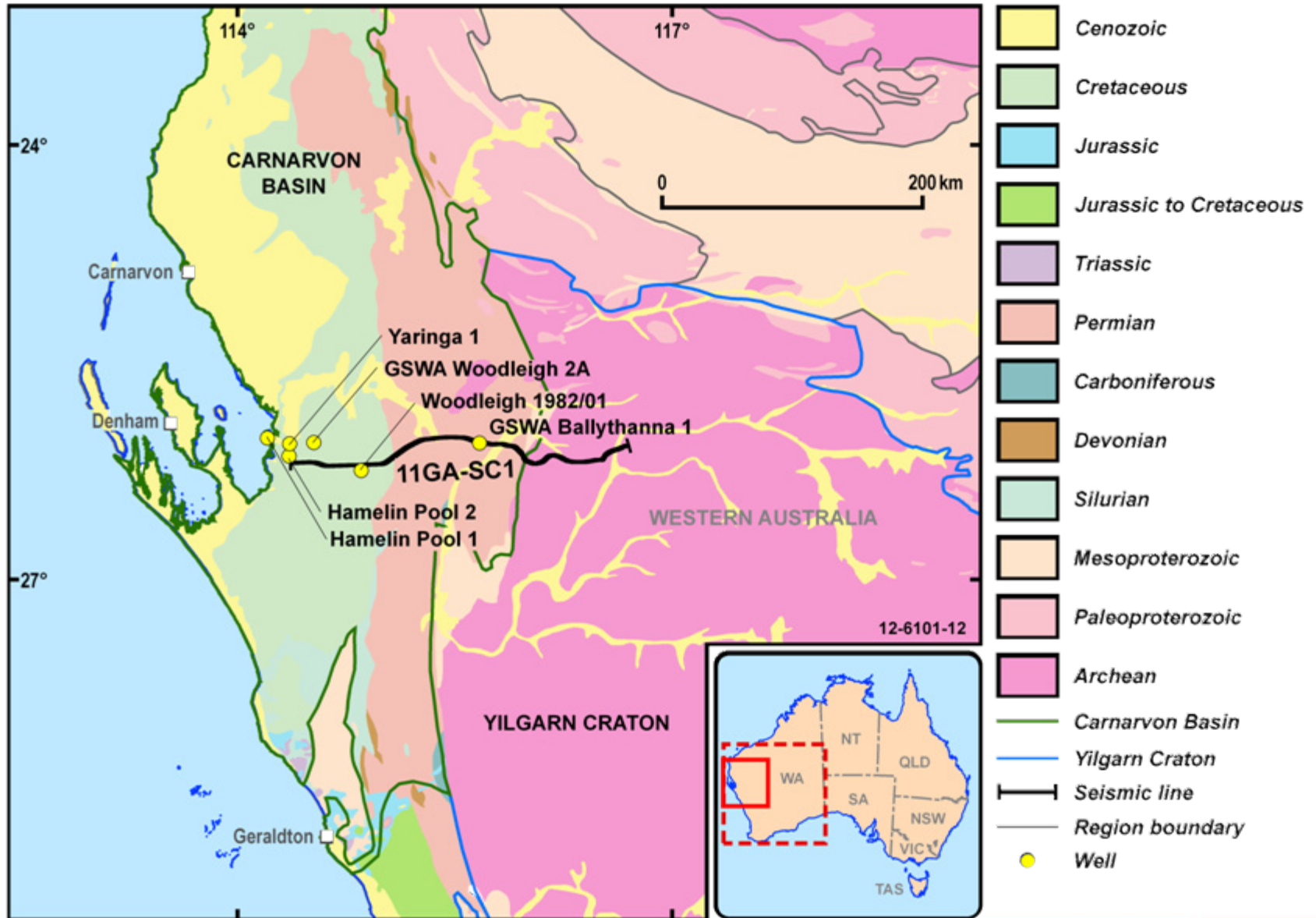
Surface geological control – Yaringa 1:250K map sheet



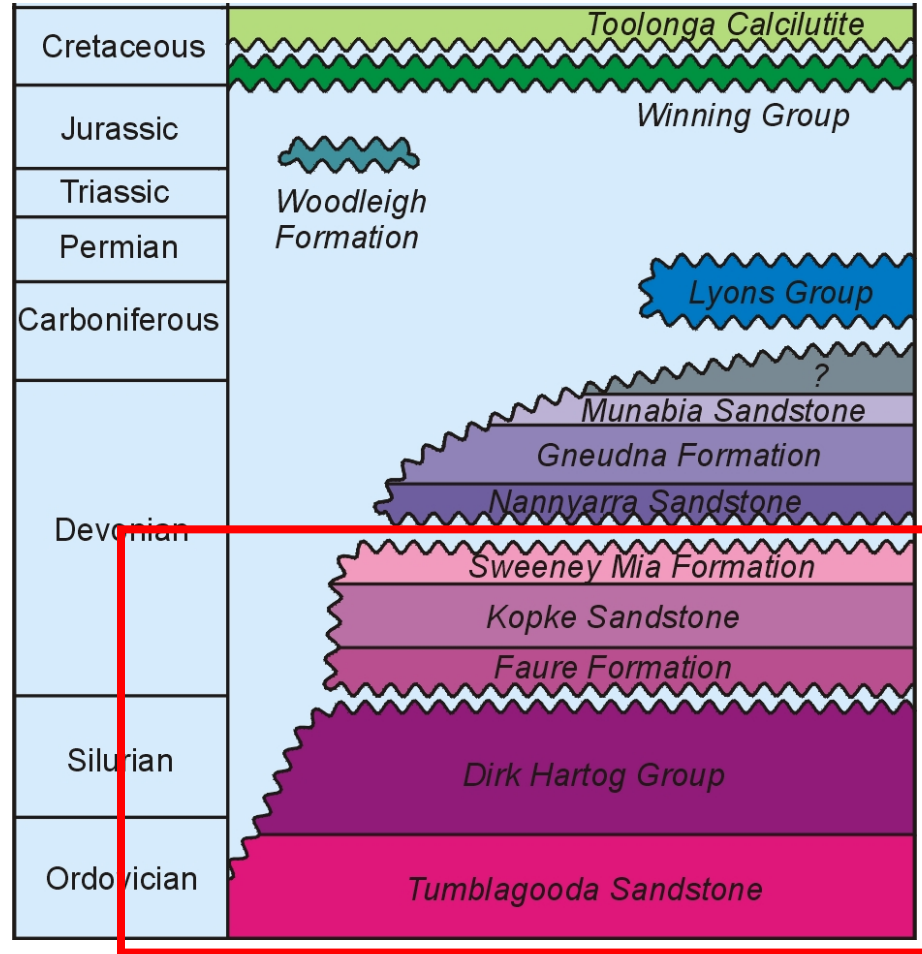
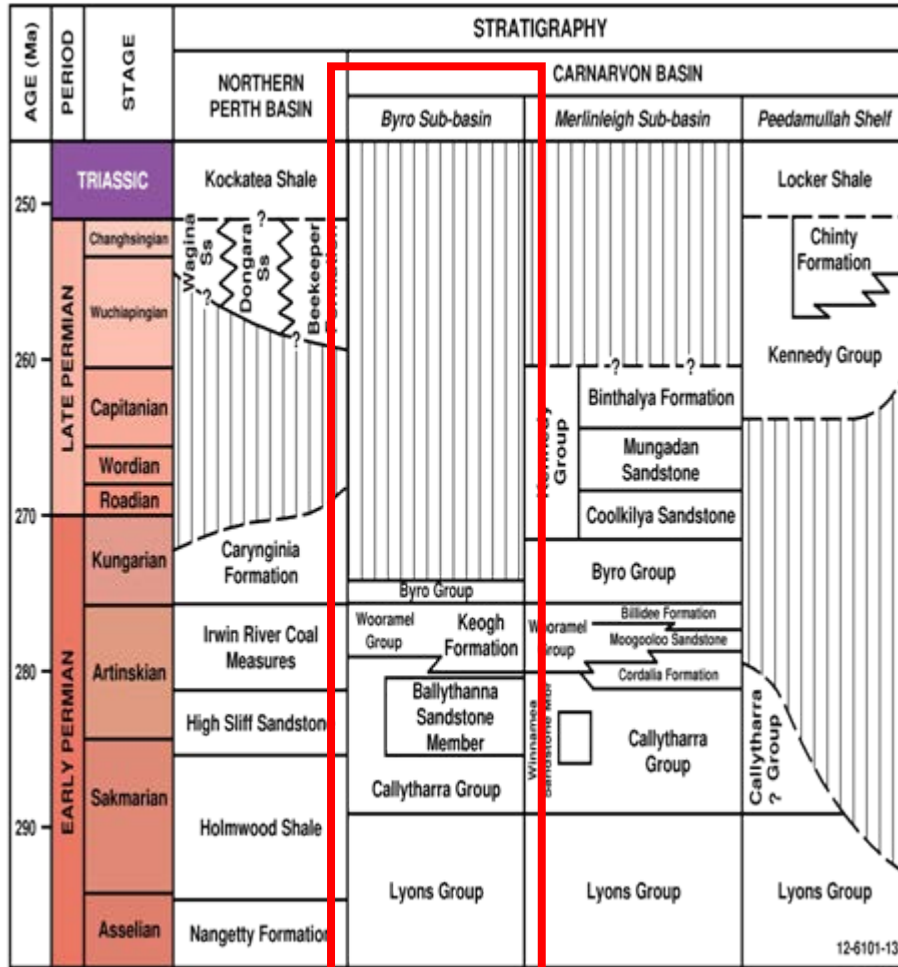
Surface geological control – Byro 1:250K map sheet



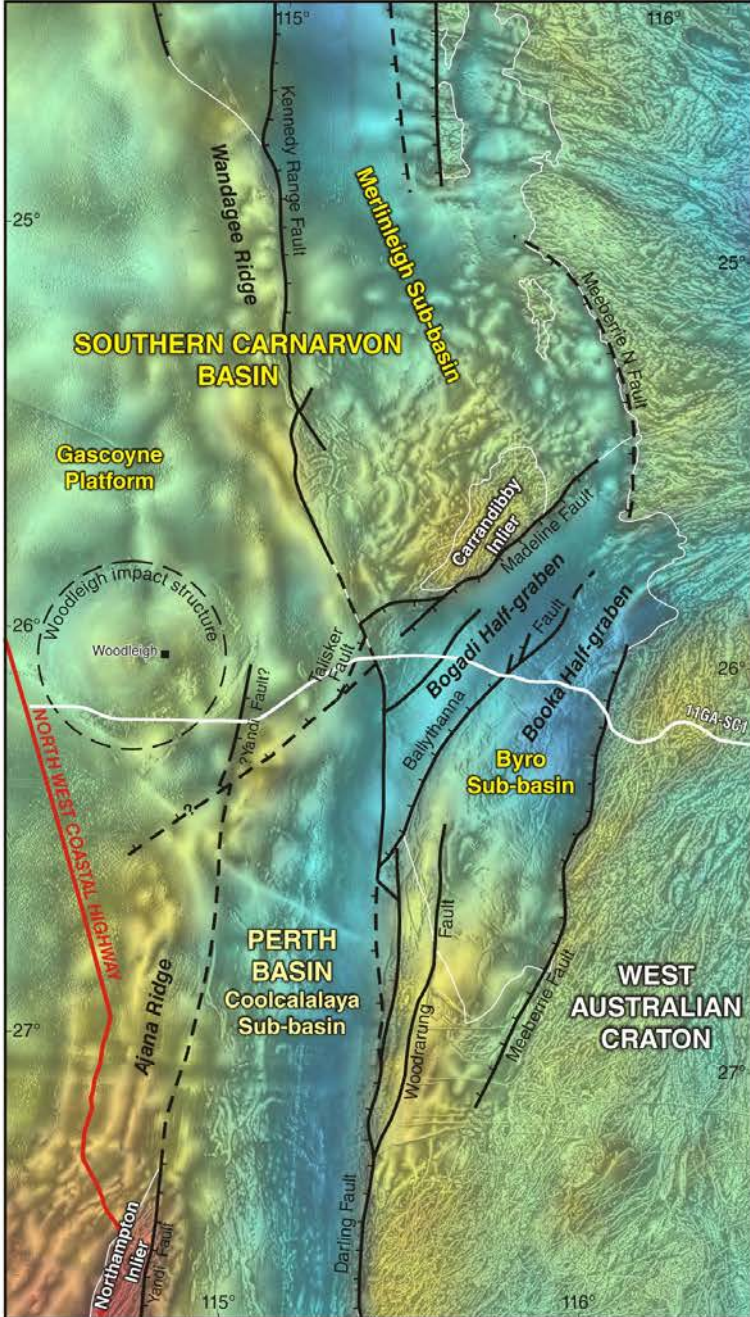
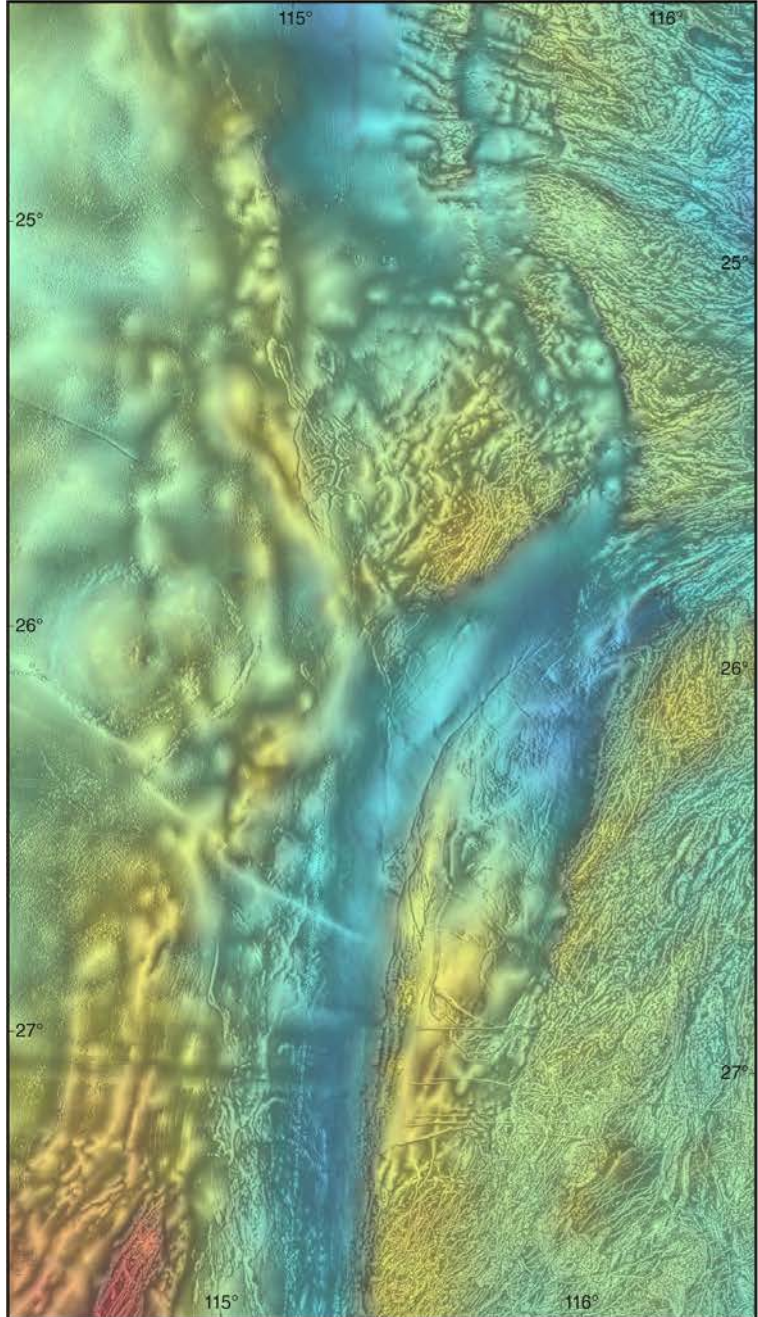
Seismic Line 11GA-SC1 across the Southern Carnarvon Basin



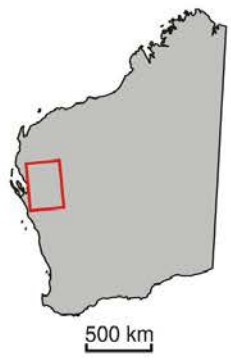
Southern Carnarvon Basin - stratigraphy



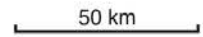
From: Mory and Backhouse (1997)



Basin Elements



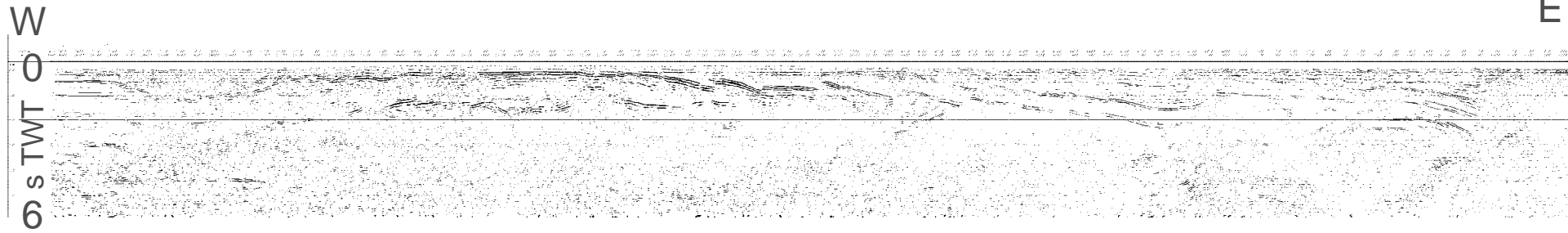
- Fault
- Fault, inferred
- Ticks indicate downside of fault
- Phanerozoic edge sub-basin margin
- Seismic line
- Homestead
- Highway



A1M697

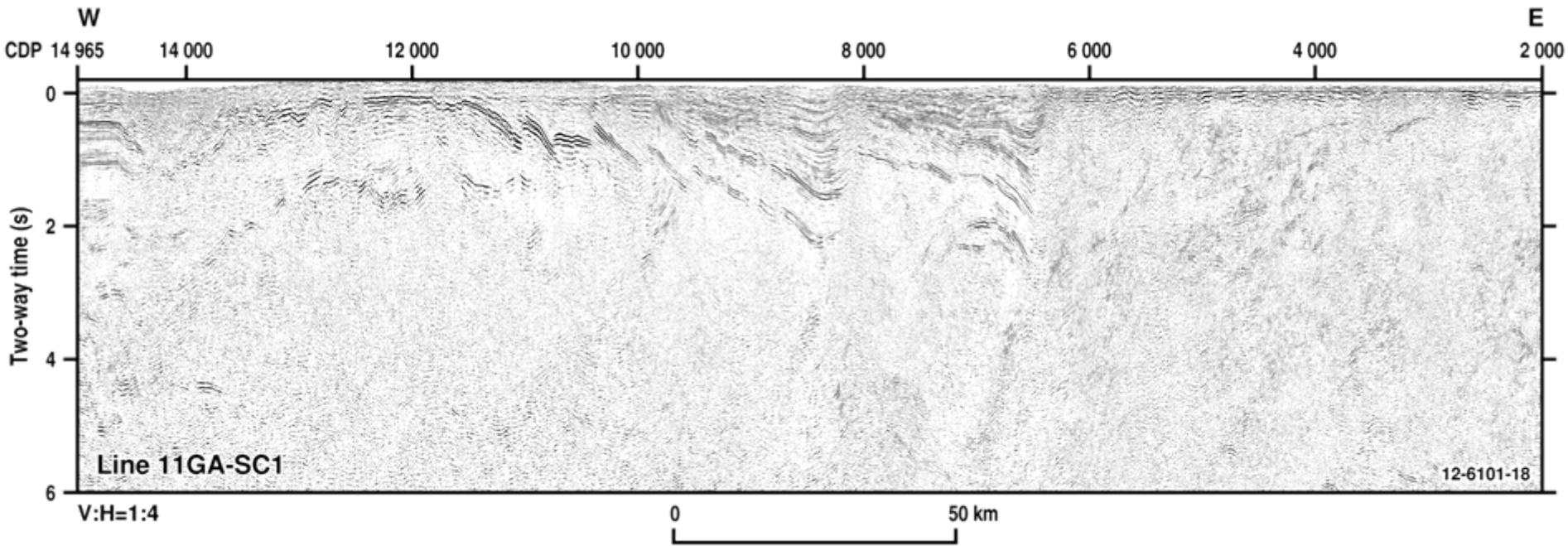
14.02.13

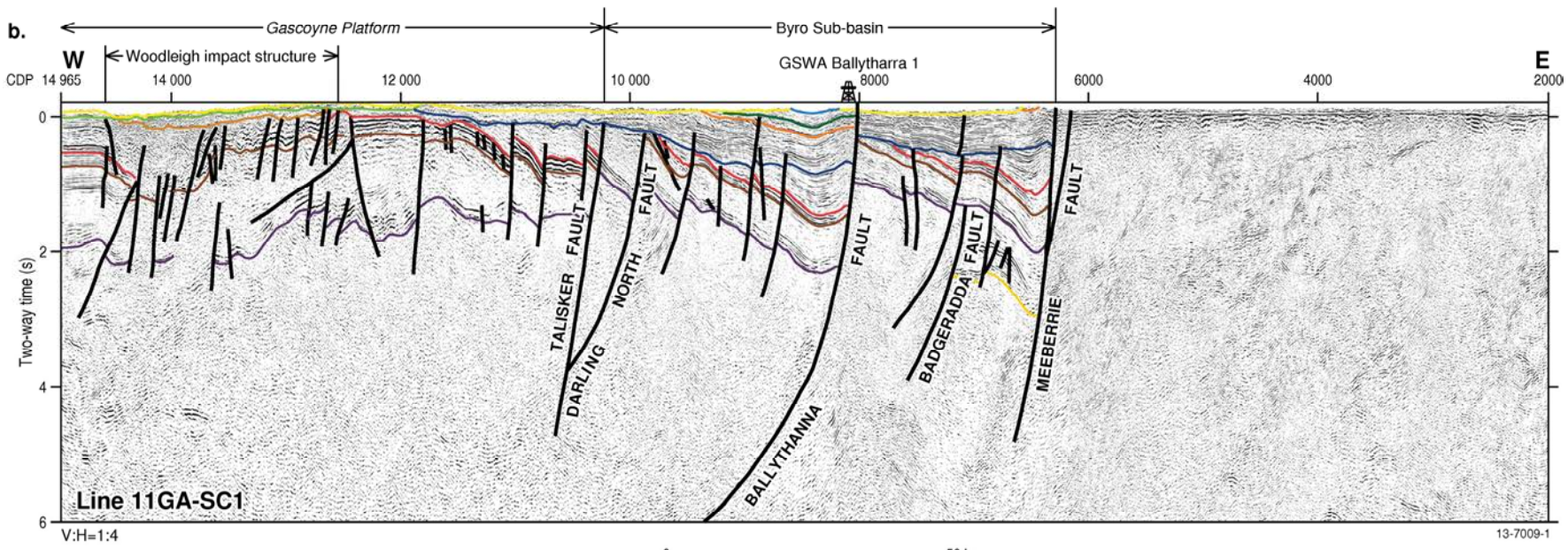
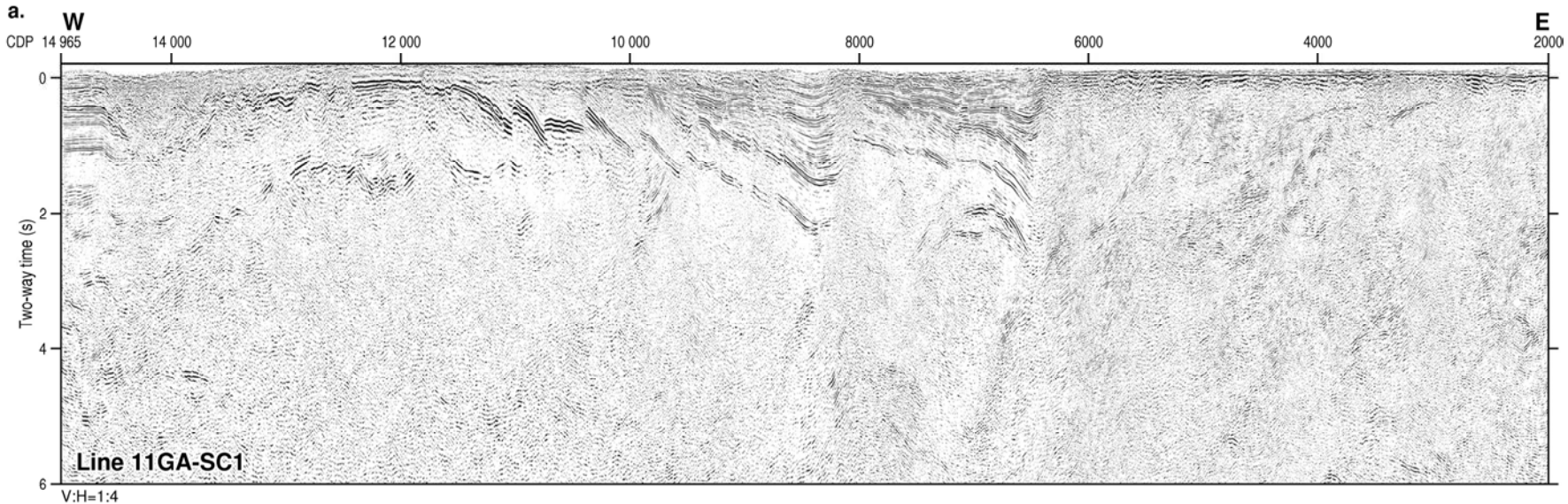
Southern Carnarvon Basin



Display with no vertical exaggeration

11GA-SC1 - uninterpreted section (squeezed x4)

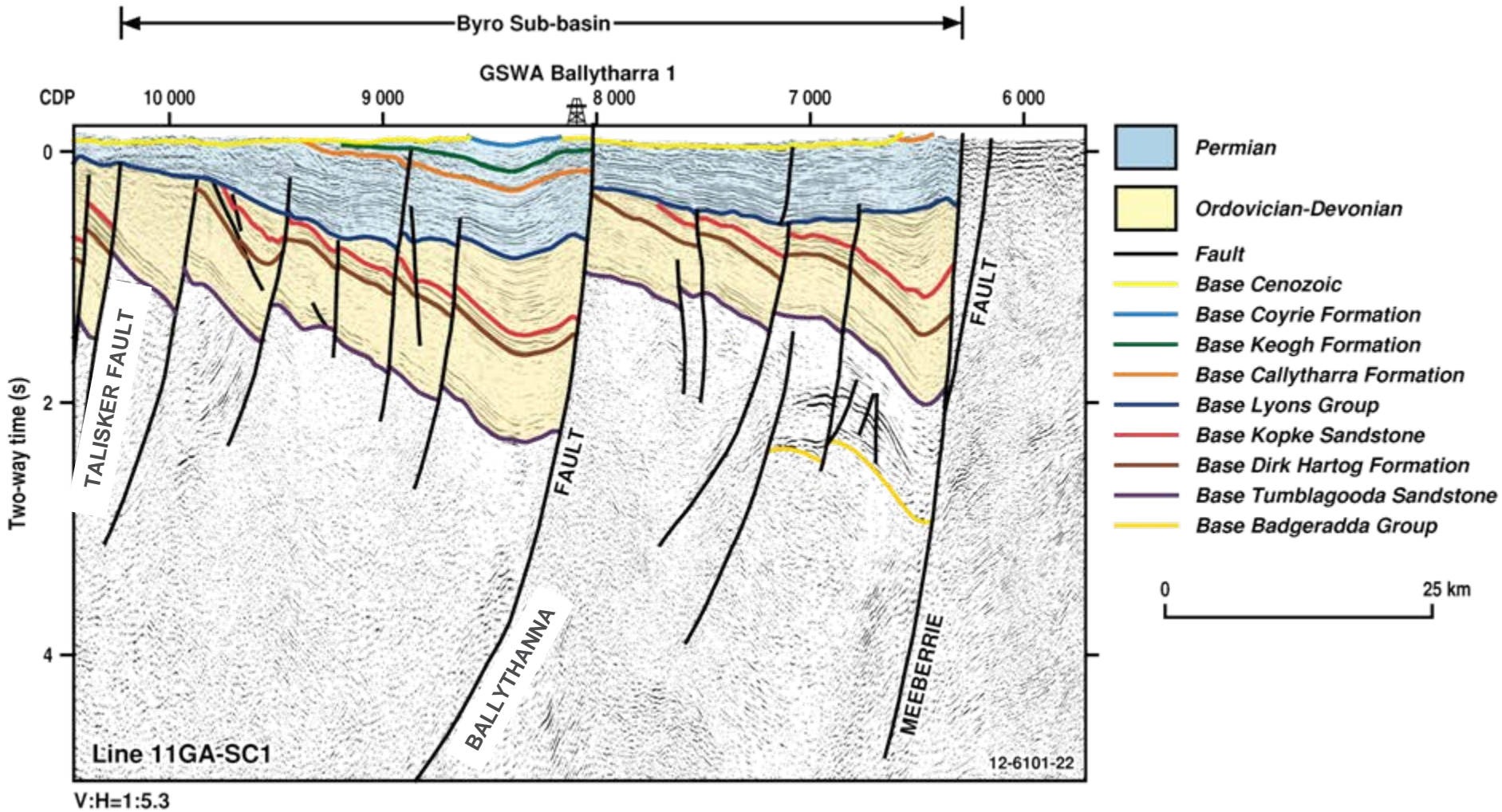




Note: VE = x4

- | | | | |
|-------------------|-------------------------|------------------------------|------------------------------|
| — Fault | — Base Jurassic | — Base Callytharra Formation | — Base Dirk Hartog Formation |
| — Base Cenozoic | — Base Coyrie Formation | — Base Lyons Group | — Base Tumblagooda Sandstone |
| — Base Cretaceous | — Base Keogh Formation | — Base Kopke Sandstone | — Base Badgeradda Group |

Byro Sub-basin interpretation



Woodleigh impact structure

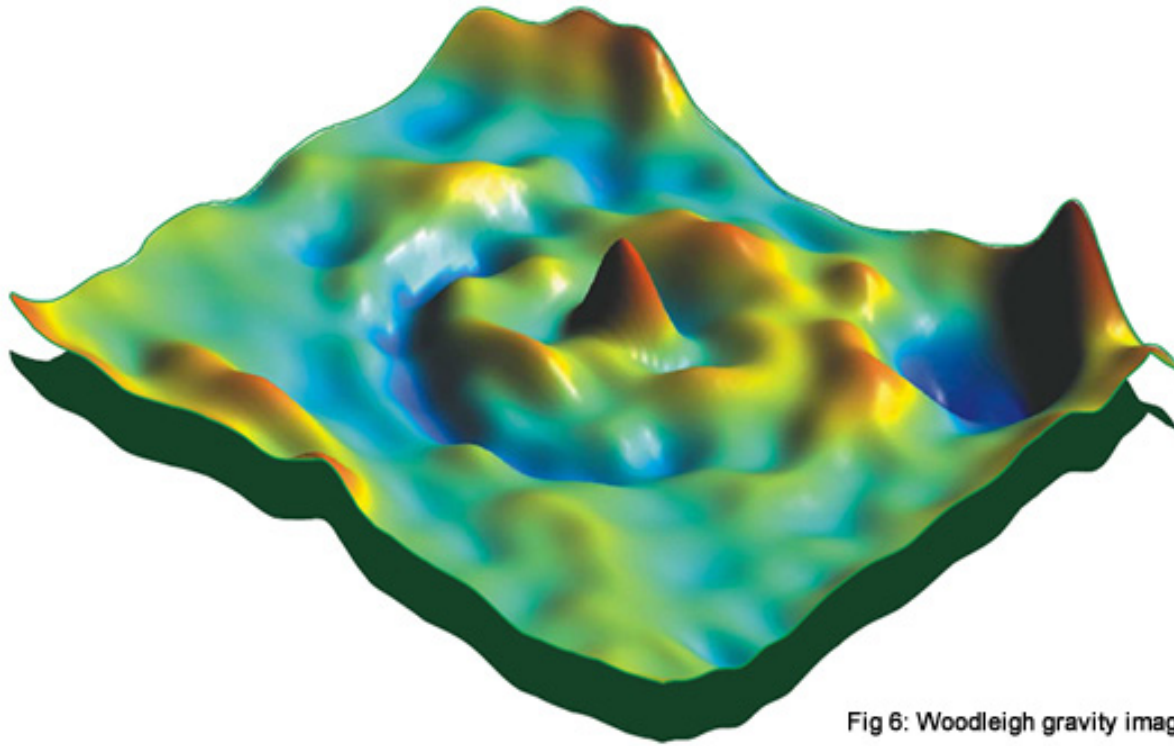
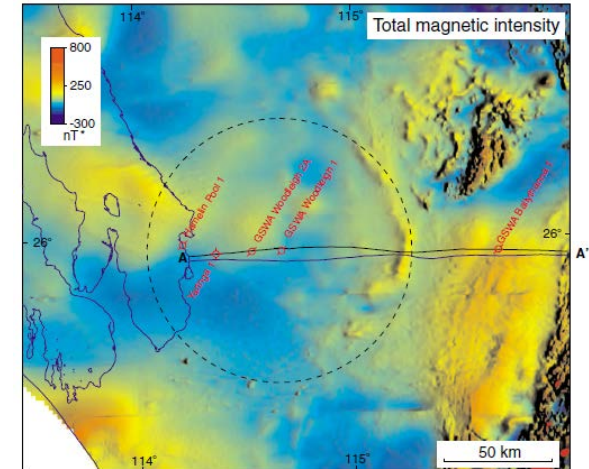
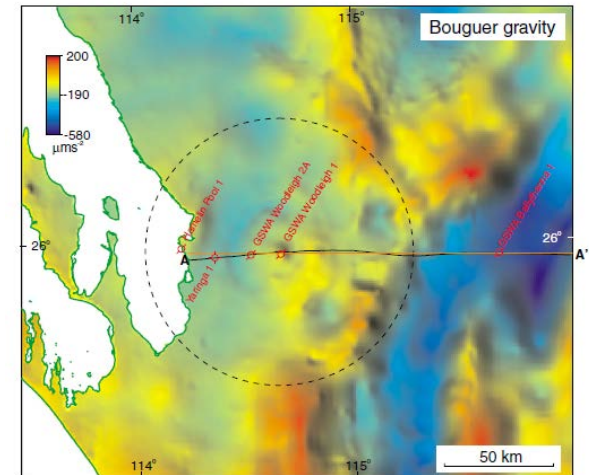


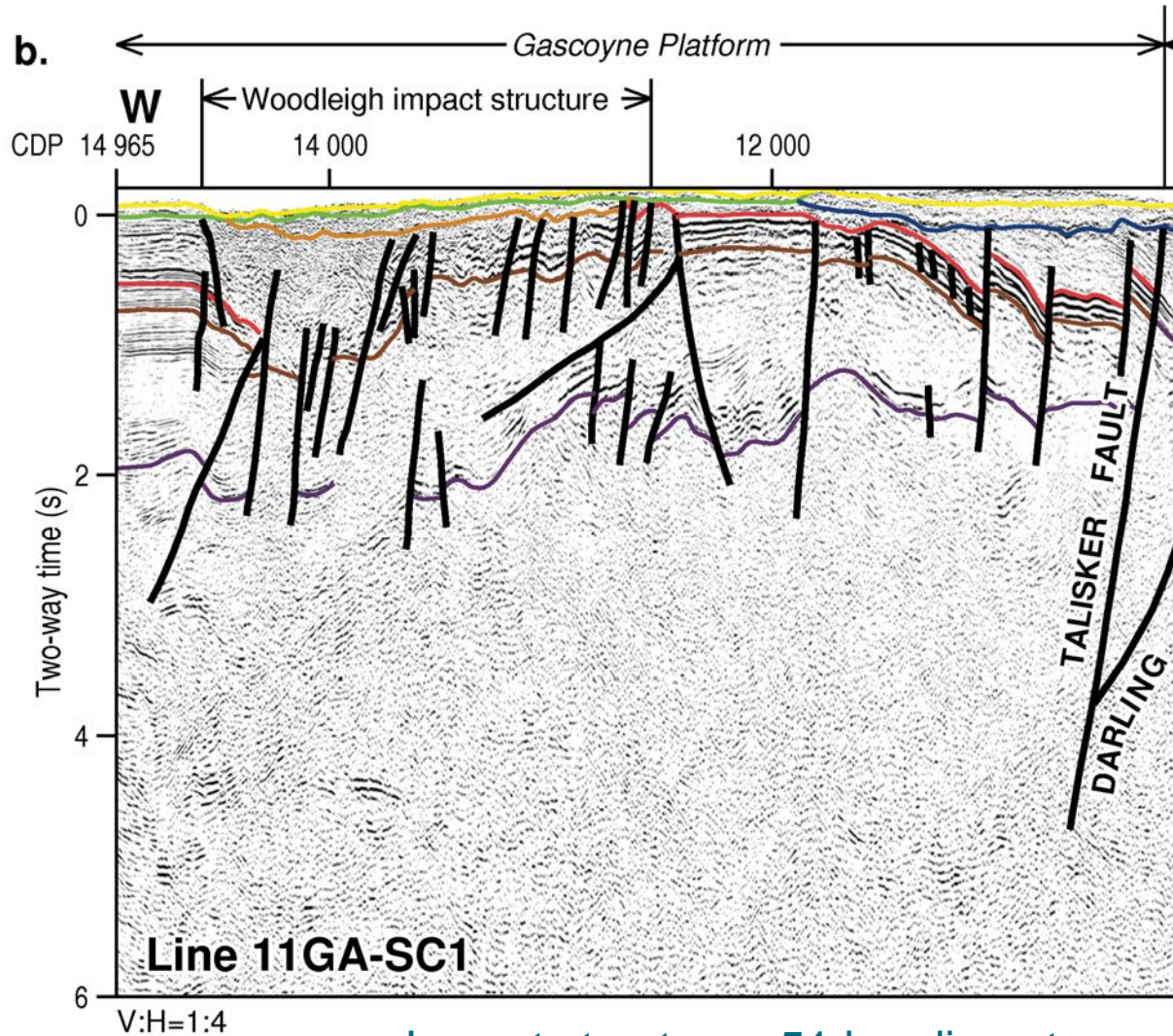
Fig 6: Woodleigh gravity image

From Iasky et al. (2001)



* International Geophysical Reference Field removed

Woodleigh impact structure



Note: VE = x4

Impact structure ~51 km diameter

Summary of the Southern Carnarvon Basin

Seismic line 11GA-SC1:

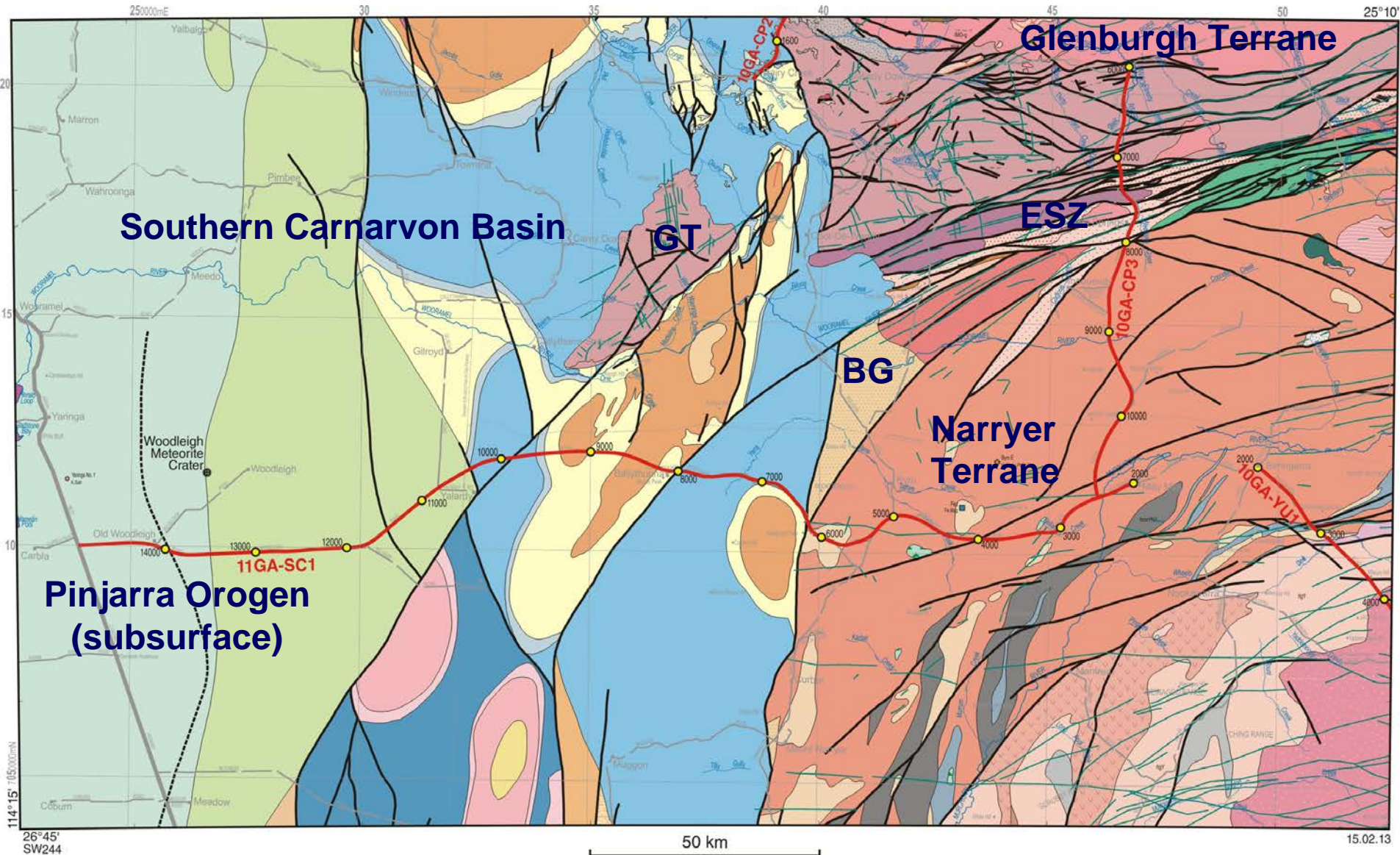
Crossed Gascoyne Platform and Byro Sub-basin

Byro Sub-basin

- two relatively thick half graben
- bounded by west-dipping faults
- two distinct sedimentary successions separated by angular unconformity are present in both half graben
- known source rocks present

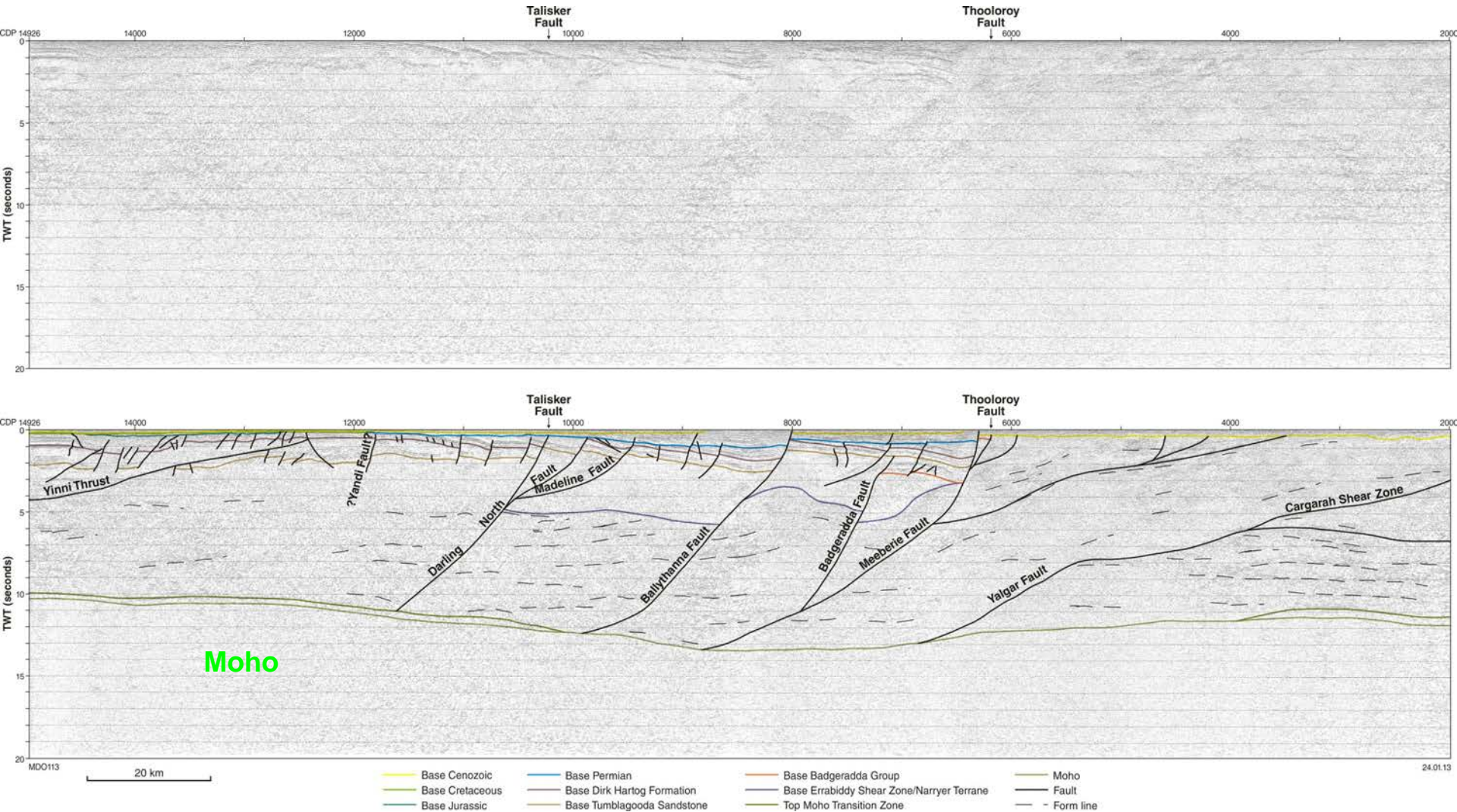
On the Gascoyne Platform the seismic line crosses southern part of Woodleigh Impact Structure

Basement Terranes



BG = Badgeradda Group ESZ = Errabiddy Shear Zone GT = Glenburgh Terrane

Southern Carnarvon seismic line – 11GA-SC1



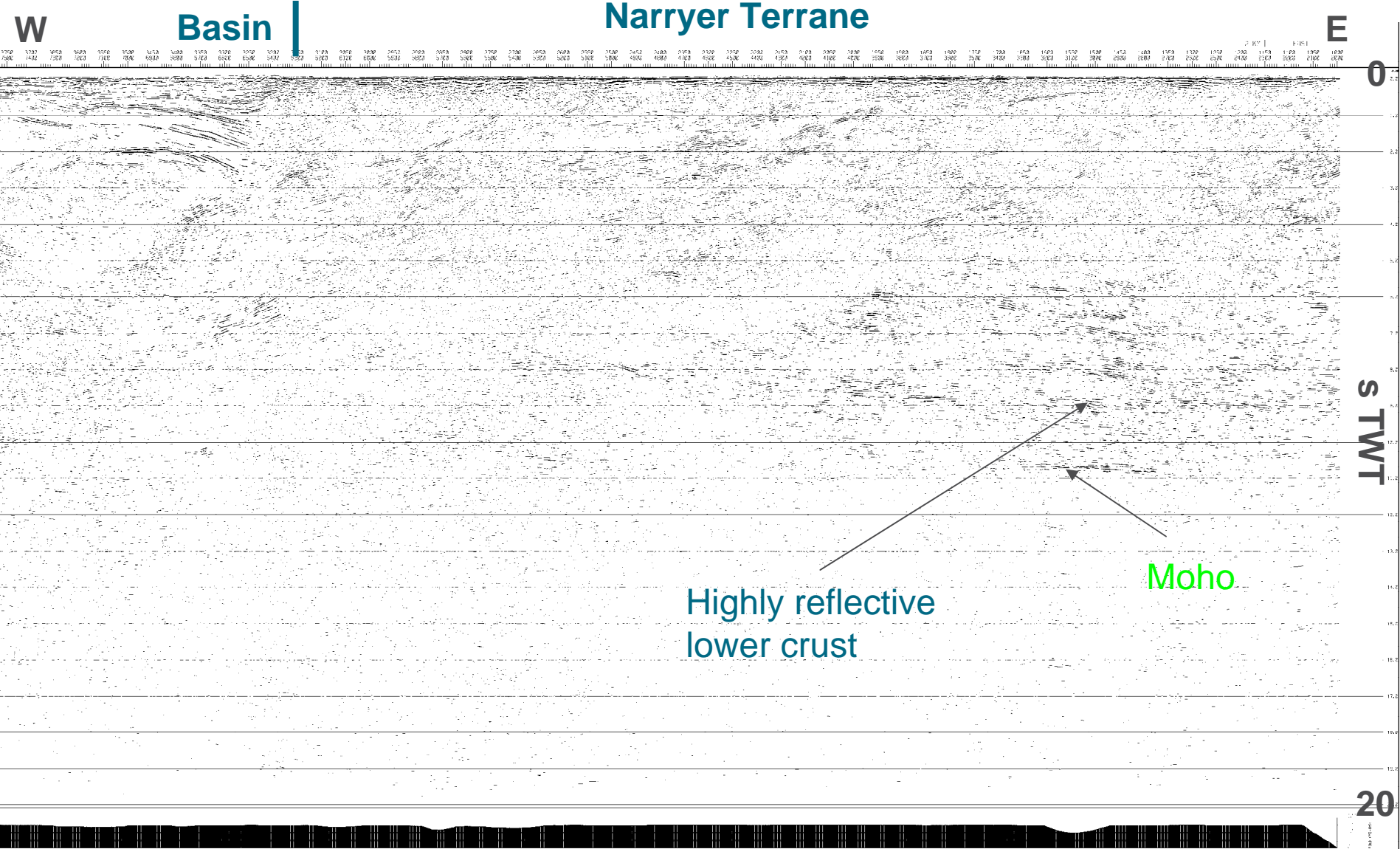
Southern Carnarvon Basin - well imaged
 Moho - varies from 30 km to ~40 km depth

Crust – variable reflectivity, mostly
 only moderate to low

11GA-SC1 – eastern end

Southern Carnarvon
Basin

Narryer Terrane



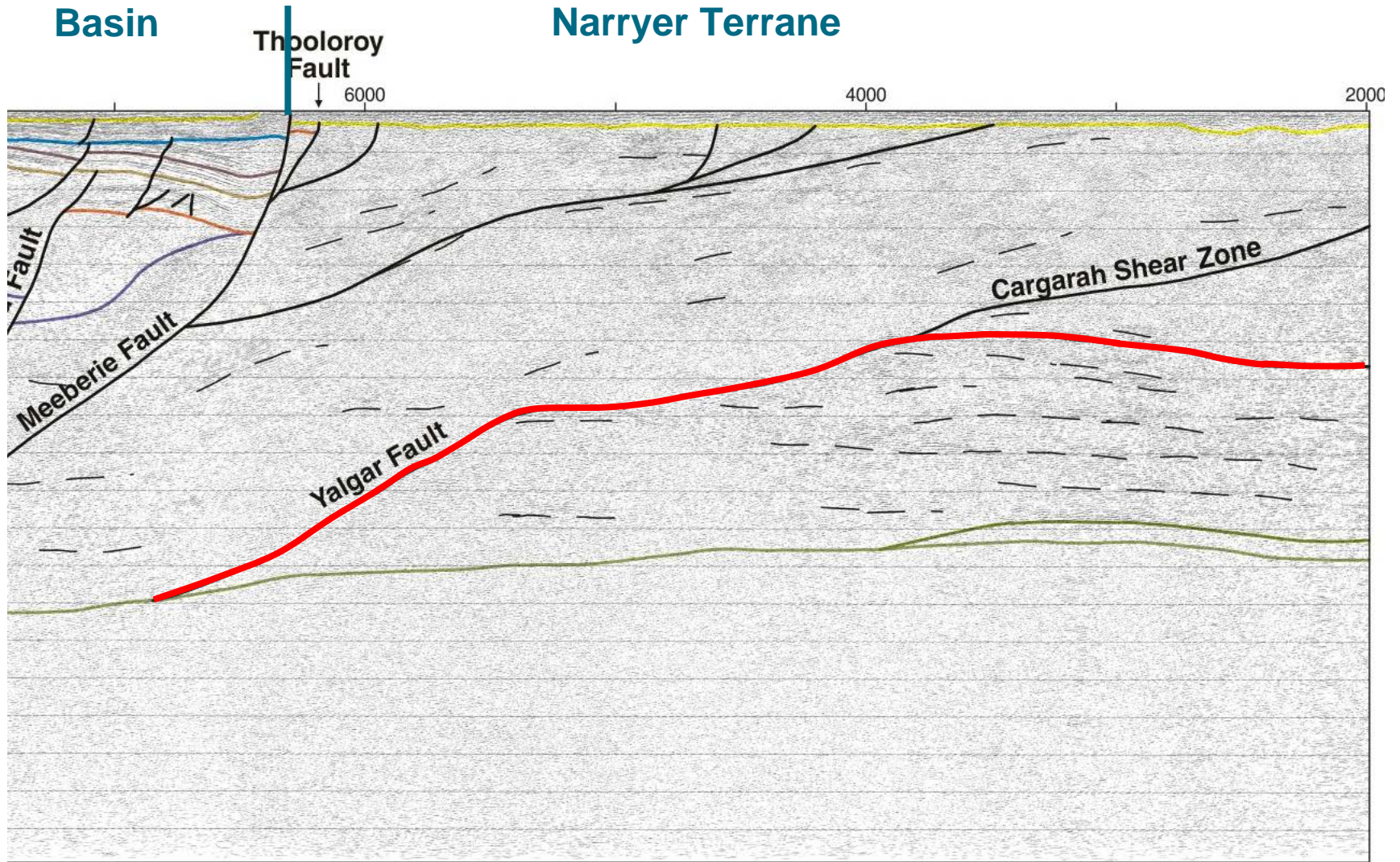
Highly reflective
lower crust

Moho

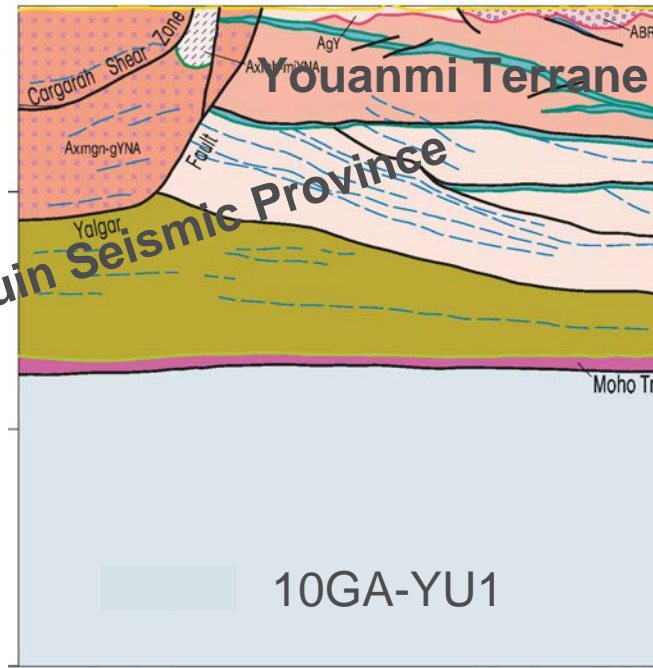
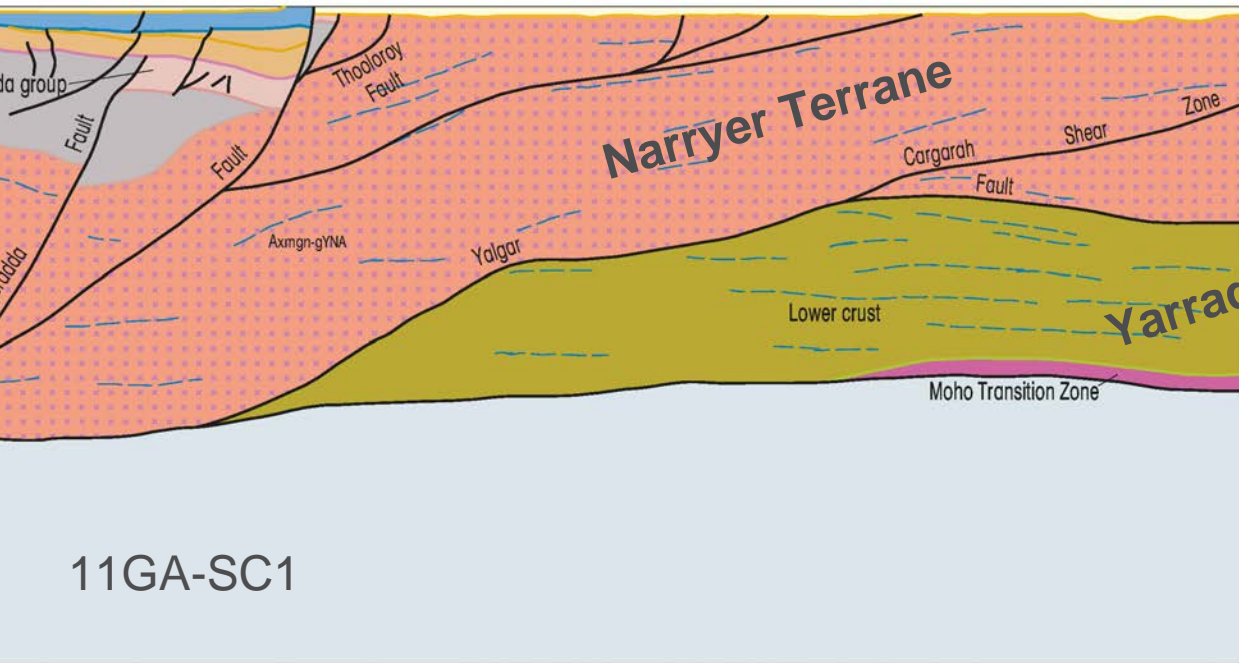
Narryer Terrane - dominated by reflections with apparent dip to west

Southern Carnarvon Basin

Narryer Terrane



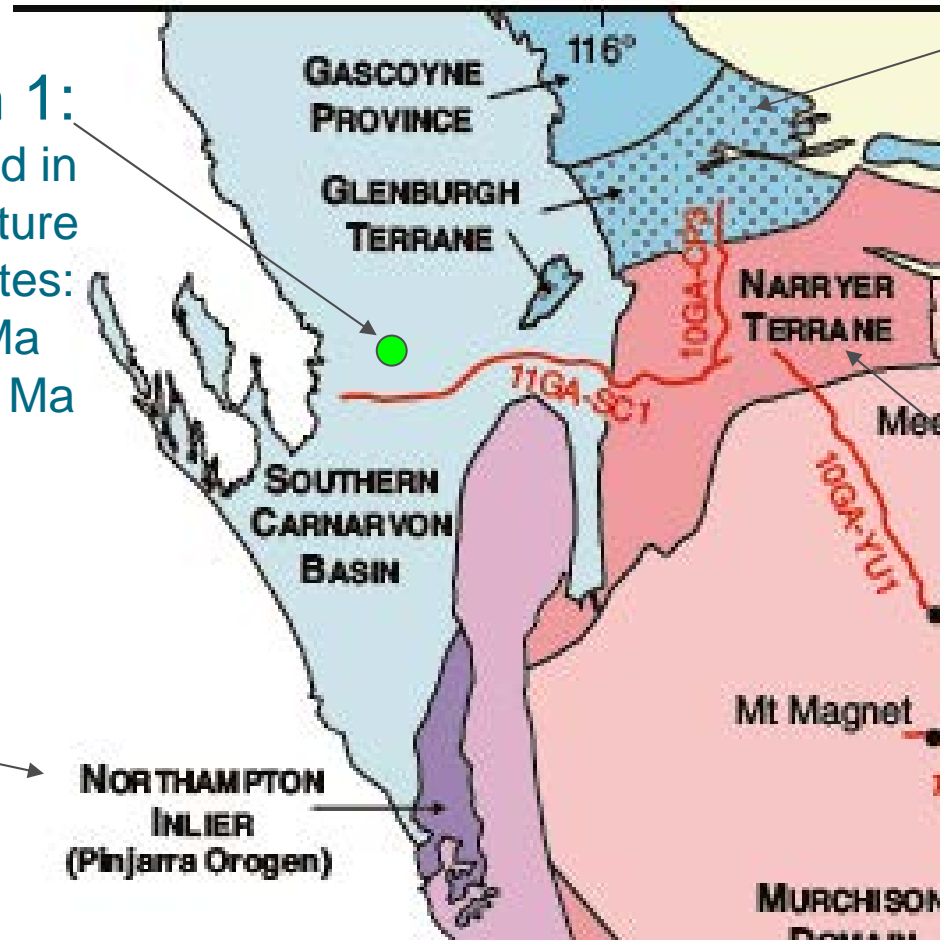
Narryer Terrane Combined 11GA-SC1 and 10GA-YU1



Basement terranes under Southern Carnarvon Basin

GSWA Woodleigh 1:
Gneissic granite sampled in Woodleigh Impact Structure
Preliminary SHRIMP dates:
Magmatic - ca. 1300 Ma
Metamorphic - ca. 1195 Ma

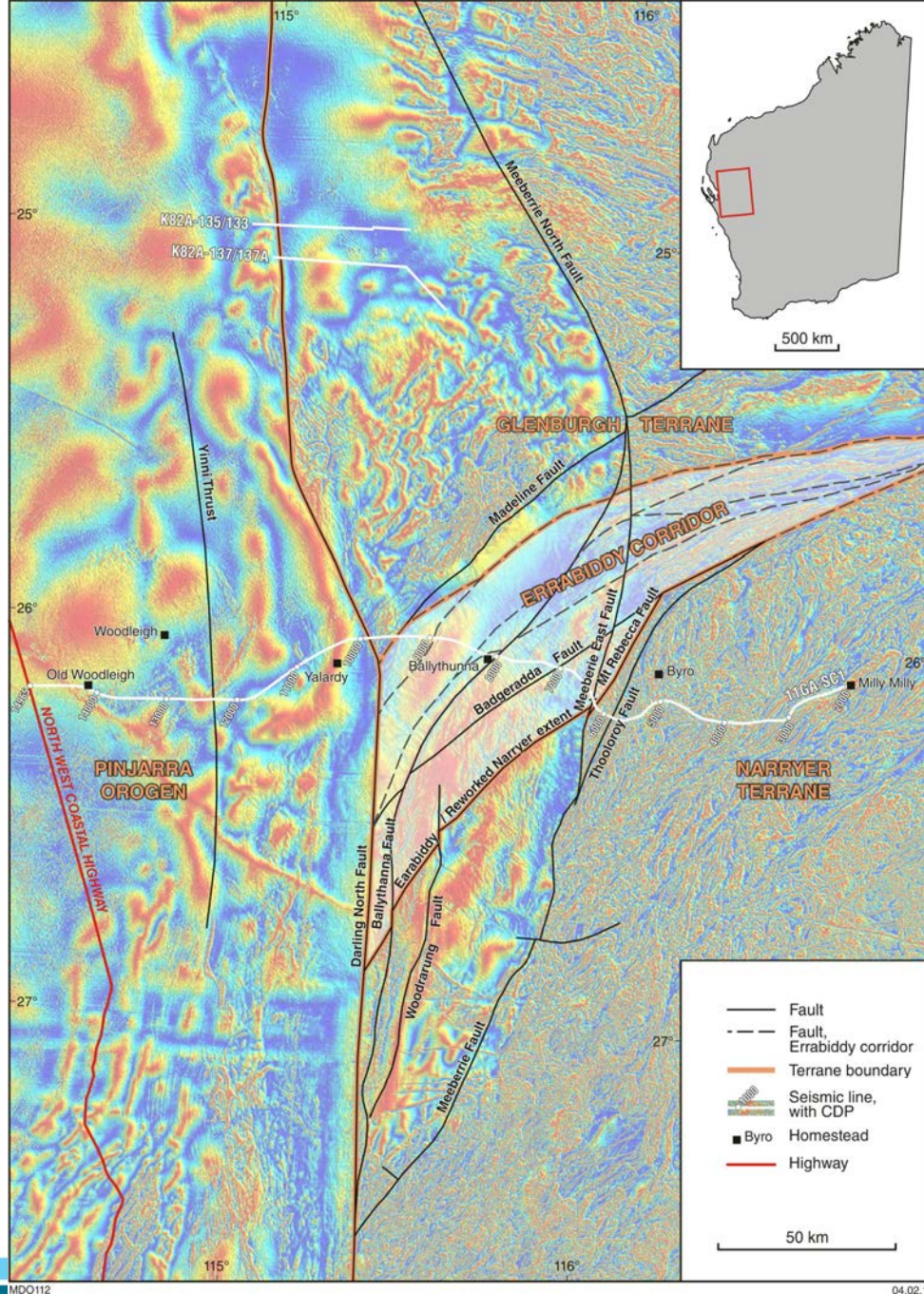
Pinjarra Orogen:
Deformation,
metamorphism &
magmatism
ca. 1080 Ma to 990 Ma



Glenburgh Terrane:
ca. 2555 Ma to
ca. 1945 Ma
(+ younger
events)

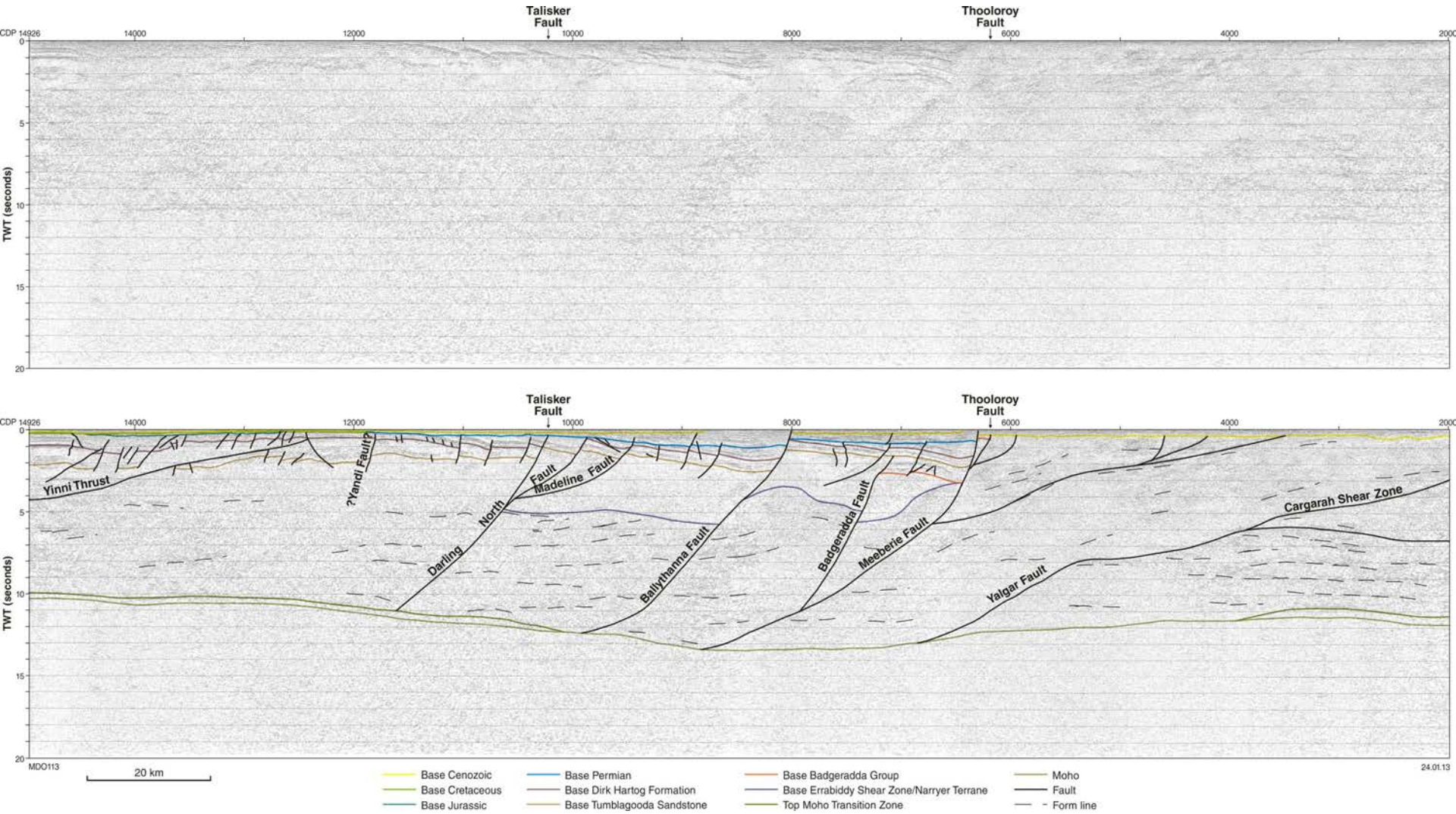
Narryer Terrane:
ca. 3730 Ma to
ca. 2620 Ma
(+ younger
rocks)

Aeromagnetic image: Interpretation of key faults and shear zones beneath Southern Carnarvon Basin

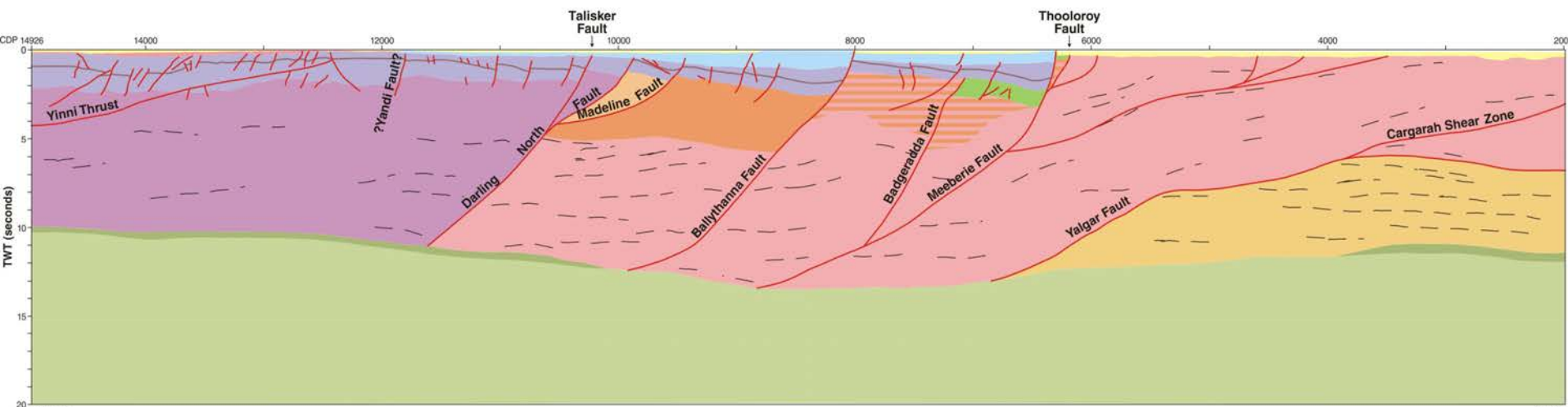
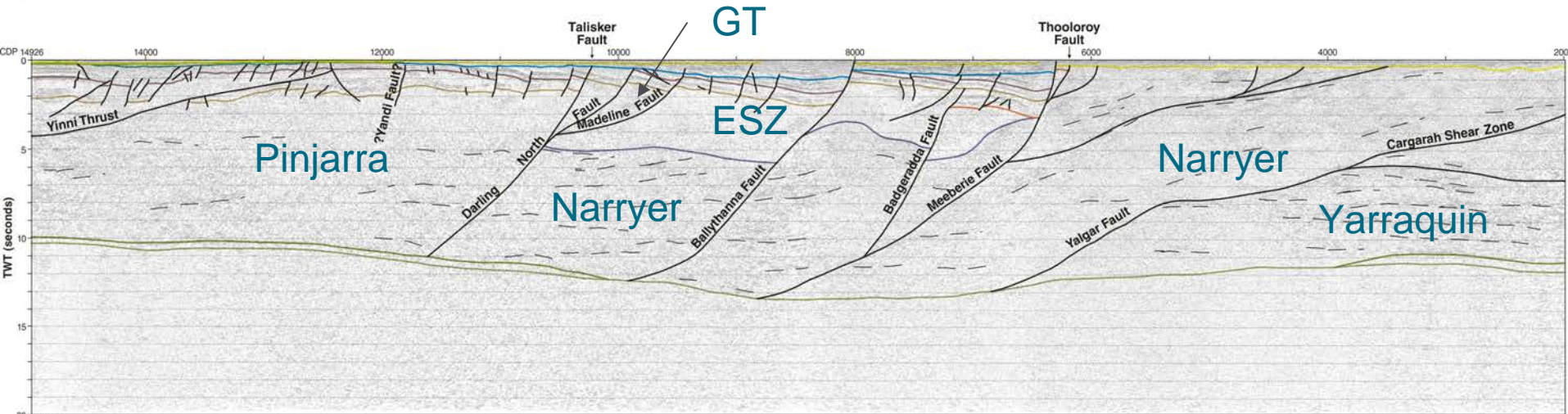


East
Narryer Terrane
Badgeradda Basin
Errabiddy Corridor
Glenburgh Terrane
- Carrandibby Inlier
Pinjarra Orogen
West

Southern Carnarvon seismic line – 11GA-SC1



Southern Carnarvon seismic line – 11GA-SC1



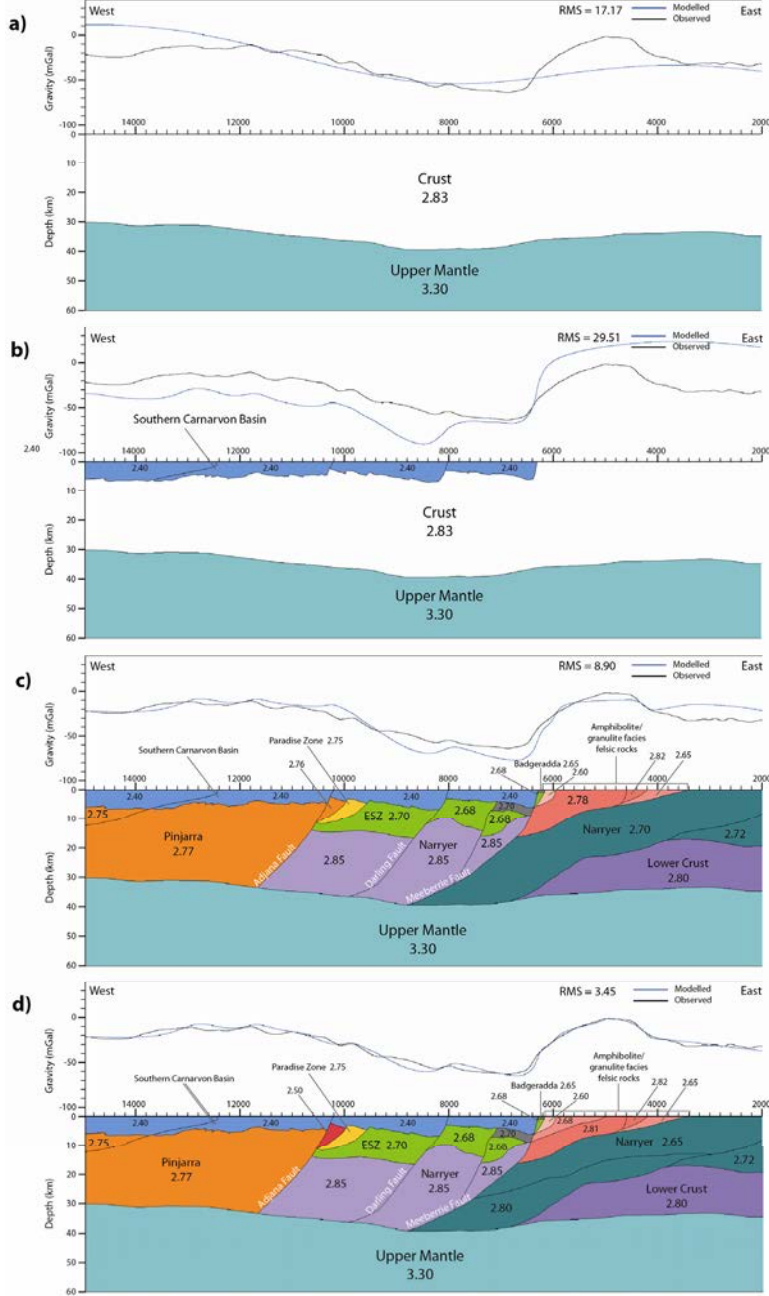
Gravity forward modelling (James Goodwin)

Two layer model

Three layer model

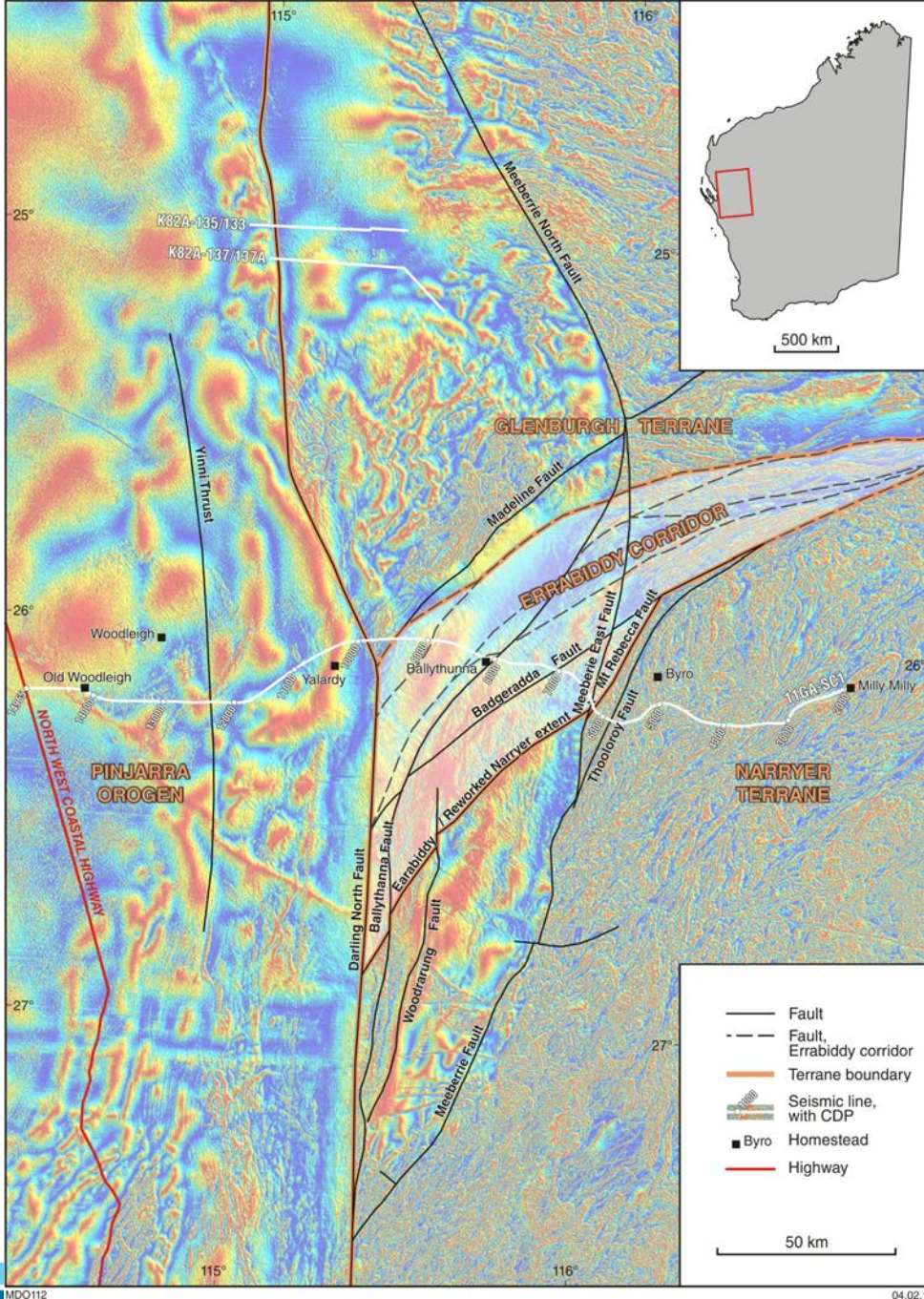
Domains assigned densities

Density subdivisions within Narryer Terrane



Possible change in polarity of eastern boundary of Pinjarra Orogen in the north?

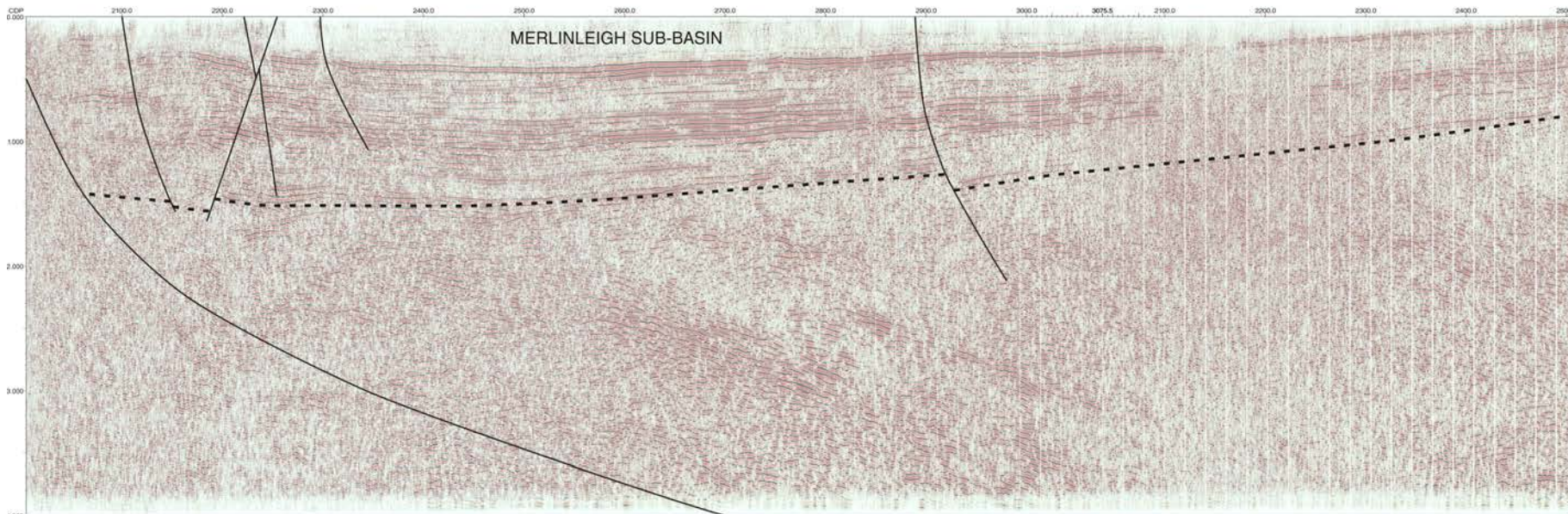
- Industry seismic lines



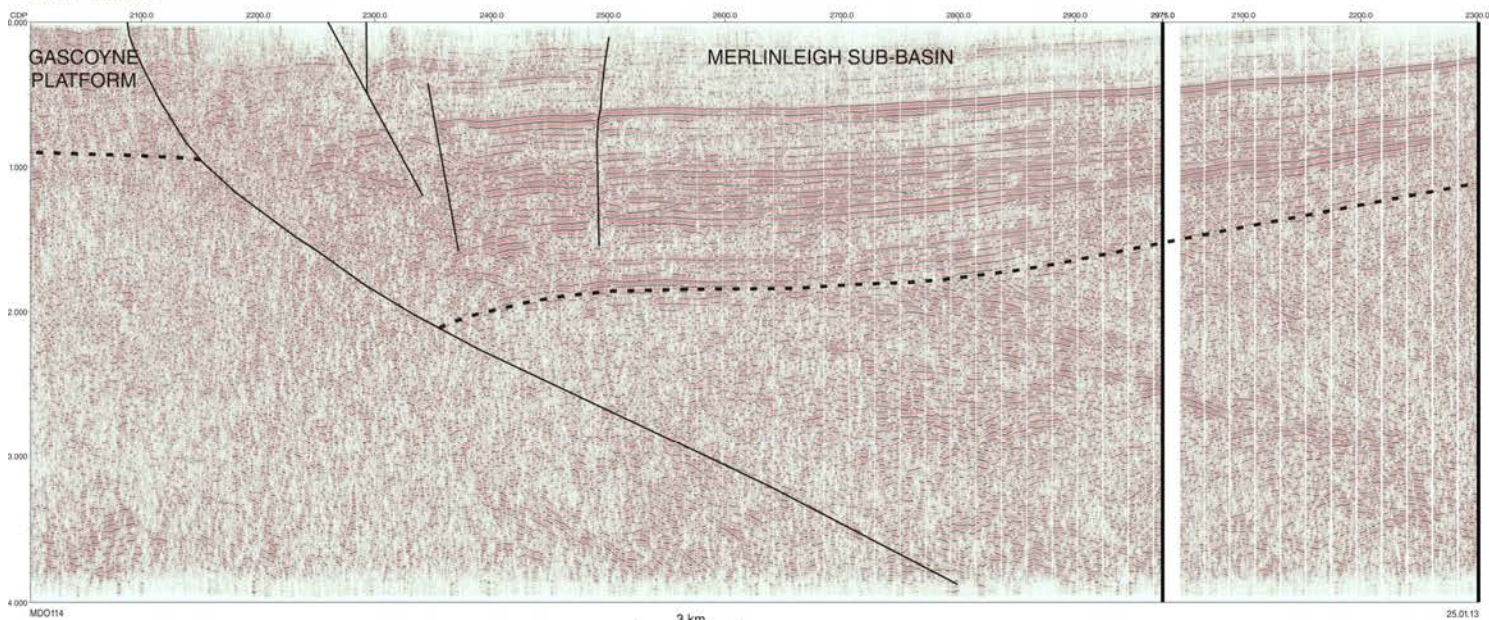
MDO112

04.02.13

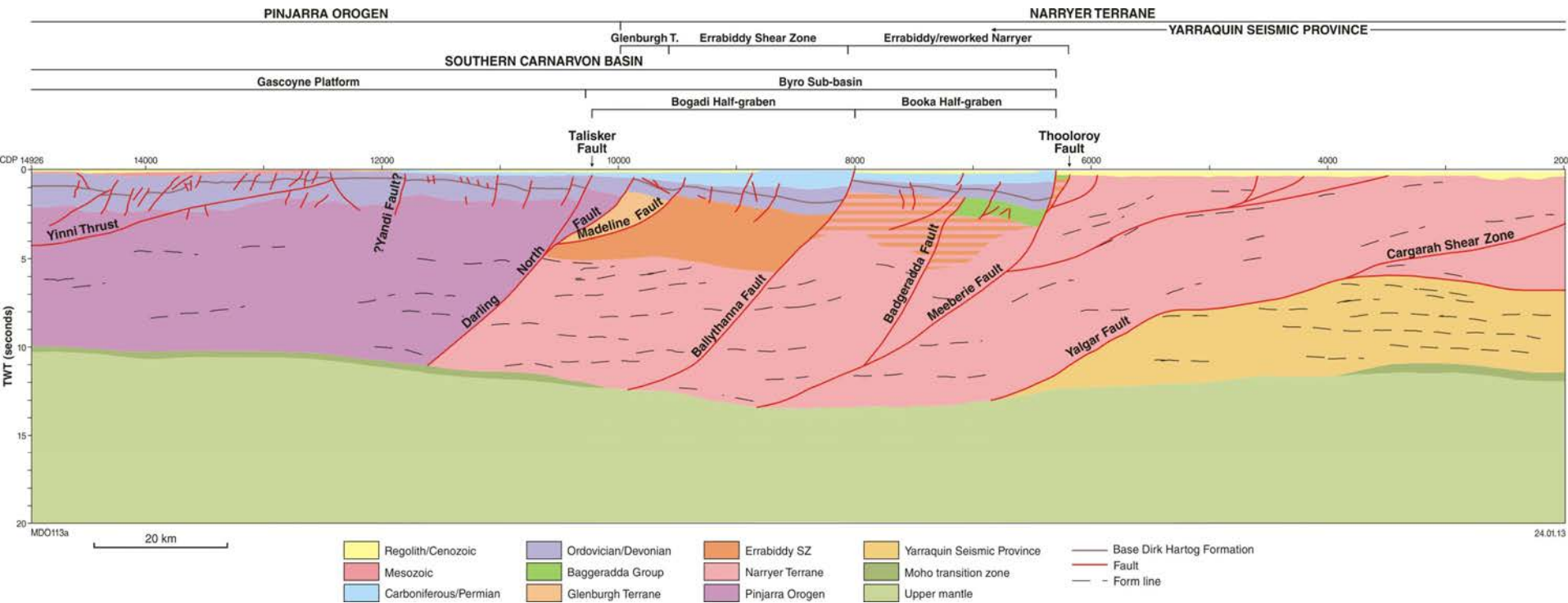
K82A-137/137A



K82A-135/133



Southern Carnarvon seismic line – 11GA-SC1



Summary

Southern Carnarvon Basin – two deep half graben (>5600 m) bounded by reactivated crustal-scale faults

Narryer Terrane – dominant structure has apparent dips to west

Basement architecture in vicinity of terrane triple junction (Narryer-Glenburgh-Pinjarra) now clarified

Darling-Darling North Fault – possible suture between Pinjarra Orogen and West Australian Craton

Change in trend of Errabiddy Shear Zone – sinistral movement on Darling North Fault



Australian Government
Geoscience Australia



THANK YOU

Seismic data and interpretations can be downloaded from:
<http://www.ga.gov.au/minerals/projects/current-projects/seismic-acquisition-processing.html>

Phone: +61 2 6249 9111

Web: www.ga.gov.au

Email: Russell.Korsch@ga.gov.au

Address: Cnr Jerrabomberra Avenue and Hindmarsh Drive, Symonston ACT 2609

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