Insights into the nature and extent of sedimentary basins underlying the Eucla Basin from reprocessing and interpretation of the 13GA-EG1 Eucla-Gawler Seismic Survey

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1. www.statedevelopment.sa.gov.au
2. www.asp.adelaide.edu.au

SOUTH AUSTRALIA

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Department of State Development

Presentation Outline

- Overview of the area.
- What is the extent and stratigraphy of Officer Basin?
  - Seismic data
  - Well data
- Is there a Permian (Denman) Basin?
  - Seismic data
  - U-Pb data
- Conclusions

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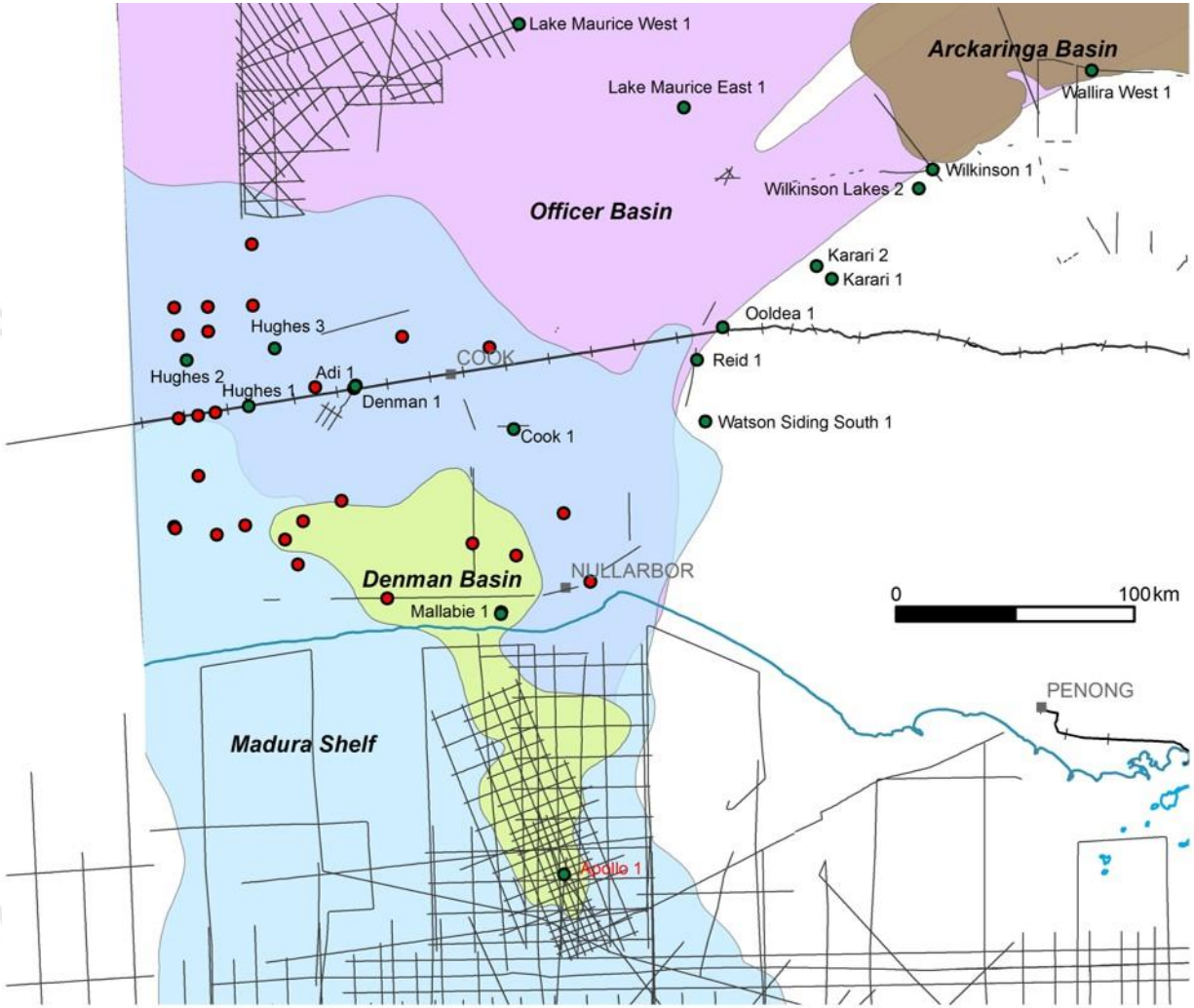
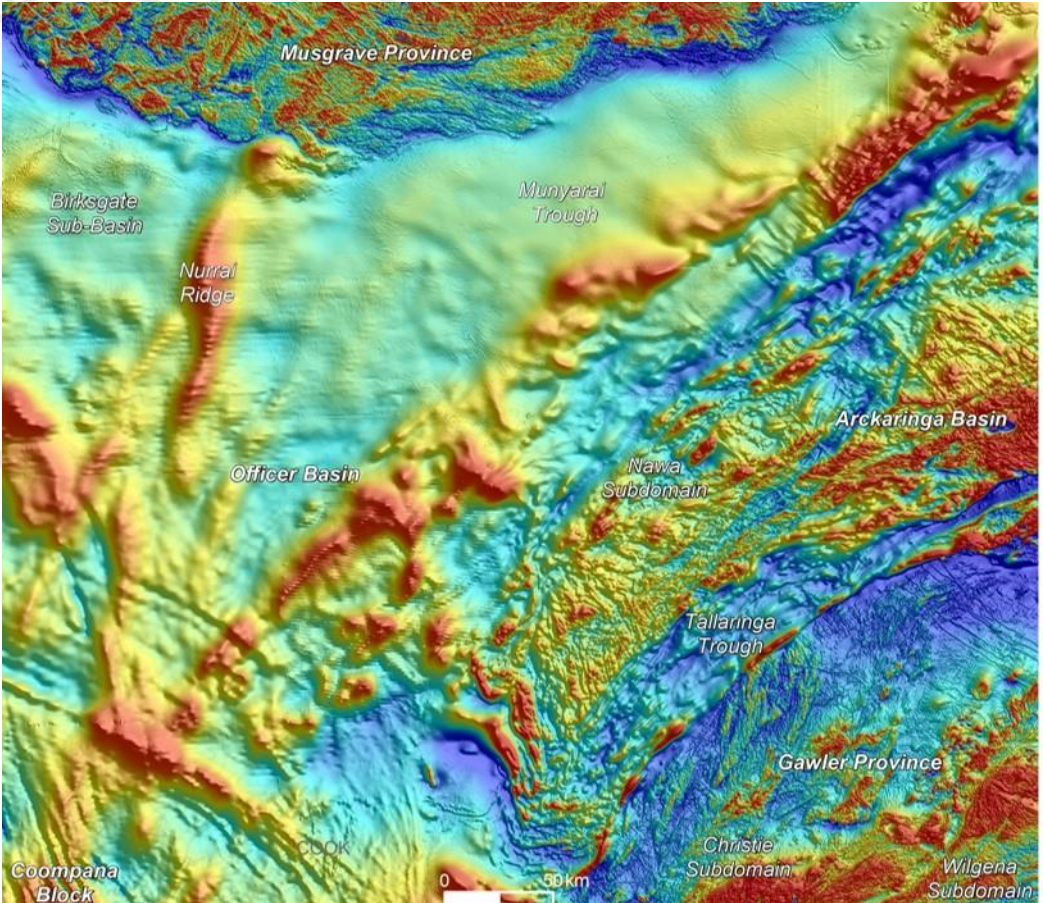
Nullarbor Plains

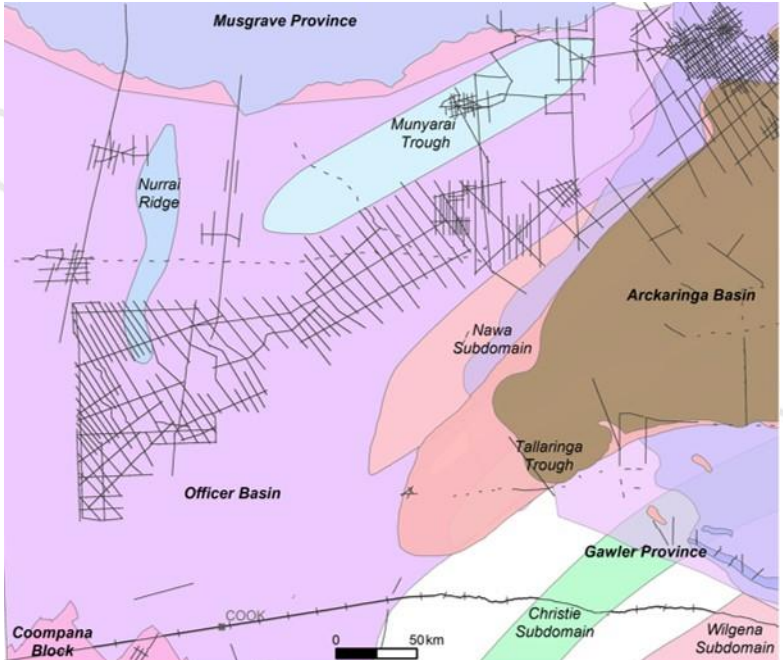
- Poorly understood area.
- Thin but pervasive cover.
- 4 stacked basins:
  - Eucla - Cenozoic;
  - Bight - mid Jurassic – late Cretaceous;
  - Denman - Permian;
  - Officer – NeoProterozoic to Cambrian.
- Limited drillhole coverage
- Few mainly 60s / 70s vintage onshore 2D seismic.
- Significant seismic to north and offshore



Officer Basin-TMI

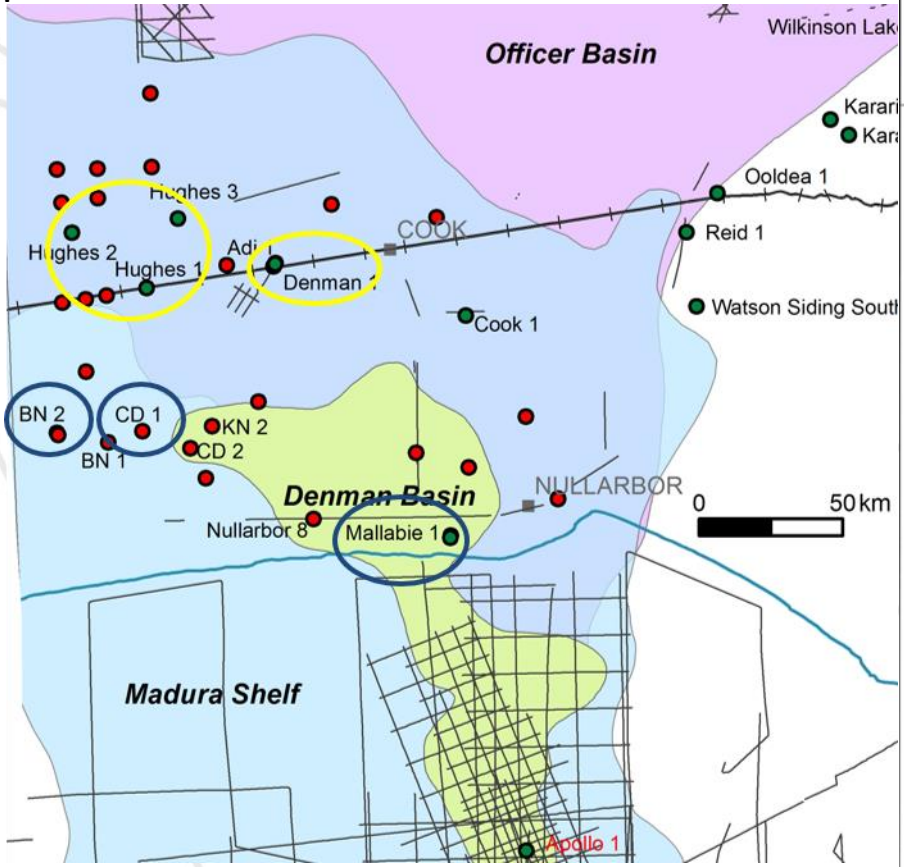


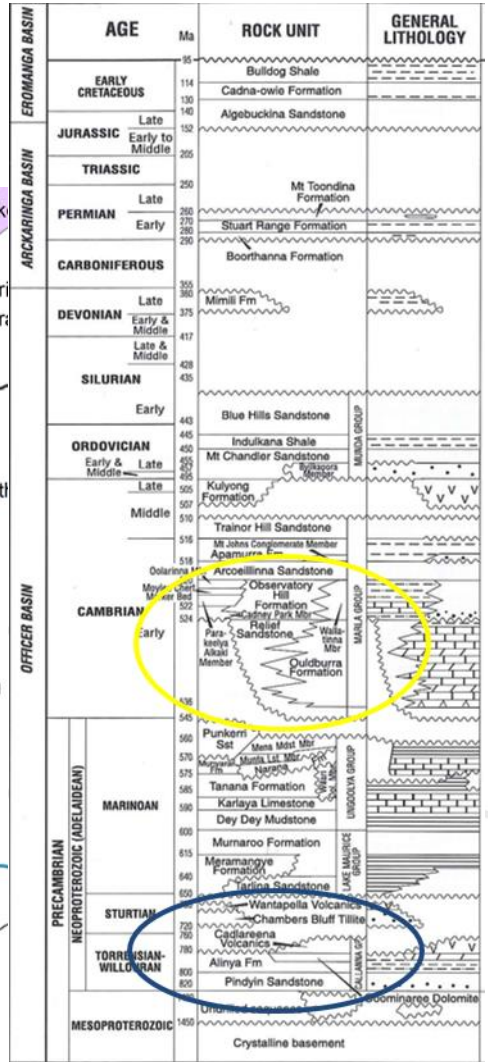
- >410,000 km^2 straddles WA/SA border
- Thickest SA sediments in northern depocentres.
- Southern margin poorly constrained.



Officer Basin- Stratigraphy

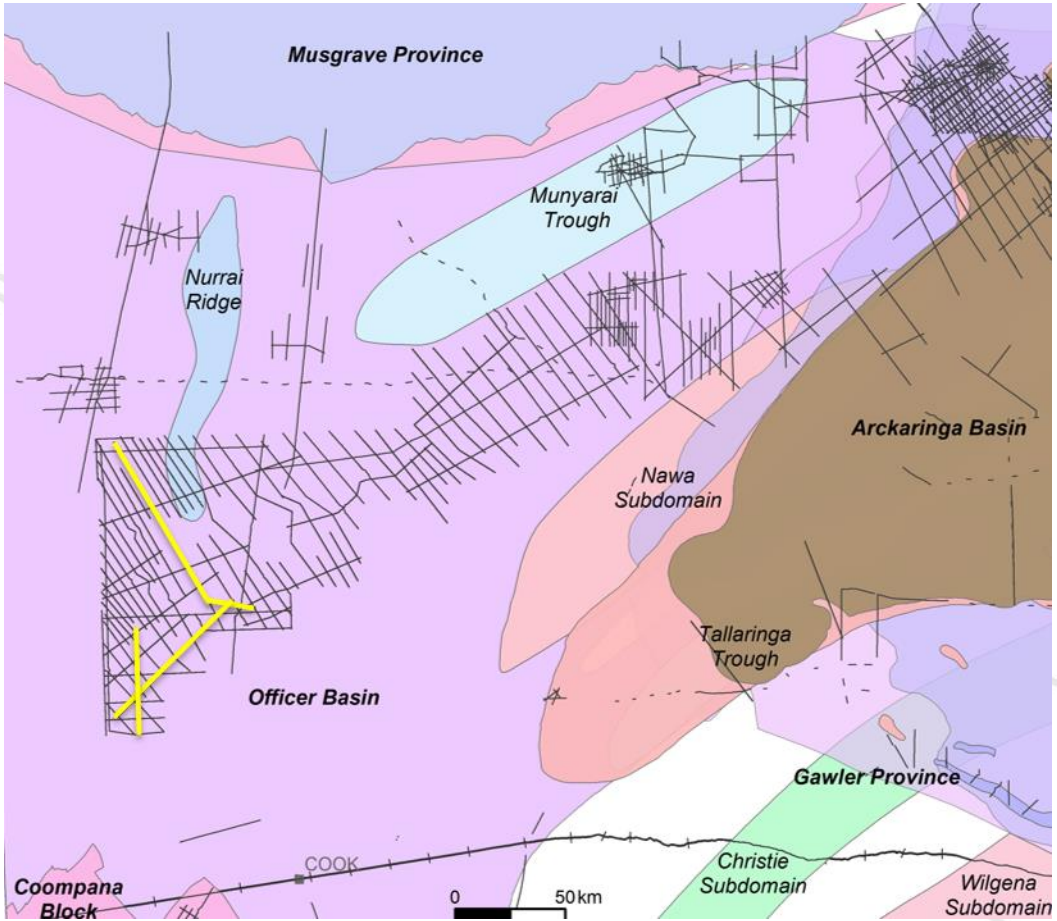
- Officer sediments in many Eucla wells.
- Cambrian or NeoProterozoic?
- Lithology suggests Cambrian.
- Zhang (1995) postulated Cambrian eroded
- Wells intersect NeoProterozoic-(Alinya Fmn?)





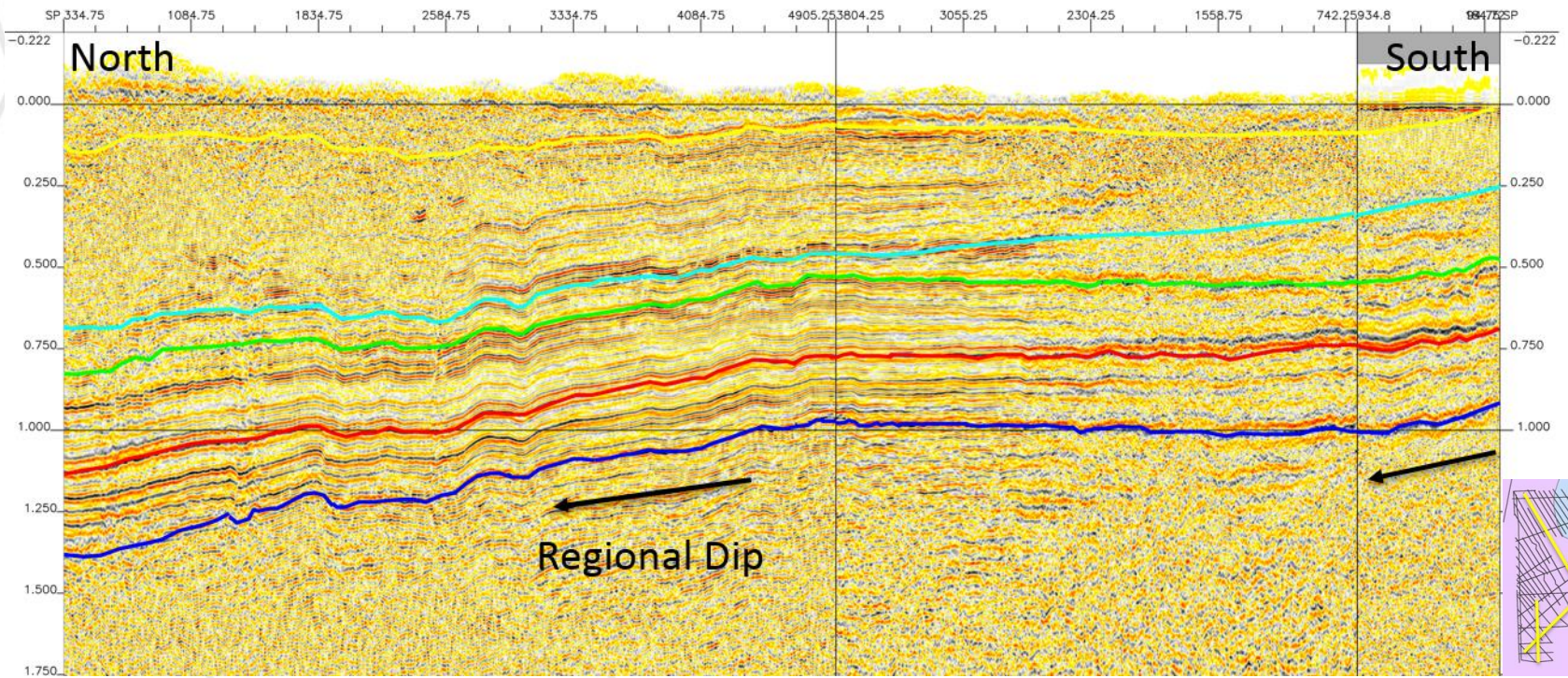
Officer Basin- Seismic

- Good seismic coverage to north.
- Most acquired since 2000.
- Compiled N-S cross section from lines OBE-08-26, OBE-10-26 and OBE-11-P14



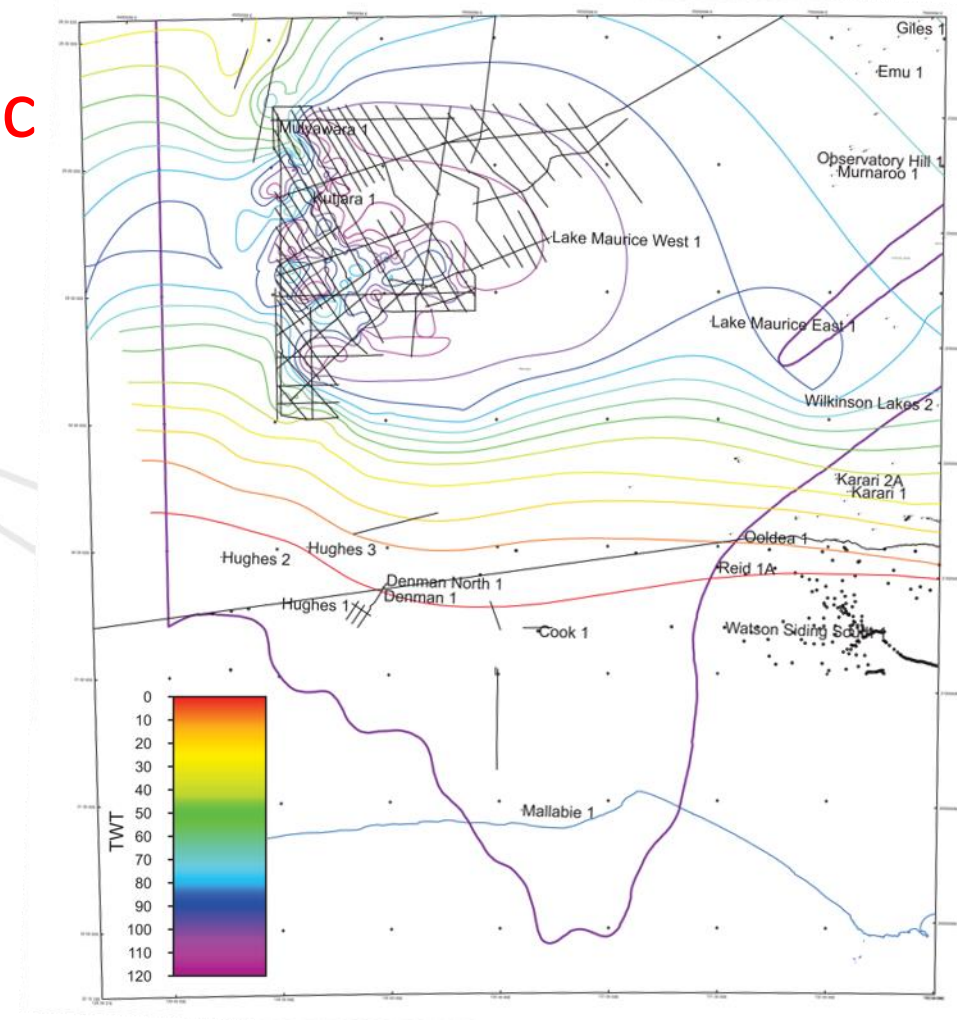
Composite Cross Section

Interpreted lines show
- pervasive regional dip to north (Petermann Orogeny).
- package of material thickening west and south
- “near top” NeoProterozoic (yellow horizon)



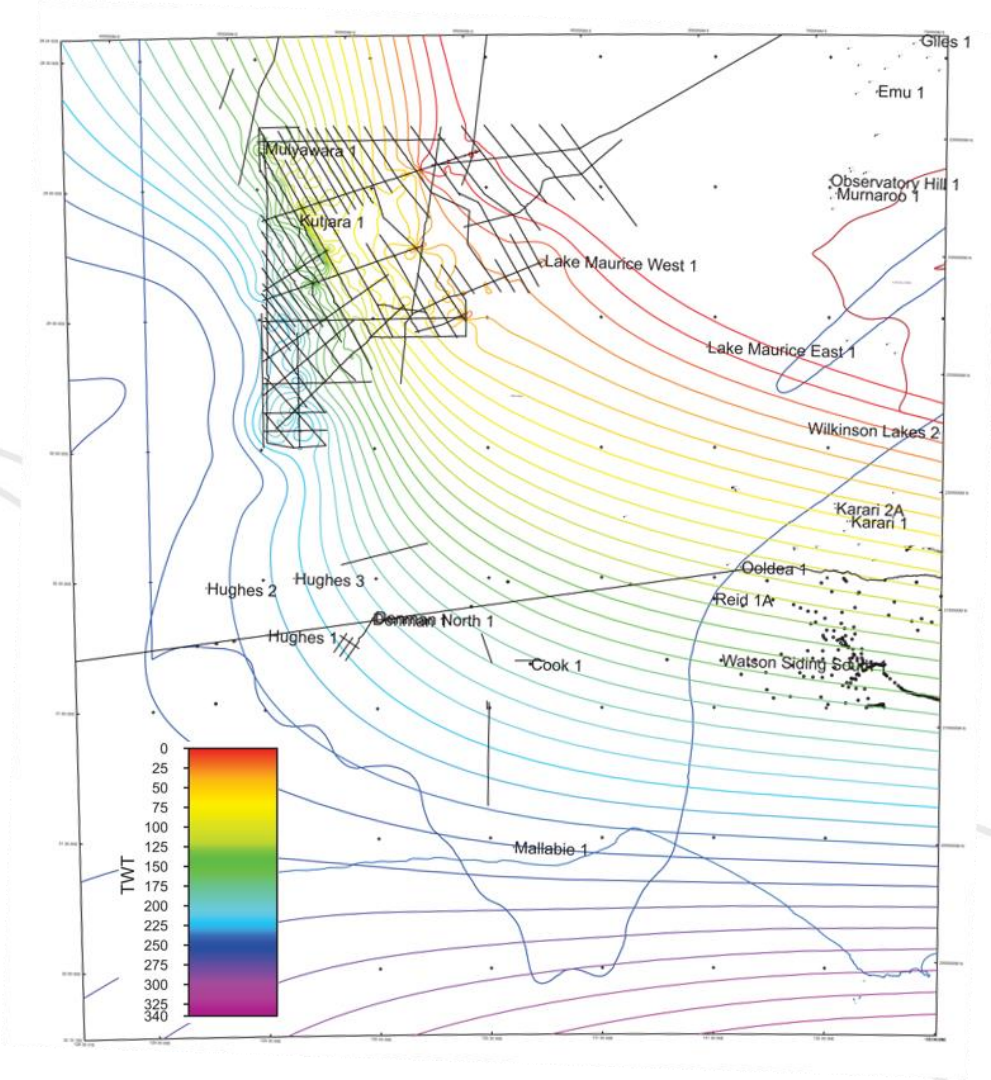
“near top”NeoProterozoic

- Interpreted as a unit below Karlaya Limestone in Mulyawara 1 /Kutjara 1.
- Extrapolated isopach map of ‘near top’ NeoProterozoic.
- Assume regional dip trend continues.
- Horizon is shallowing southward.
- Gone before reaching 13GA-EG1.
- Cambrian eroded away toward southern extent of the northern lines.

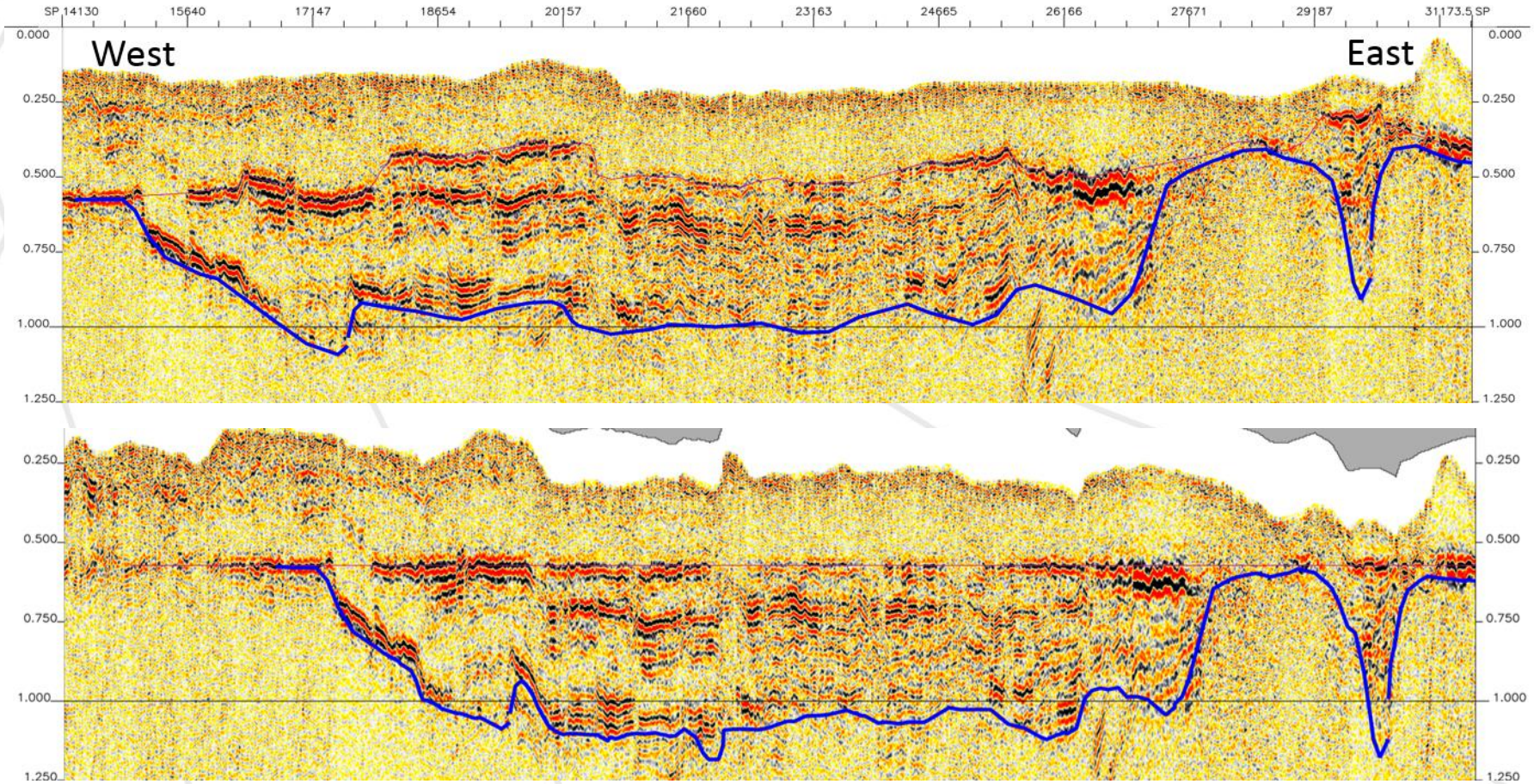


‘Package’ Isopach map

- NeoProterozoic package appears present only in western SA Officer
- Pinches out north-eastwards.
- Burra Group equivalent?
- Erosion of NeoProterozoic down to mid-way through ‘package’.
- Corresponds to Mundallio Subgroup in Mulyawara 1 and Kutjara 1.
- Lithological descriptions consistent with those in Eucla wells.
- BUT – no linking line and no palaeontology to confirm correlations of litho-stratigraphy.

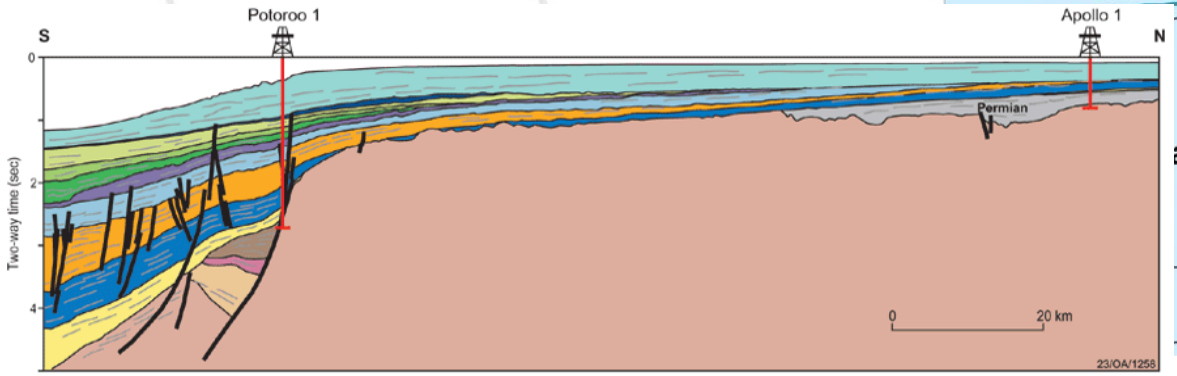


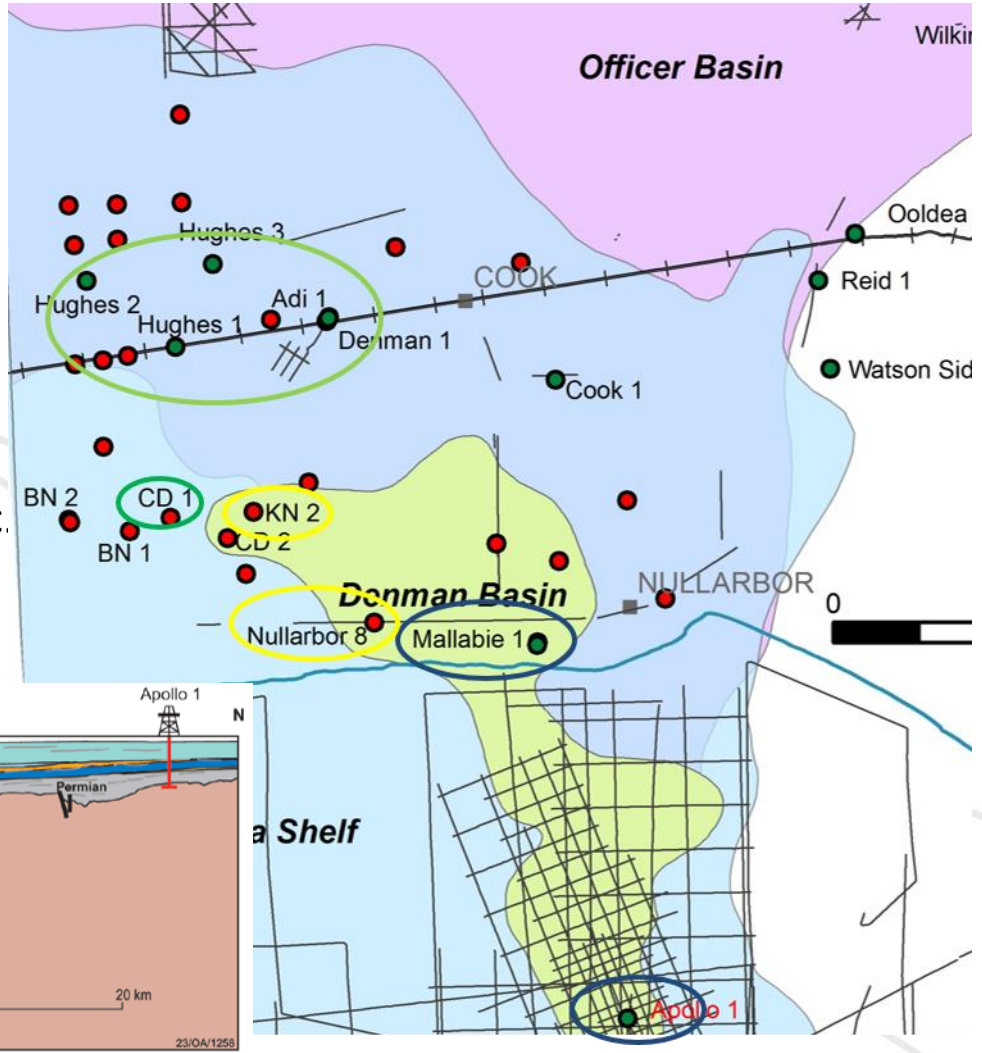
13GA-EG1


SP 14130
15640
17147
18654
20157
21660
23163
24665
26166
27671
29187
31173.5 SP
West
East
0.000
0.250
0.500
0.750
1.000
1.250

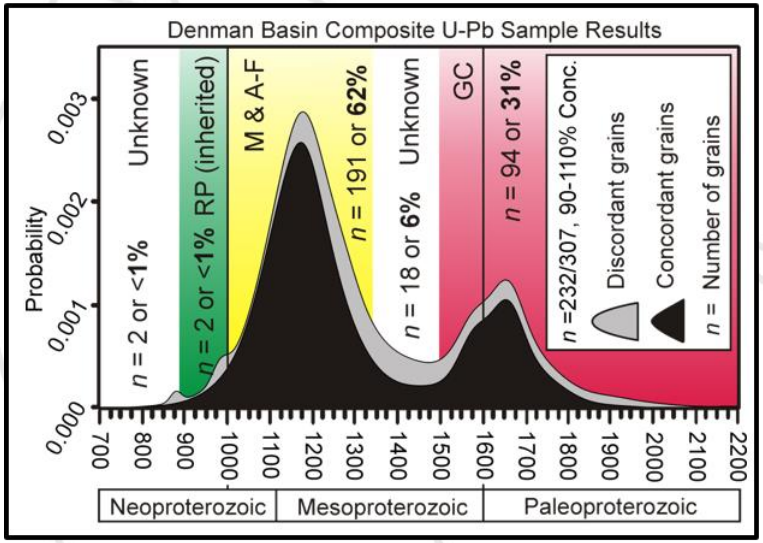
Denman Basin onshore

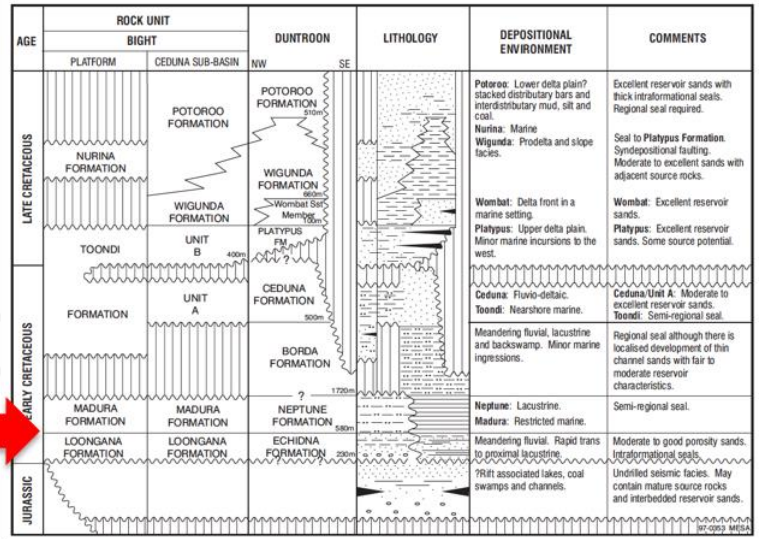
- N-NW trending intra-cratonic trough mainly offshore.
- Sub-horizontal Permian succession correlated with Arckaringa Basin.
- Permian sediments in many wells are misidentified Cretaceous.
- Isolated depocentres seen in NE seismic.
- Offshore Bight Basin includes Triassic & Permian material (palynology).



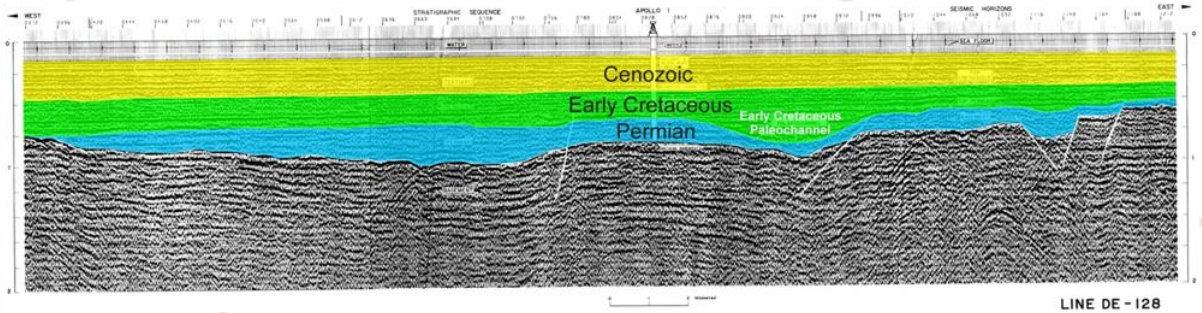


Denman Basin- New Provenance Data



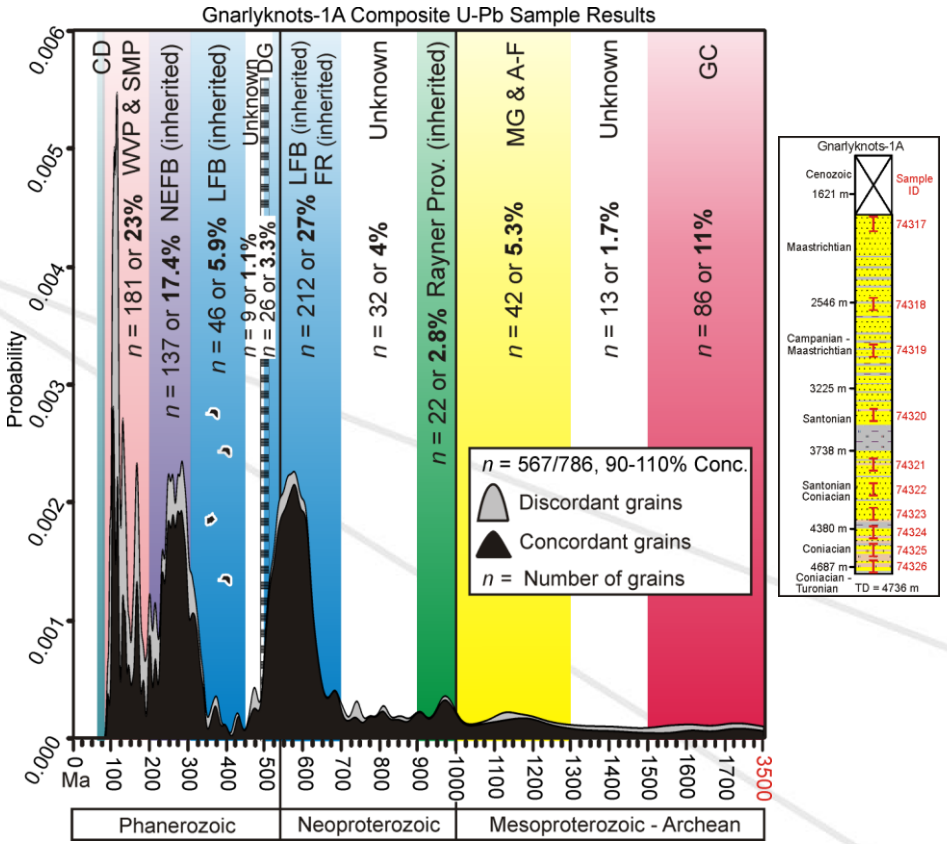


Loongana Formation Hauterivian-Valanginian clastics



Ceduna Basin-Provenance Data

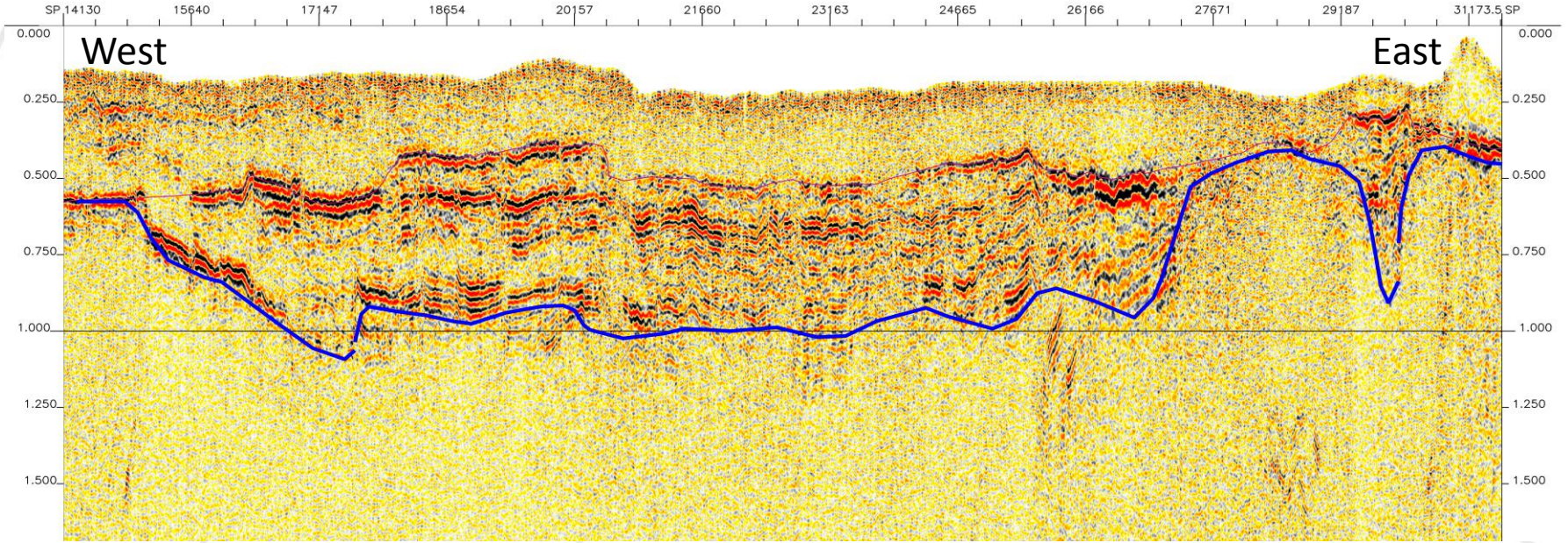
- Gnarlyknots-1A U-Pb data Ceduna Basin
- Turonian to Maastrichtian samples.
- Wide range of ages suggests substantive recycling of material
- Notable Permo-Carboniferous populations (purple) ~ 220 – 350 Ma.
- Data suggests substantial erosion across our study area, prior to deposition of offshore Cenozoic carbonates.



MacDonald et al. (2013) JGSL

13GA-EG1 – Permian?

- No evidence of a contiguous Permian basin.
- May be remnant depocentres off the line.
- Garnet sands in Cook 1 / Cook Bore may be Permian.
- Approx. ~200m of Cretaceous and Cenozoic sediments U/C over Officer.



Conclusions

- Seismic evidence indicates that the Officer Basin is consistently dipping north.
- A package of NeoProterozoic material (Burra Group equivalent?) is seen in the western SA Officer and thickens consistently west and south.
- Isopach maps of the package suggests it is present in the area of 13GA-EG1.
- Extrapolations of mapped horizons suggests the Cambrian is eroded off before 13GA-EG1 and the (eroded) top Officer at 13GA-EG1 is mid-way through the NeoProterozoic package.
- Rocks intersected in Mulyawara 1 and Kutjara 1 within the Neo Proterozoic package are similar to rocks described in offset wells near 13GA-EG1.
- There is no link line or palaeontology to convincingly correlate these units.
- No evidence of a contiguous Permian basin is seen in 13GA-EG1.
- Evidence of Permian material being re-deposited offshore but not onshore.
- Plausible that some isolated remnant depocentres still exist off the line.
- About 200 m of Cretaceous and Cainozoic sediments unconformably overlie the Officer.

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