

Play Analysis in the Pedirka Basin- Poolowanna Trough region

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Play Analysis in the Pedirka Basin- Poolowanna Trough region

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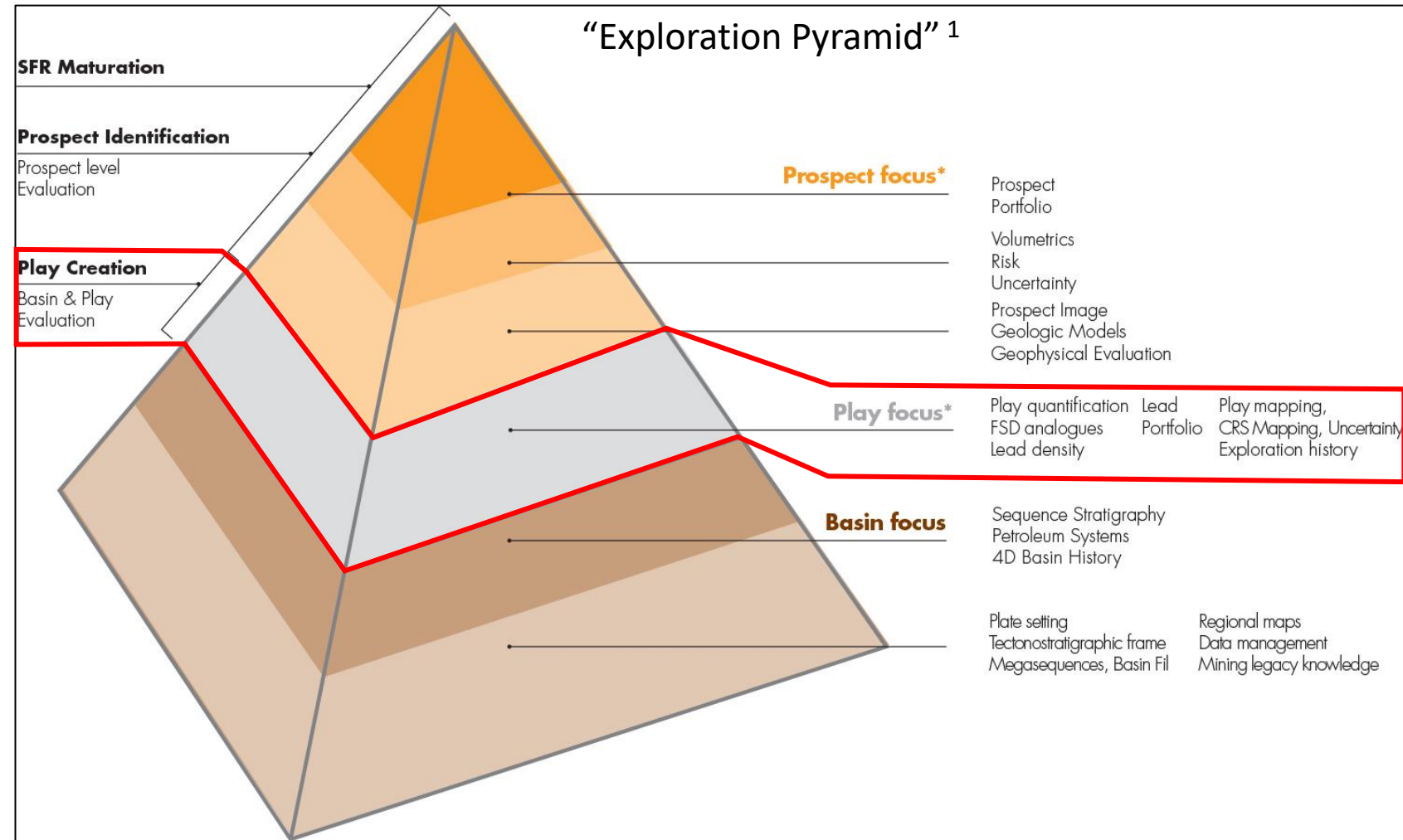


Pedirka Basin-Poolowanna Trough

Play-Based Exploration Overview 1



- Play-Based Exploration
 - Understanding of petroleum system in basin leads to identification, mapping and quantification of plays within basin
 - Maps:
 - Play elements
 - Summary play maps
 - Common risk segments
 - Identification of sweet spots
- Analysis of plays using this process is **not static**
 - Iterative feedback required following new information



¹ Royal Dutch Shell, 2014: [Play Based Exploration, A Guide for AAPG's Imperial Barrel Award Participation](#)

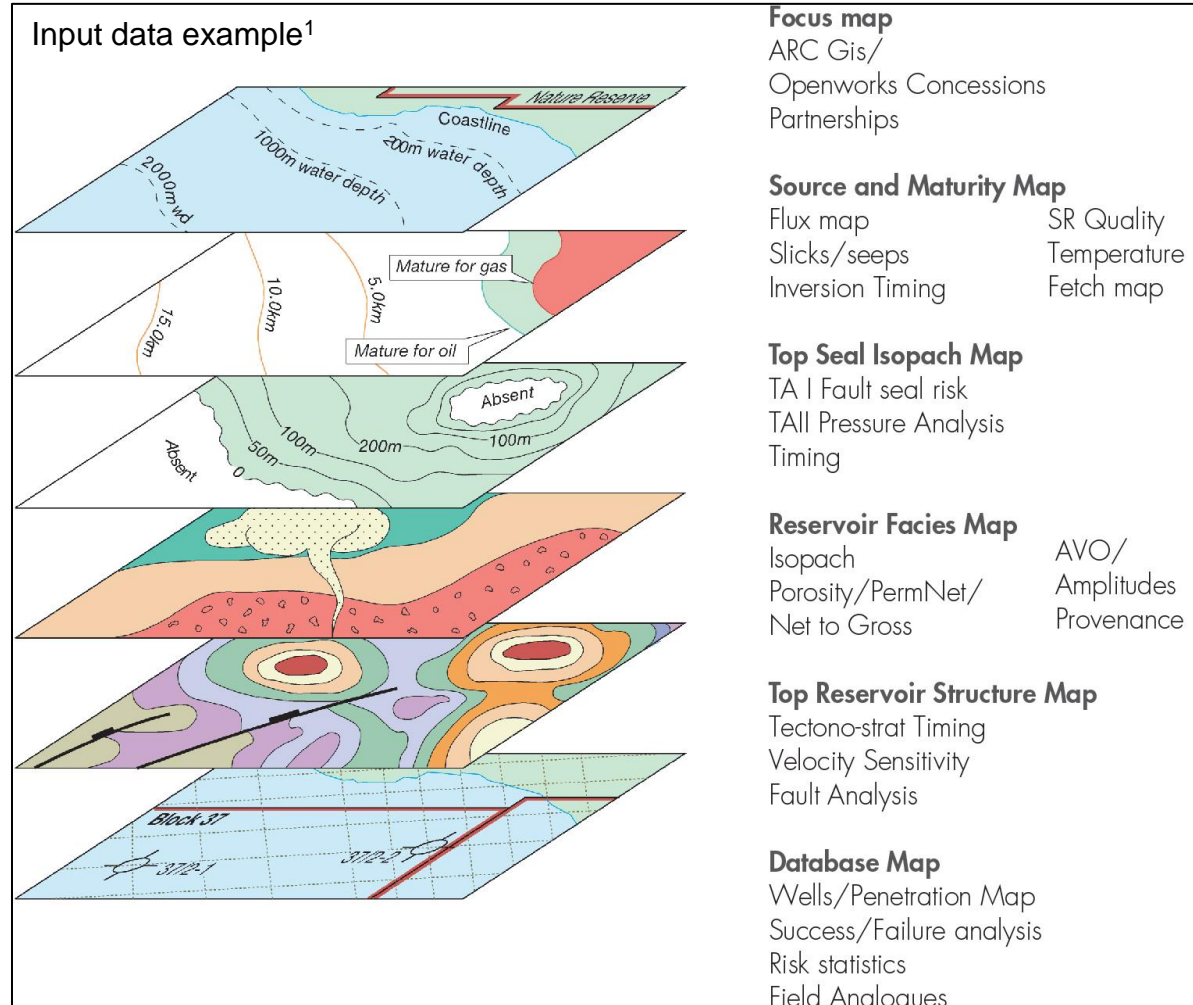
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Play-Based Exploration Overview 2



Geological boundaries required for all elements of Petroleum System:

- Extent and type of Reservoir interval
- Hydrocarbon Charge:
 - Extent of likely Source Rock
 - Maturity of Source Rock
 - Limits of potential migration from Source Rock
- Entrapment:
 - Extent of Sealing interval
 - Structural elements



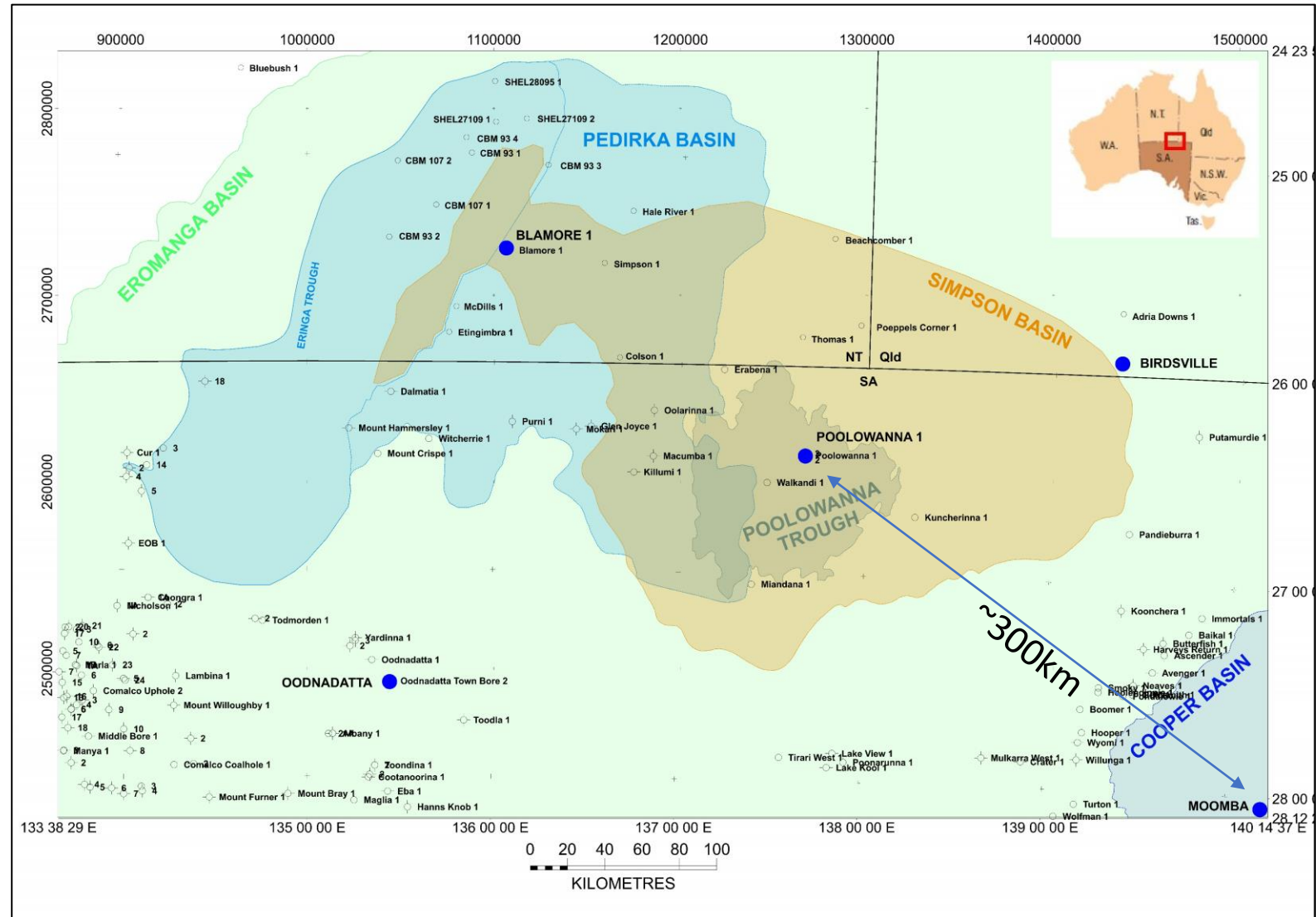
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¹ Royal Dutch Shell, 2014: [Play Based Exploration, A Guide for AAPG's Imperial Barrel Award Participation](#)

Pedirka Basin-Poolowanna Trough

Location of Study Area

- Remote and harsh environment in central Australia:
 - Simpson Desert
- Several basins prospective for hydrocarbons
 - Jurassic-Cretaceous Eromanga
 - Triassic Simpson
 - Permian Pedirka
- Collaboration Between DEM-ERD, Geoscience Australia and NT Geological Survey as part of Australia's Future Energy Resources (AFER) project





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Pedirka Basin-Poolowanna Trough

Stratigraphy and Plays Reviewed

AGE	ROCK UNIT	LITHOLOGY	DEPOSITIONAL ENVIRONMENT	COMMENTS
JURASSIC	Mid-Late ALGEBUCKINA SANDSTONE Maximum thickness 800m Average thickness (570m)		Braided fluvial	Reservoirs rely on overlying marine shale seal. Small anticlinal traps requiring close seismic grid. Intraformational seals rare.
	Early POOLOWANNA FORMATION 290m (191m)		Meandering or anastomosing fluvial, minor associated floodplain deposits.	Uneconomic oil in Poolowanna 1
TRIASSIC	ERMONGA BASIN			
	Late PEERA PEERA FORMATION 190m (192m)		Lacustrine and low energy, meandering fluvial.	Thickness and extent strongly structurally controlled requiring close seismic coverage. Variable quality, discontinuous reservoirs.
	Middle WALKANDI FORMATION 130m (107m)		Shallow, ephemeral lacustrine.	Tight, potential seal to underlying Permian where present. Possible local reservoir development as for Arrabury Formation. (See Cooper Basin)
	Early SIMPSON BASIN			
PERMIAN	Late PURNI FORMATION 350m (192m)		Lacustrine, meandering fluvial and back swamp.	Fair + good gas - and oil - prone source rocks, thermally mature for oil generation.
	Early MT TOONDINA FORMATION 600m (420m) STUART RANGE FM 490m (158m)		Marginal marine.	Stuart Range Formation could provide excellent seal.
	Early CROWN POINT FORMATION 600m + ? (112m) BOORTHANNA FORMATION 420m (276m)		Shallow marine-fluvial periglacial.	Reservoir sands may be developed in Crown Point and Boorthanna Formations
LATE CARB	PEDIRKA BASIN ARCKARINGA BASIN			
CAMBRIAN DEVONIAN	UNDIFFERENTIATED WARBURTON, OFFICER AND AMADEUS BASIN SEDIMENTS			Flat to steeply dipping. Locally highly structured.

 Oil shows in NT sector
Potential for oil in SA sector

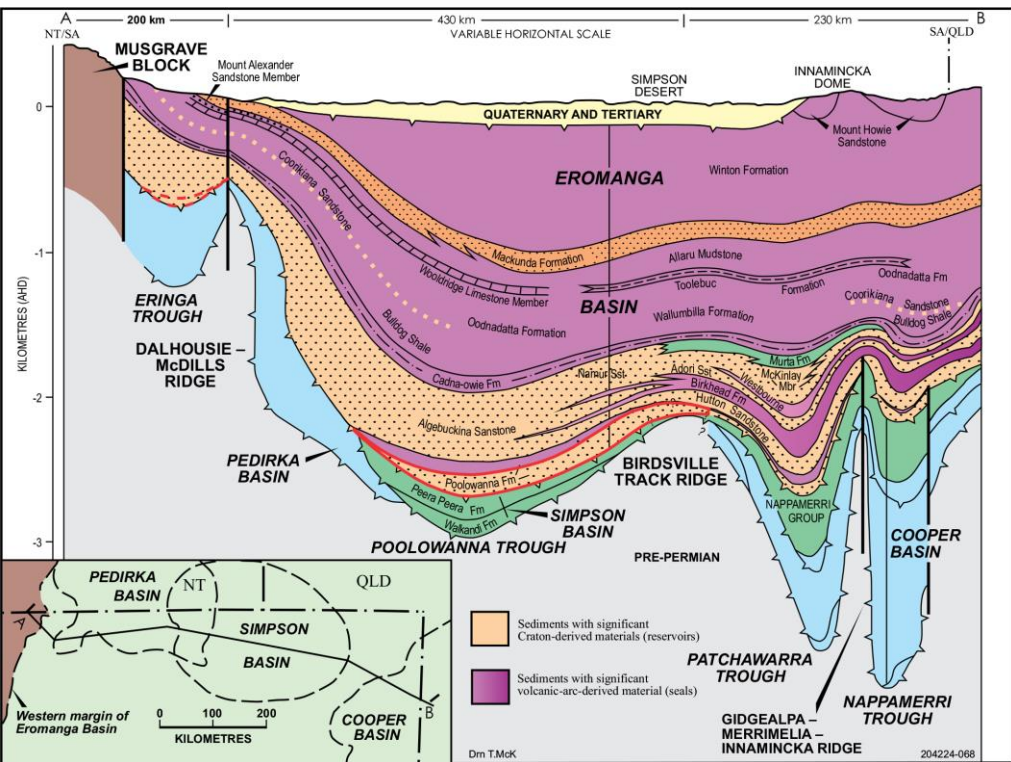
 Oil and gas recovered in SA sector

 Potential for gas in SA & NT sectors



Pedirka Basin-Poolowanna Trough

Structure and Petroleum System Events



Schematic cross-section of the Eromanga, Pedirka and Simpson Basins

200														100					(Ma)
PERMIAN		TRIASSIC			JURASSIC			CRETACEOUS		TERTIARY					Geological time scale				
E	L	E-M	L	E	M	L	E	L	PALEO	EOCENE	OLIGO	MIOCENE	PLIOCENE						
PEDIRKA		SIMPSON			EROMANGA				LAKE EYRE					Basins					
Crown Point Fm	Purni Fm	Walkandi Fm	Peera Peera Formation	Poolowanna Fm	Algebuckina Formation	Cadna-owie Fm	Buildog Shale	Oodnadatta Fm	Winton Fm	Eyre Fm	Namba Fm			Stratigraphy					
														Source rock					
														Reservoir rock					
														Seal rock					
Structural trap development and fault reactivation					Compaction and drape over early structures					Trap development and fault reactivation	Compaction	Fault reactivation	Compaction	Fault reactivation	Compaction	Trap formation			
Initial generation in deepest parts of basin							Early mature in deepest parts of basin		Major generation					Generation, migration and entrapment					
Subsidence	Uplift	Subsidence in Poolowanna Trough	Uplift	Subsidence			Compression	Subsidence	Reactivation	Subsidence	Reactivation	Subsidence	Tectonics						
														Main critical moment					

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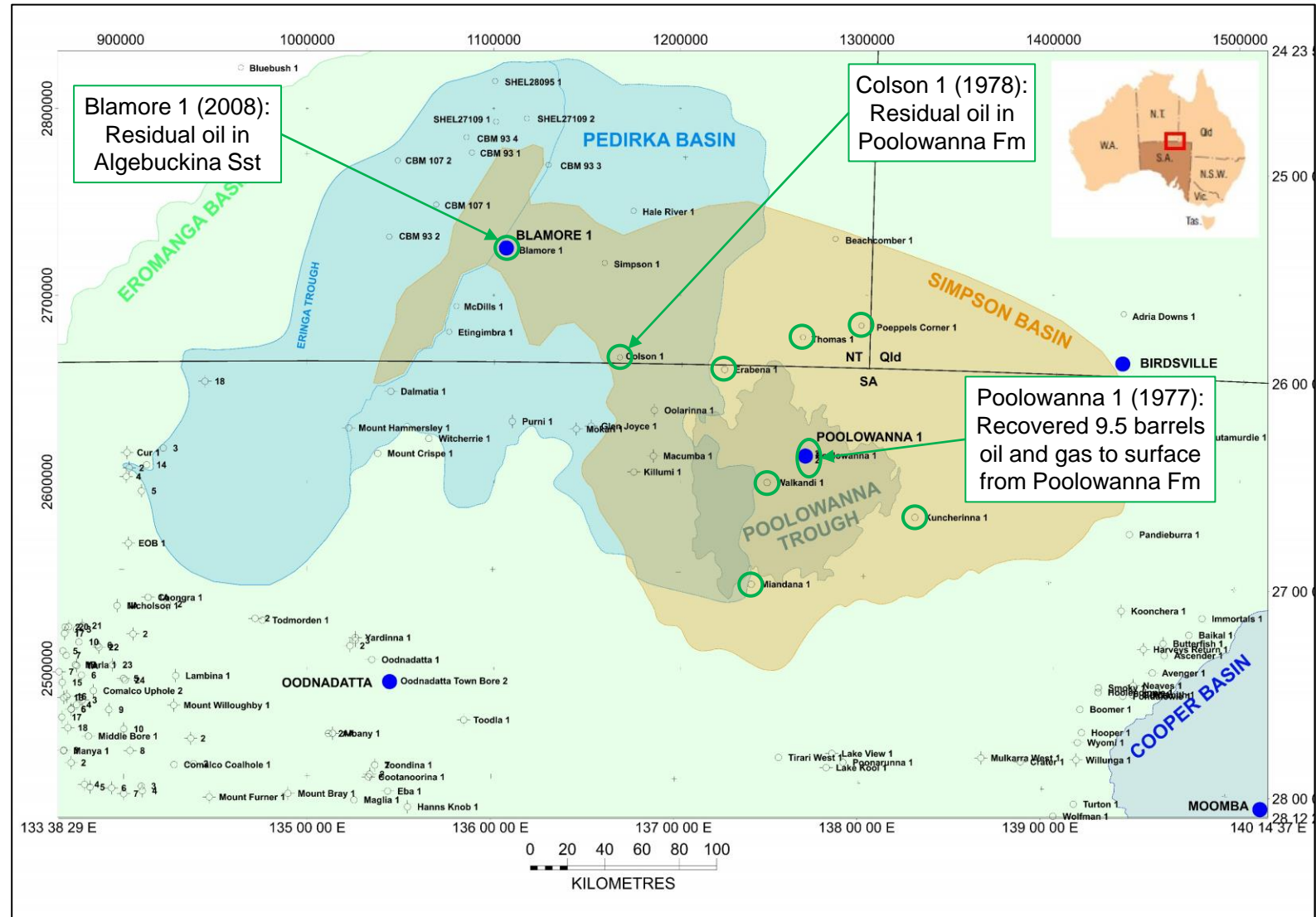


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Pedirka Basin-Poolowanna Trough

Exploration History and Hydrocarbon Shows

- 1950s: Exploration commenced
 - Licences first acquired by Santos
- 1957: First petroleum well - Oodnadatta 1
- 1963: Cooper Basin gas discovered
- 1976: First commercial hydrocarbon in Eromanga Basin - gas from Namur 1
- 1977: Oil discovered in Poolowanna Trough - uneconomic oil flows from Jurassic and Triassic in Poolowanna 1
- Several wells with oil and gas shows in study area

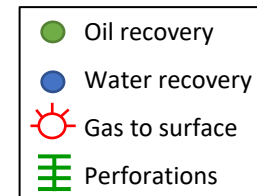
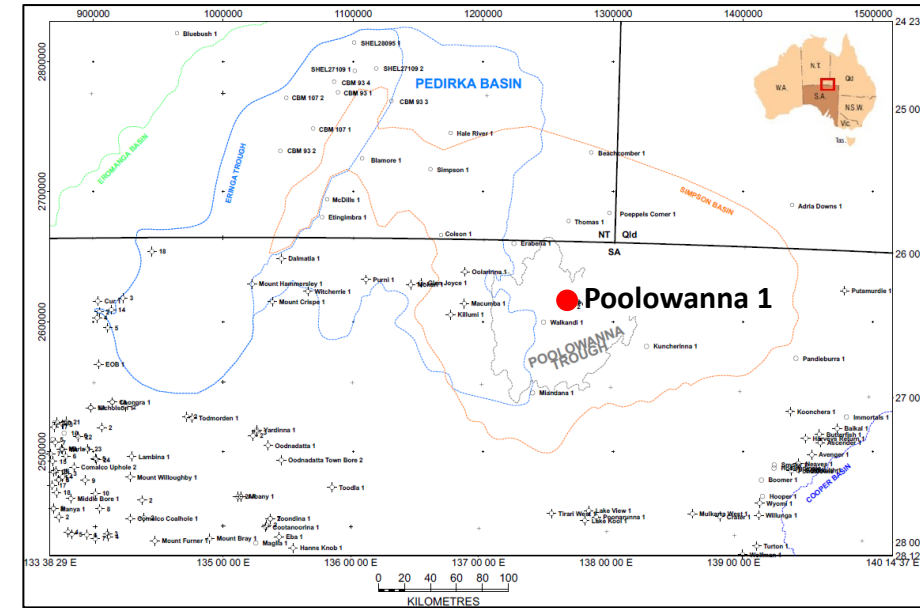
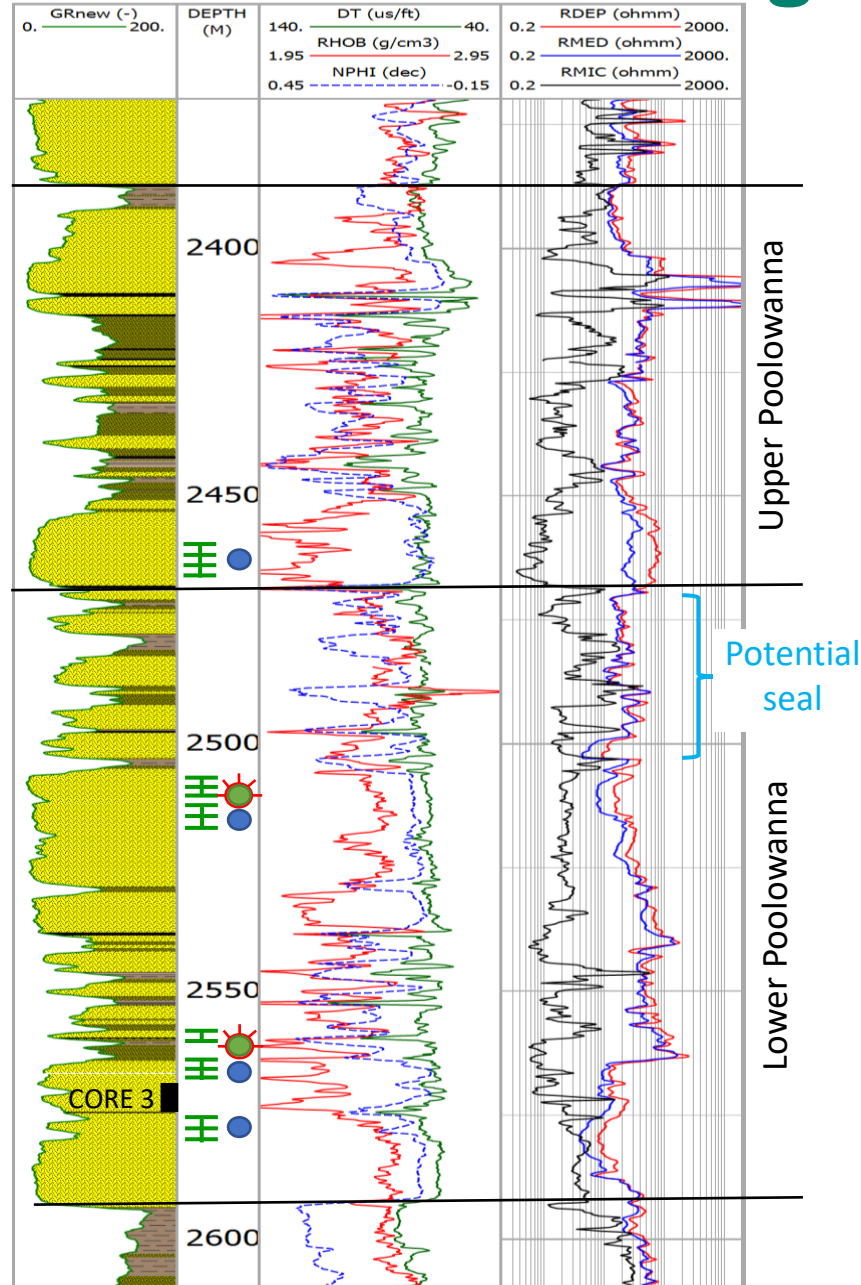


Pedirka Basin-Poolowanna Trough

Type Well: Poolowanna 1

Poolowanna 1 (Santos, 1977):

- Poolowanna Fm
 - The type section for the formation in the Eromanga Basin
 - Recovered 71¼ barrels water, 9½ barrels oil and gas to surface



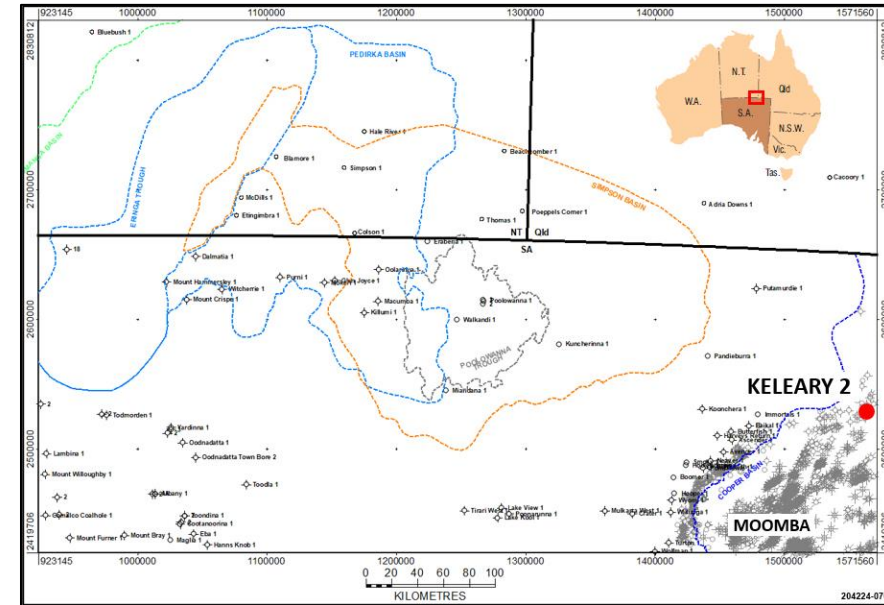
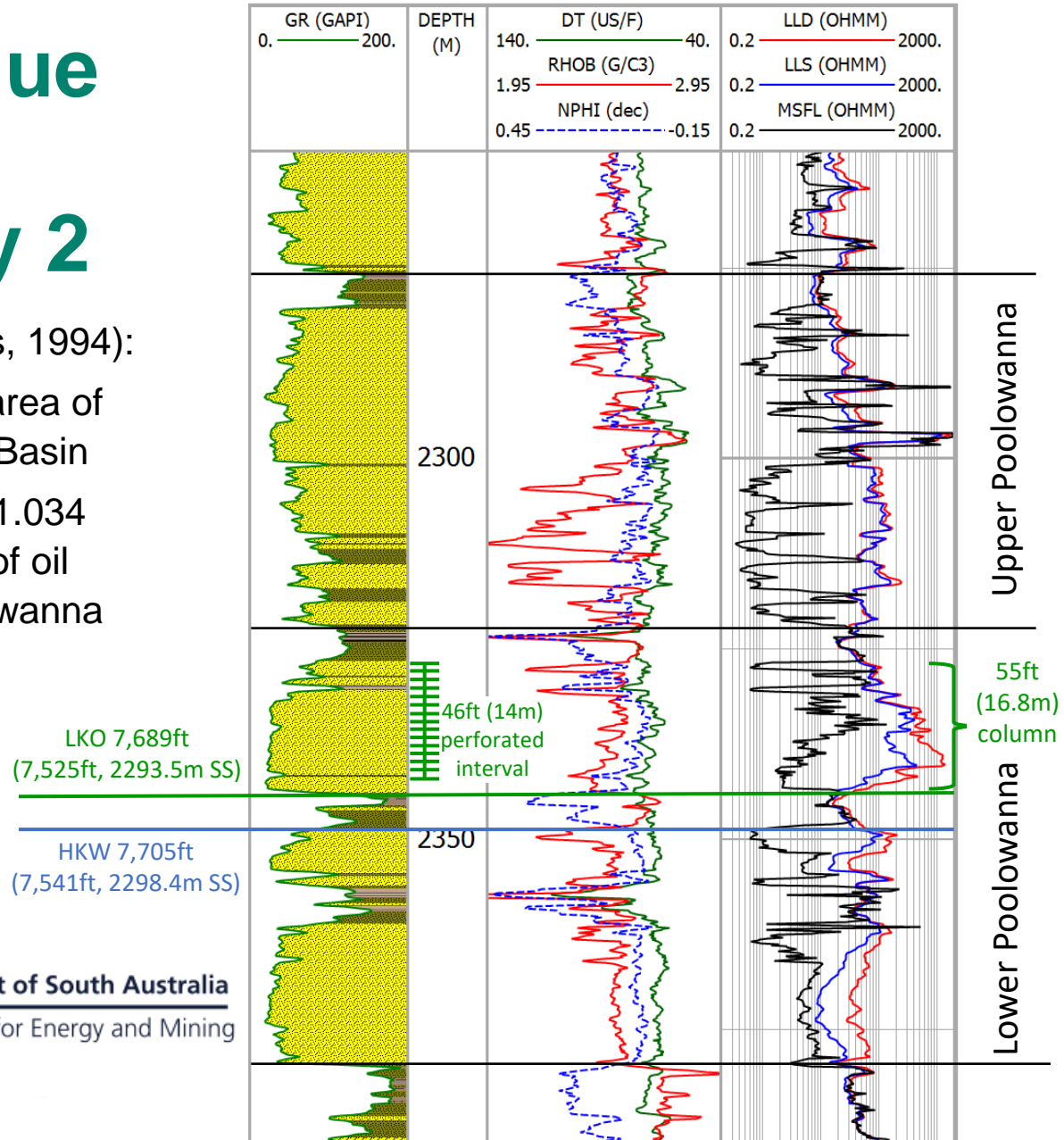
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Pedirka Basin-Poolowanna Trough

Analogue Well: Keleary 2

Keleary 2 (Santos, 1994):

- Cooper Basin area of the Eromanga Basin
- Has produced 1.034 million barrels of oil from the Poolowanna Fm



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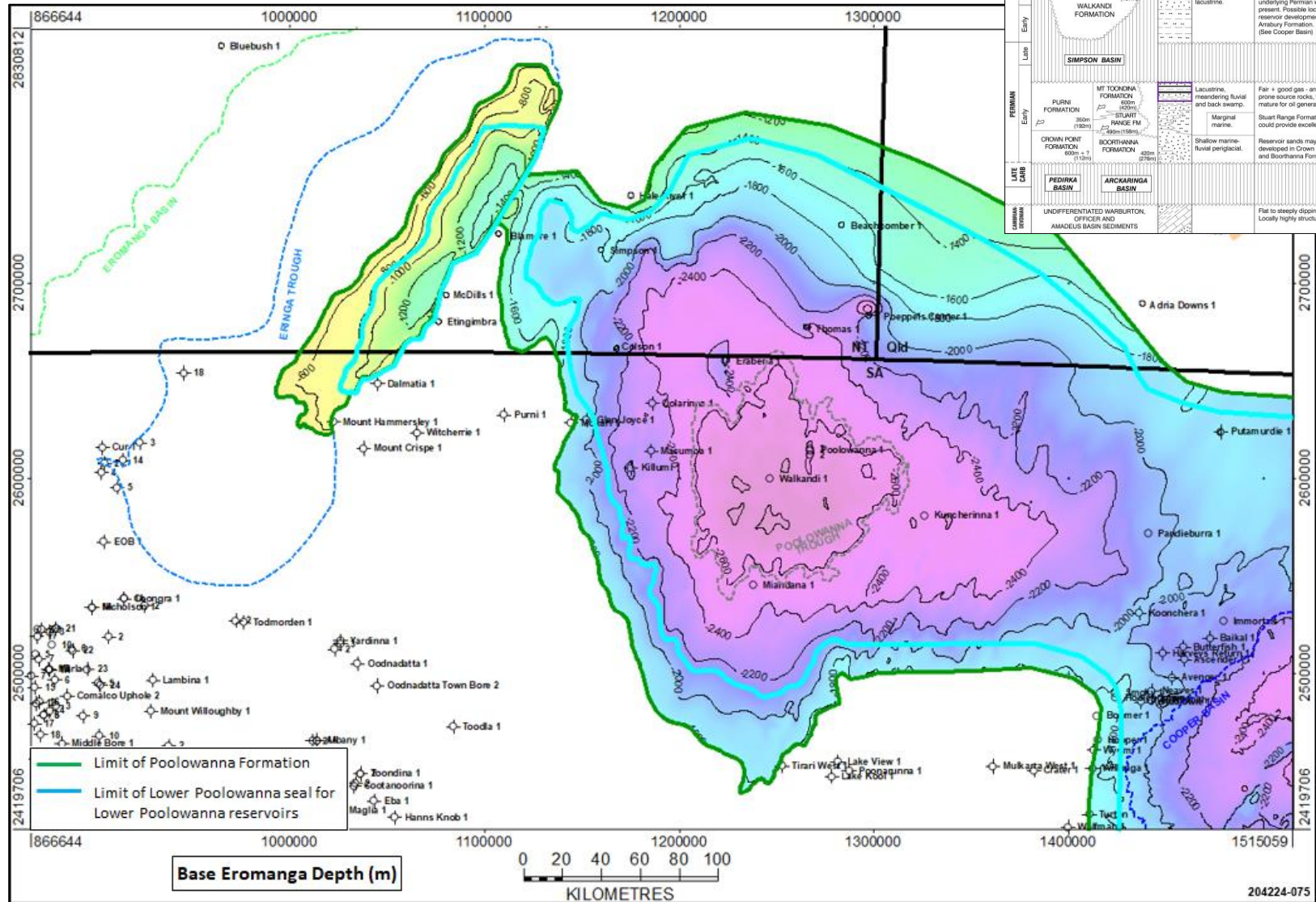
Pedirka Basin-Poolowanna Trough

Play Elements: Reservoir and Seal

Poolowanna Formation Play

- Reservoir:
 - Lower Poolowanna Formation sandstone
- Seal:
 - Siltstones and shales of the uppermost Lower Poolowanna Formation

AGE	ROCK UNIT	LITHOLOGY	DEPOSITIONAL ENVIRONMENT	COMMENTS
JURASSIC	Maximum Thickness 800m Average Thickness 370m ALGEBUSKINA SANDSTONE		Braced fluvial	Reservoirs rely on overlying marine shale seal. Small anticlinal traps requiring close seismic grid. Informational seals rare.
	200m (110m) POOLOWANNA FORMATION		Meandering or anastomosing fluvial; minor associated floodplain deposits.	Uneconomic oil in Poolowanna 1.
TRIASSIC	EROMANGA BASIN			
	180m (120m) PEERA PEERA FORMATION		Lacustrine and low energy, meandering fluvial.	Thickness and extent strongly structurally controlled requiring close seismic coverage. Variable quality, discontinuous reservoir.
	130m (100m) WALKANDI FORMATION		Shallow, ephemeral lacustrine.	Tight, potential seal to underlying Permian where present. Possible local reservoir development as for Anabury Formation. (See Cooper Basin)
PERMIAN	SIMPSON BASIN			
	160m (120m) MT TOODINA FORMATION		Lacustrine, meandering fluvial and back swamp.	Fair to good gas and oil-prone source rocks, thermally mature for oil generation.
	300m (180m) PURNI FORMATION		Marginal marine.	Shallow fluvial formation could provide excellent seal.
	300m (180m) CROWN POINT FORMATION		Shallow marine-fluvial peritidal.	Reservoir sands may be developed in Crown Point and Booraburra Formations.
LATE CARBONIFEROUS	PEDIRKA BASIN			
	UNDIFFERENTIATED WARBURTON, OFFICER AND AMADEUS BASIN SEDIMENTS			Flat to steeply dipping. Locally highly structured.

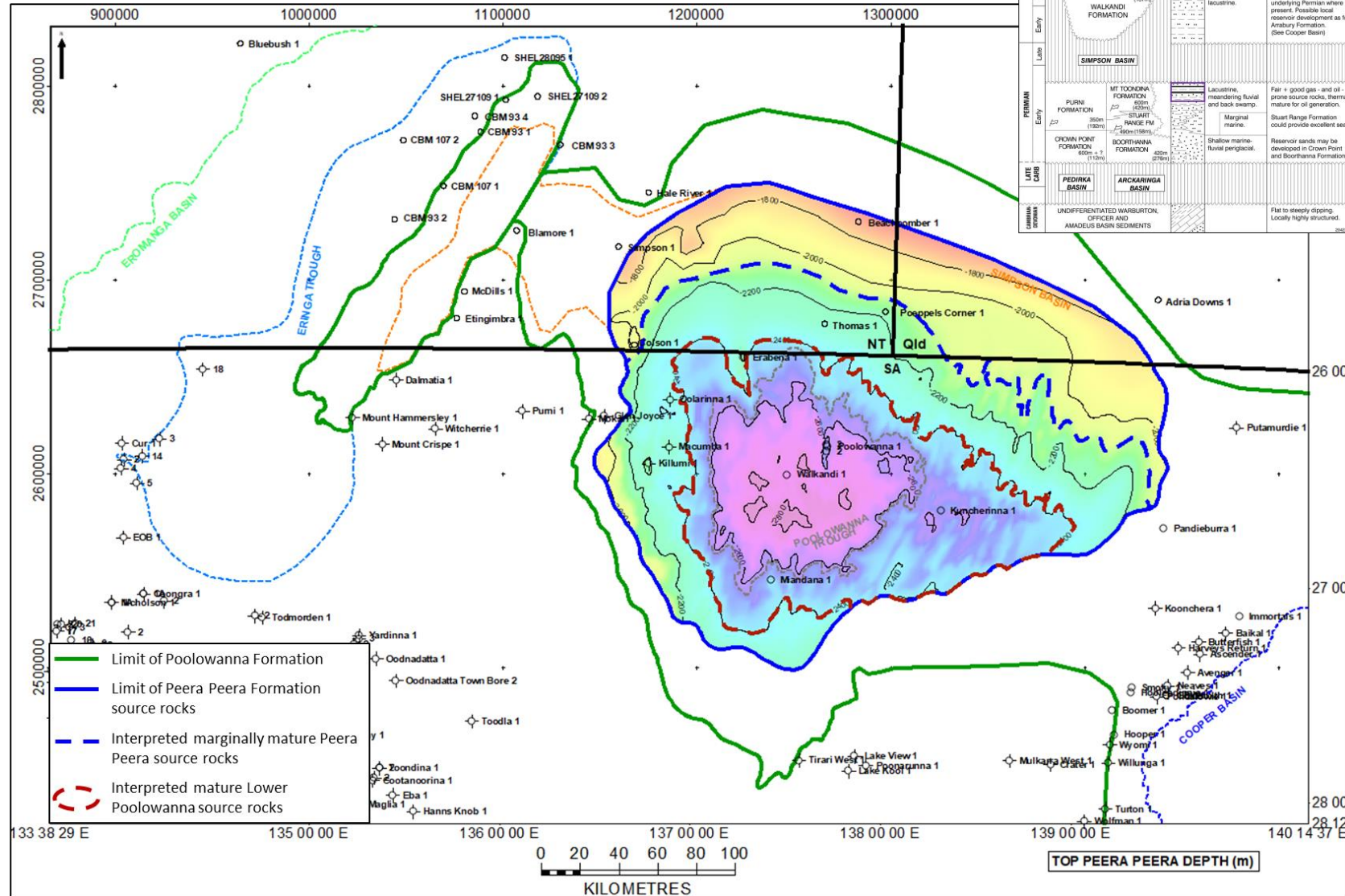


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Pedirka Basin-Poolowanna Trough

Play Element: Source Rock Maturity

- Potential source rocks in Poolowanna Trough region:
 - Basal Jurassic Lower Poolowanna Formation
 - Triassic Peera Peera Formation
 - Permian Purni Formation
- Maturity for hydrocarbon generation dependent upon:
 - Type of organic matter present
 - Depth of burial

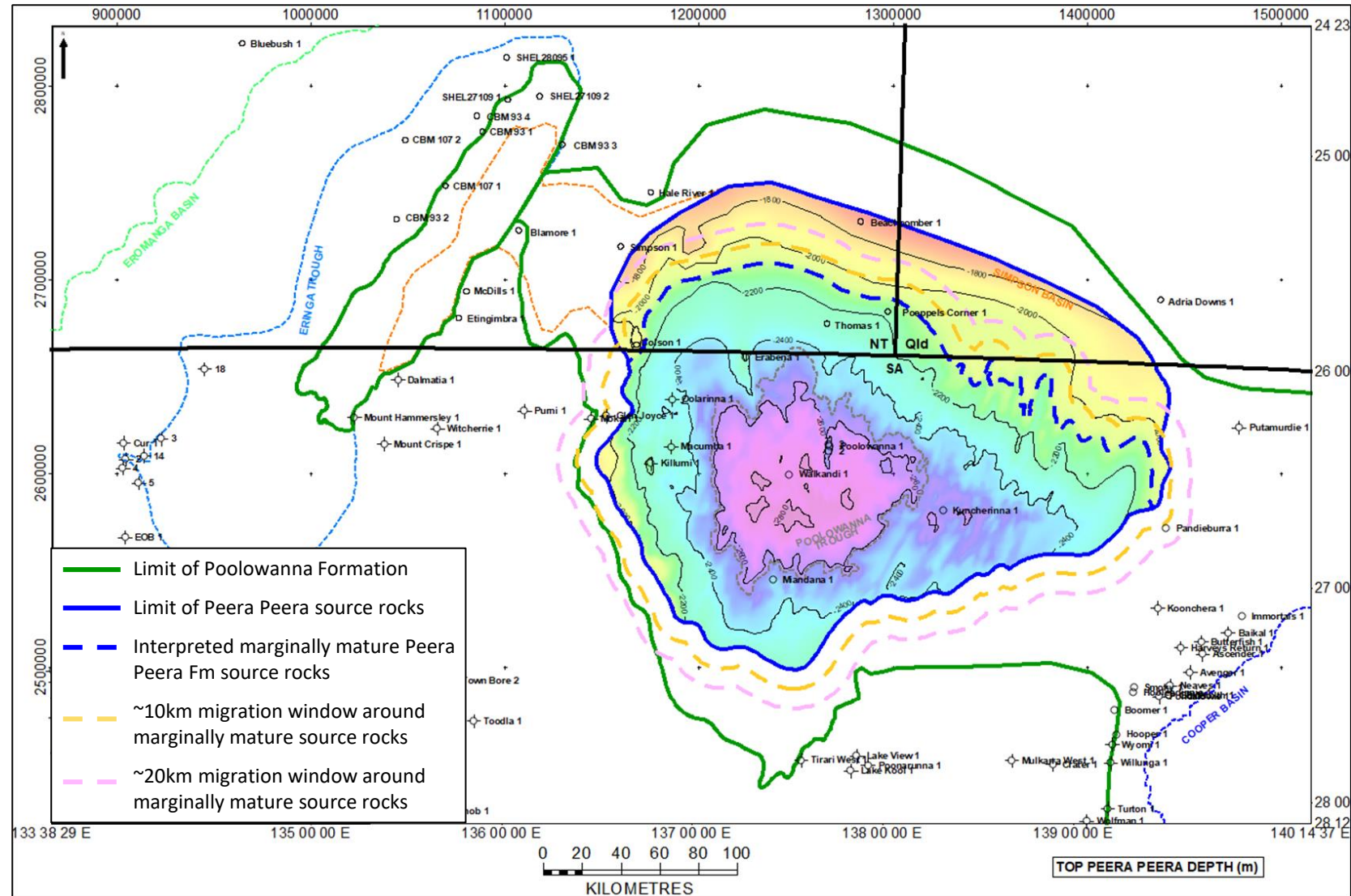


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Play Element: Hydrocarbon Charge

Rule of thumb:

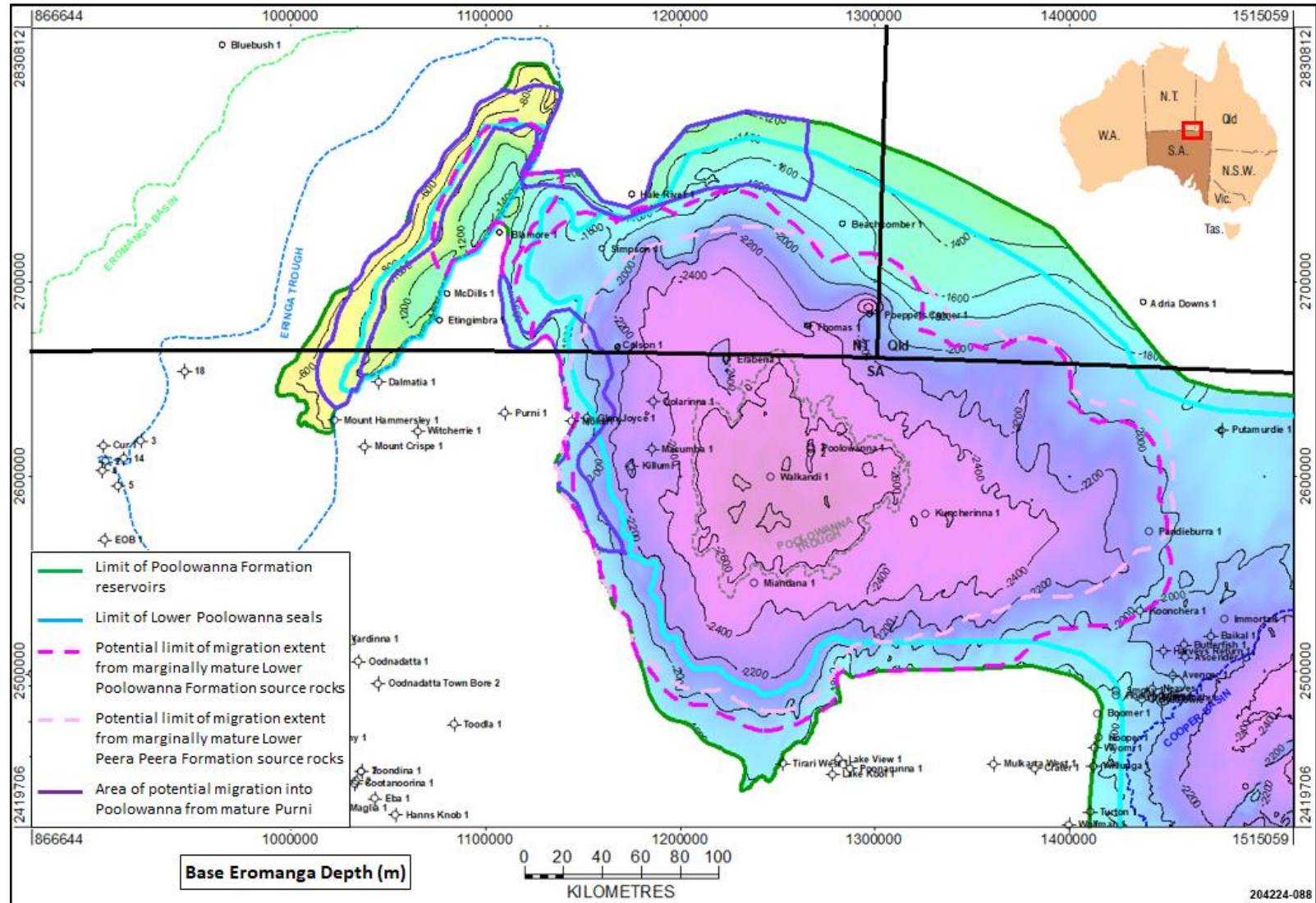
Up to 20km from mature source rocks is a reasonable migration distance within porous reservoirs



Pedirka Basin-Poolowanna Trough

Play Elements: Poolowanna Formation

- Outlines for Poolowanna Formation play:
 - Reservoir extent
 - Extent of seal above reservoir
 - Extents of potential migration 20km outside presence of mature source rocks:
 - Lower Poolowanna
 - Peera Peera Formation
 - Purni Formation



Pedirka Basin-Poolowanna Trough

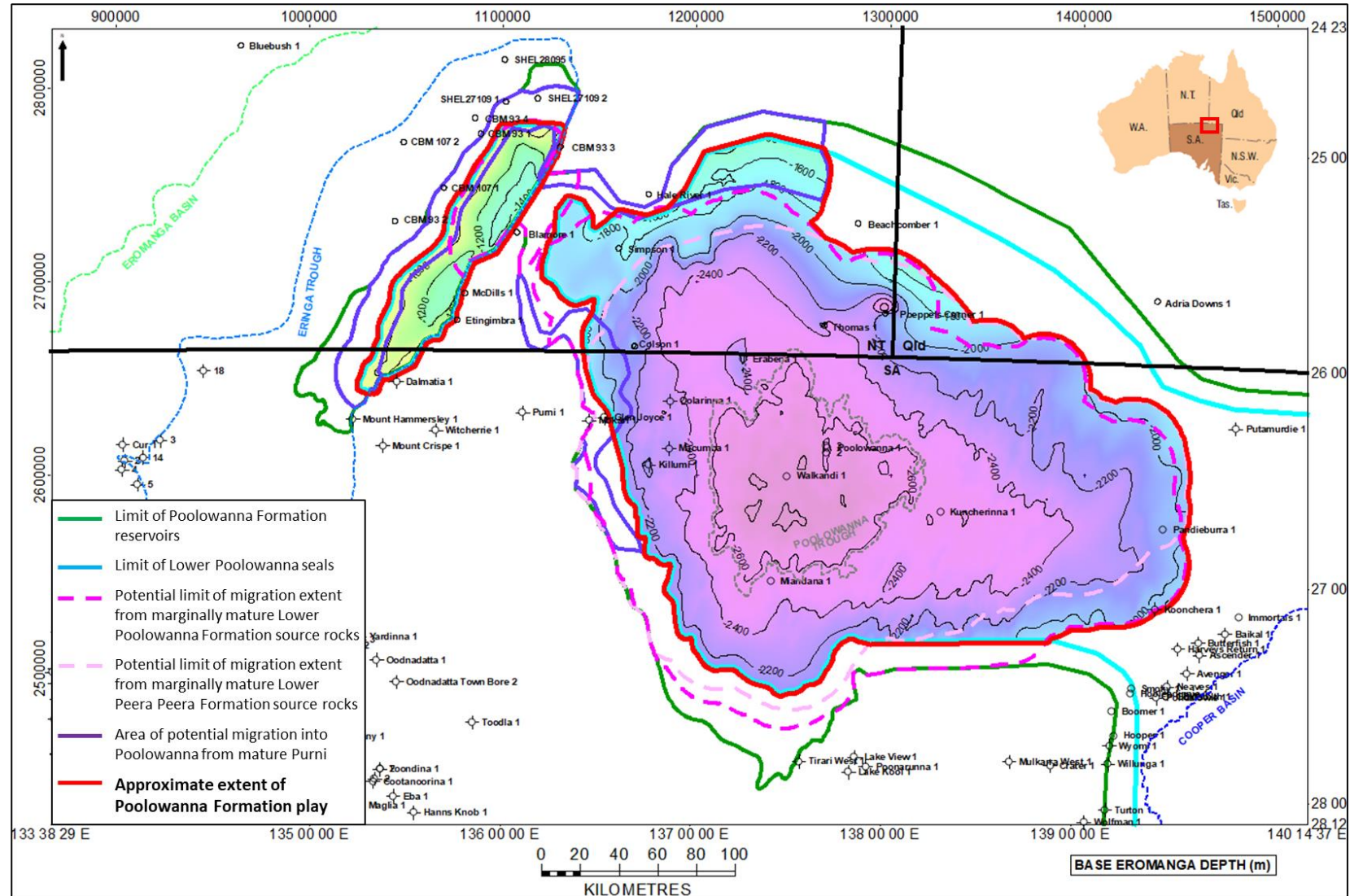
Play Extent: Poolowanna Formation

- Outlines for Poolowanna Formation play :

- Reservoir extent
- Extent of seal above reservoir
- Extents of potential migration 20km outside presence of mature source rocks:
 - Lower Poolowanna
 - Peera Peera Formation
 - Purni Formation
- Poolowanna Fm play extent

NB: In theory - no chance of play being found outside of approximate extent of the play

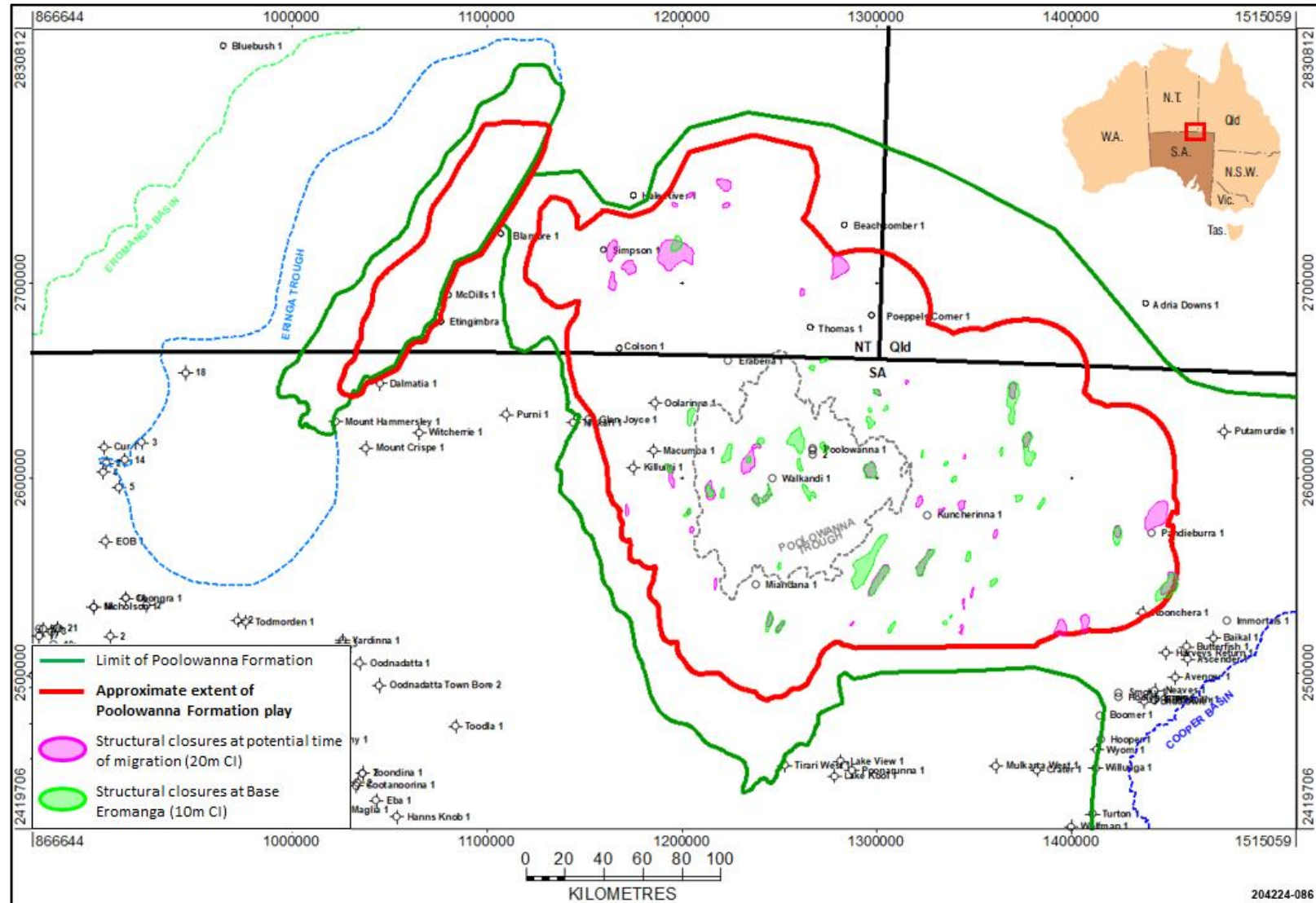
- Extents only as good as data available



Pedirka Basin-Poolowanna Trough

Poolowanna Formation Structural Closures

- Present Day closures at Base Eromanga
- Structural closures within Poolowanna play area at potential time of migration
 - Top Winton to Base Eromanga isopach
- Closures defined by 2D seismic data BUT seismic coverage is relatively poor compared with Cooper Basin

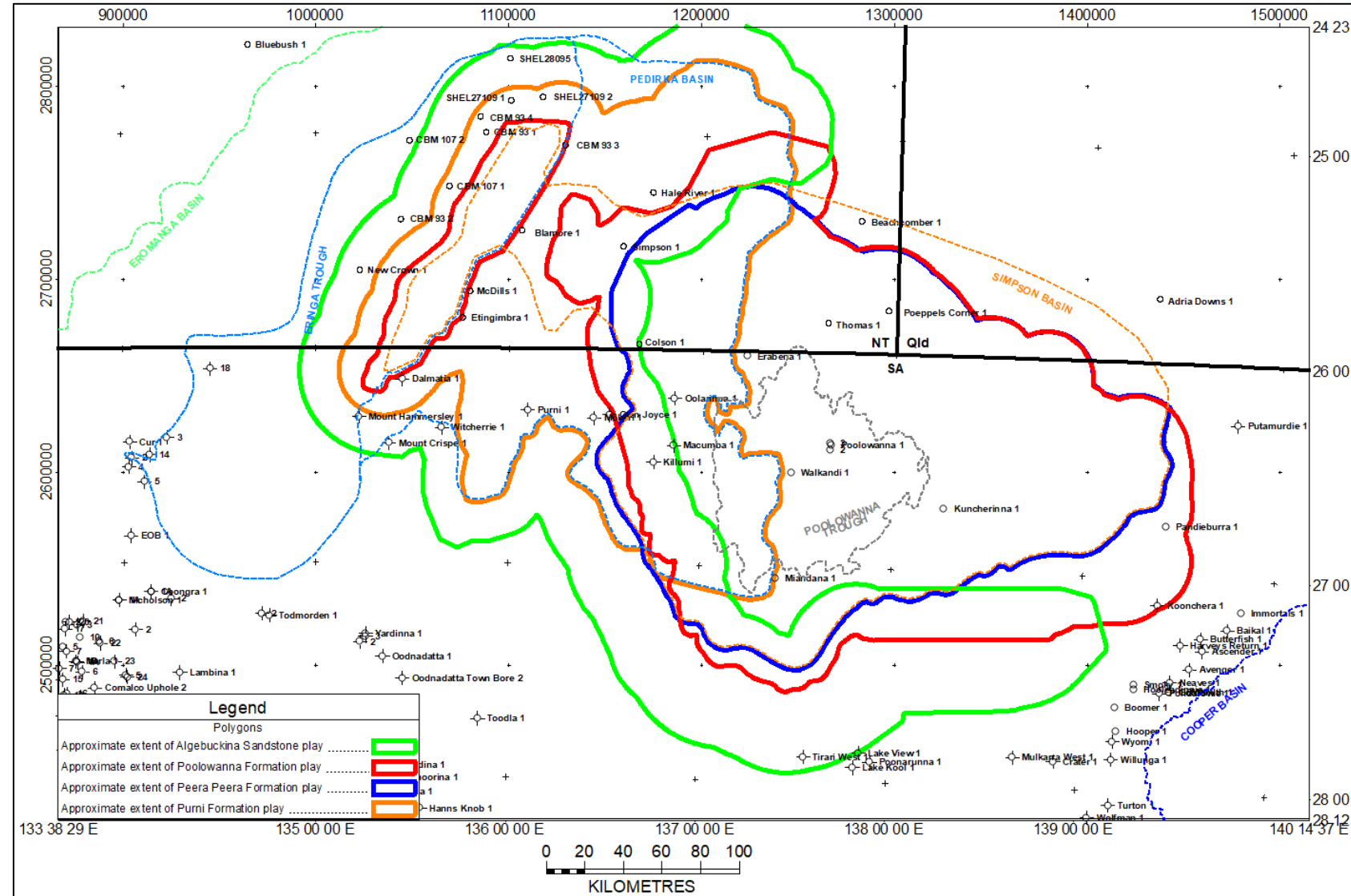


Pedirka Basin-Poolowanna Trough

Summary of Plays Reviewed

Extents of plays and mapped closures:

- Algebuckina Sandstone
- Poolowanna Formation
- Peera Peera Formation
- Purni Formation



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Pedirka Basin-Poolowanna Trough Play Analysis Data Available

- All 4 plays reviewed in study documented on the DEM Energy Resources website under individual Basins:
 - <https://www.energymining.sa.gov.au/industry/energy-resources/geology-and-prospectivity>
- Shapefiles, GeoTiffs and layered PDFs of the results included in **Basin in a Box Pedirka Basin** on SARIG (<https://map.sarig.sa.gov.au>)

<https://www.energymining.sa.gov.au/industry/energy-resources/geology-and-prospectivity/mesozoic-basins/eromanga-basin>

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Eromanga Basin

Otway Basin

Simpson Basin

Renmark Trough

Polda Basin

On this page

- Summary
- Figures
- Prospectivity

The Eromanga Basin is a Early Jurassic - Late Cretaceous basin.

The Eromanga Basin encloses the multi-aquifer system of the Great Artesian Basin and overlies late Palaeozoic and older basins. It consists of a broad downwarp with two main depocentres – the Poolowanna Trough and the Cooper region.

See the [Petroleum geology of South Australia, Volume 2: Eromanga Basin \(Second edition\)](#) for information on Eromanga, Pedirka, Arckaringa and Simpson basin structural and tectonic history, new seismic mapping, litho- and biostratigraphy, source rocks and maturity, reservoirs, seals, trap development, discovered reserves, field reviews, undiscovered potential, exploration history, infrastructure, economics and land access considerations.

Eromanga Basin plays

- [Poolowanna Formation Play, Poolowanna Trough region](#)
- [Algebuckina Sandstone Play, Poolowanna Trough region](#)



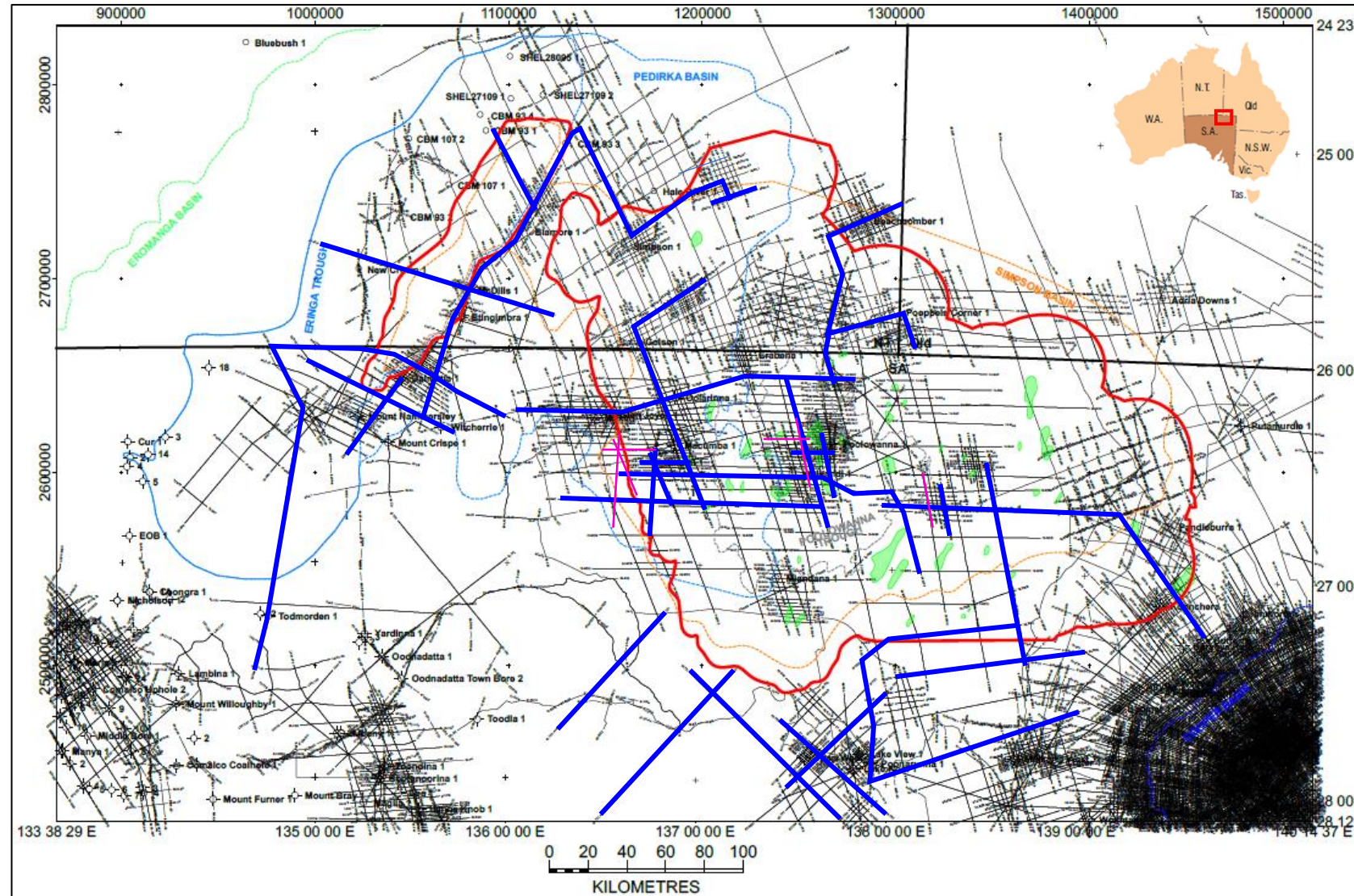
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Pedirka Basin-Poolowanna Trough

Next Steps

Collaboration Between DEM-ERD, Geoscience Australia and NTGS as part of AFER project:

- Age-dating of rock samples (GA/NTGS)
- Reprocessing of 2D seismic data and interpretation (GA)
- Consistency of wireline log data (DEM)
- Build a geological model of basin (DEM)
 - Predict hydrocarbon migration paths
 - Identify potential filled structures
 - Risked resource estimates for conventional and unconventional hydrocarbons and CCS (GA)
 - **Promote model and findings to industry to stimulate new exploration**



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