

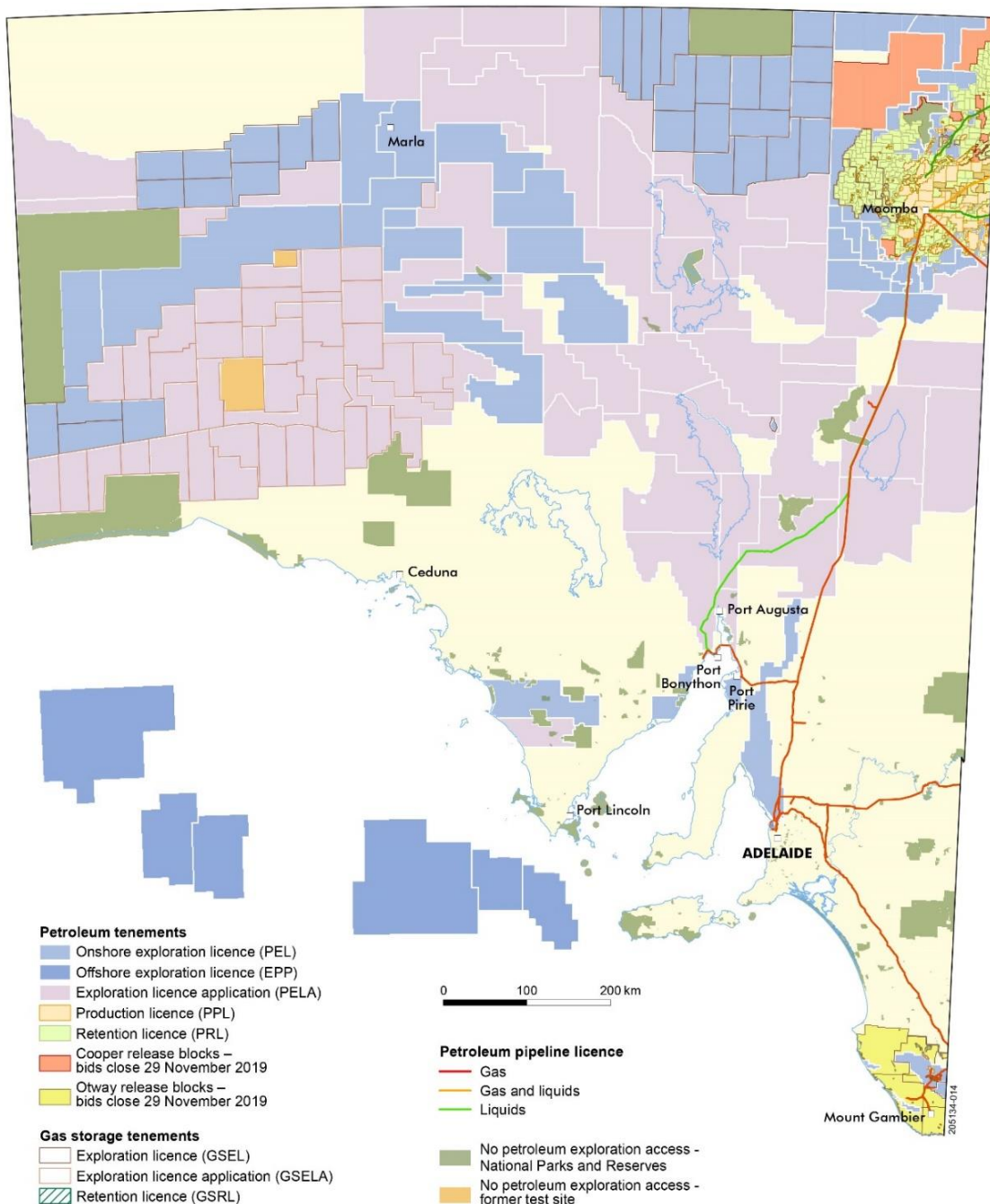


# South Australian Cooper-Eromanga and Otway basins acreage releases

Tony Hill, Energy Resources Division  
South Australian Department for Energy and Mining

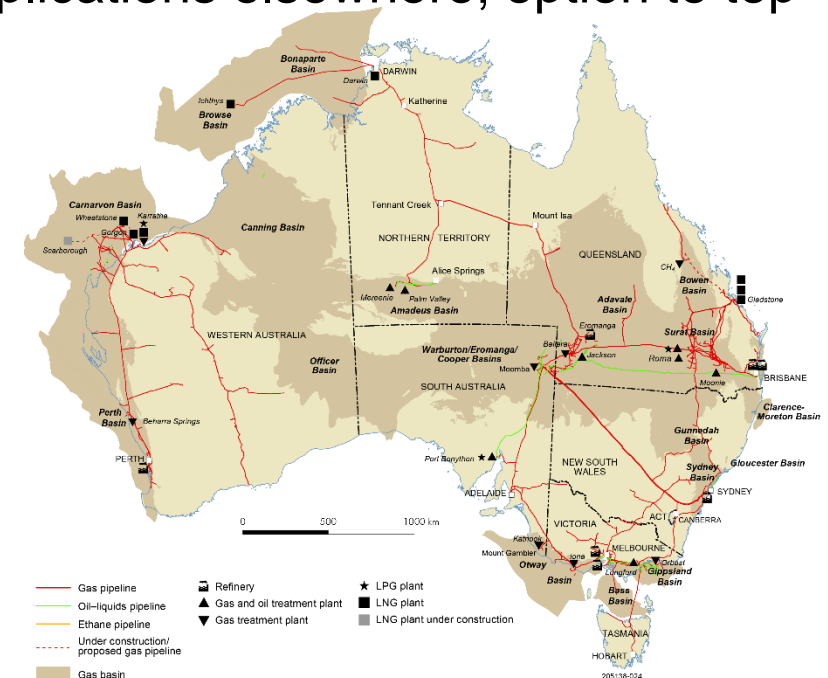
*Good Oil Conference, 12<sup>th</sup> September 2019, Perth*





# State of play in SA

- SA and Qld Cooper-Eromanga basins remain Australia's largest onshore oil and gas producer
- Huge potential for gas in Cooper Basin unconventional reservoirs, including the world's deepest coal seam gas
- Work program bidding in Cooper & Otway, application fee \$4,666 as at 1/7/19.
- Over-the-counter applications elsewhere; option to top file existing PELAs



# Cooper Basin



- First commercial gas discovered in 1963
- Produced ~ 5.5 TCF of gas since 1970; 211 mmbbl oil; 86.6 mmboe LPG; 86 mmboe condensate since 1983
- 2,500 petroleum wells in SA Cooper,
- >50 wells targeting gas in unconventional reservoirs
- >900 wells stimulated since 1968; ~1857 frac stages safely conducted without incident
- Large unconventional gas resource targets - huge tight sandstone and deep coal/source rock gas plays. Proven 1,000+ m gas columns



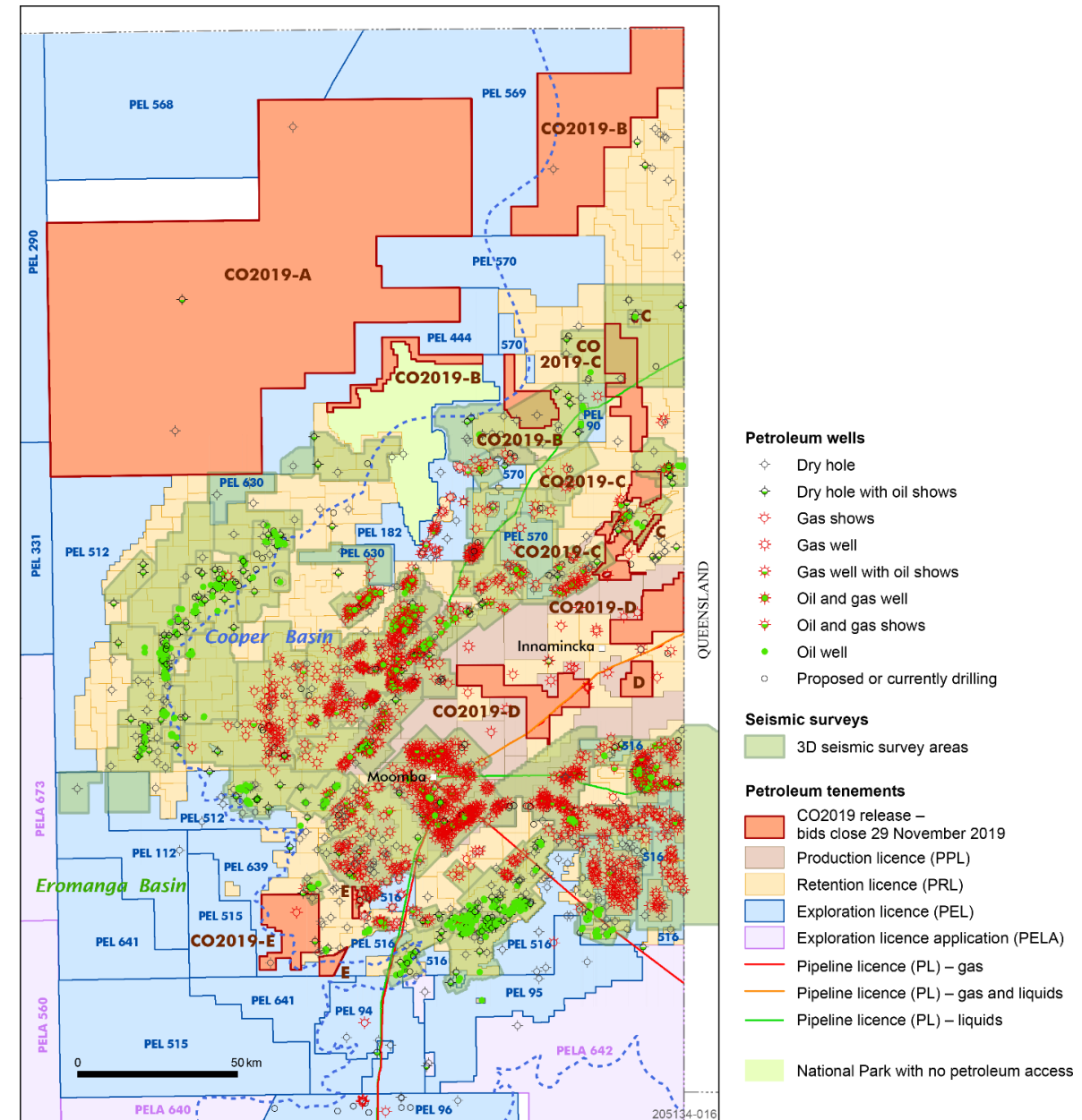


# Cooper Basin Acreage Release Blocks CO2019 A-E

- 5 blocks now open for competitive work program bidding for PELs with 3 five year terms
- Oil and gas shows within acreage release areas and oil and gas production in adjacent areas
- Myriad of conventional and unconventional oil and gas plays
- Potential for Warburton Basin plays in all blocks

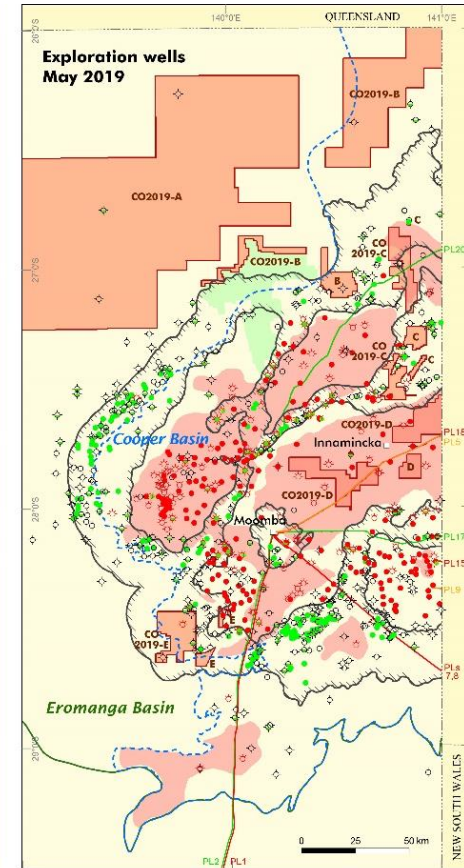
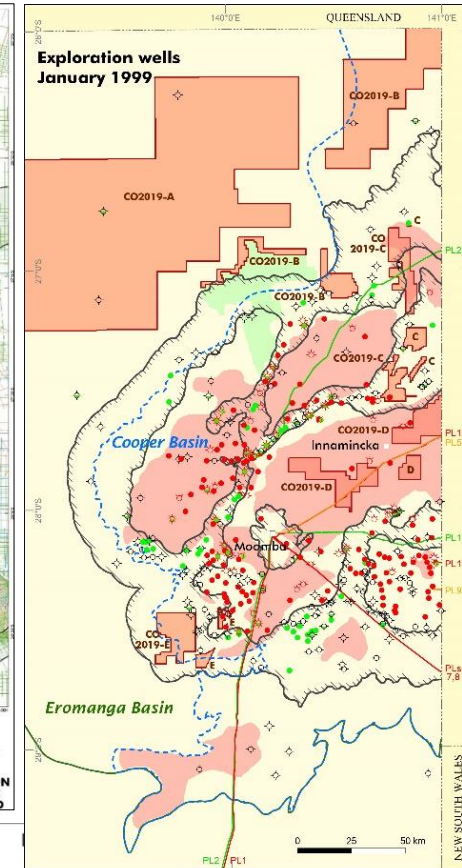
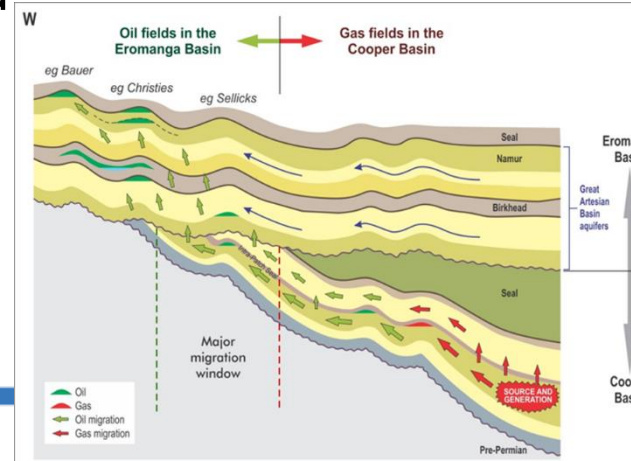
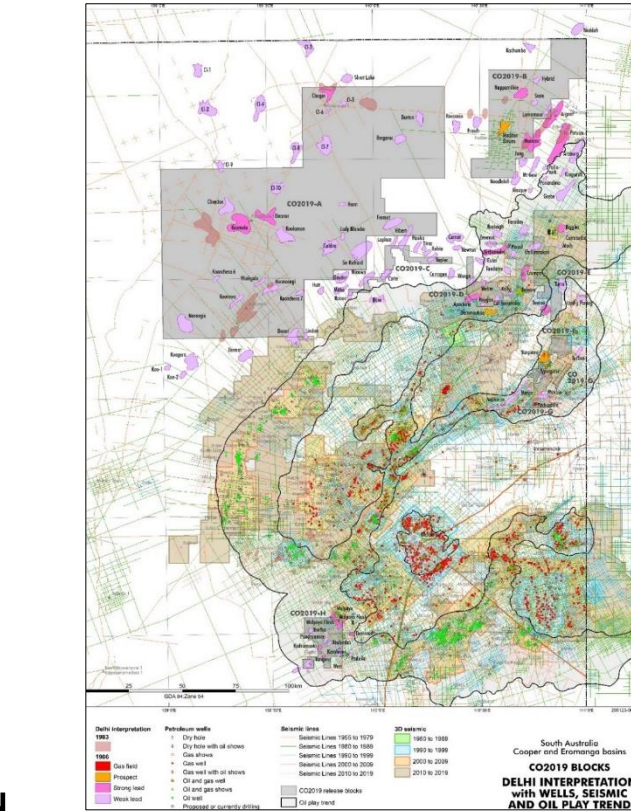
**Bids close Friday 29 November 2019**

Block	Total Area (km <sup>2</sup> )	Wells within blocks	2D Seismic (Line km)	3D Seismic (km <sup>2</sup> )
CO2019-A	9892.9	3	2163.7	8.1
CO2019-B	2009.0	2	1147.6	124.9
CO2019-C	545.2	1	1180.8	259.9
CO2019-D	742.3	0	899.6	0.0
CO2019-E	392.9	5	687.0	14.4
	13,582.3	11	6,078.8	407.3



# Cooper Basin Acreage Release Blocks CO2019 A-E

- Block CO2019-A and portions of CO2019-B are adjacent to Proven Oil Play Trend (POPT) but remain poorly explored
- Block CO2019-B lies in part within the POPT
- Block 2019-C lies in part within the POPT and Proven Gas Play Trend (PGPT)
- Block CO2019-D lies within the Basin Centred Gas Play trend
- Block CO2019-E lies within POPT and in part is adjacent to PGPT



CO2019 acreage release blocks  
Bids close 29 November 2019

**Petroleum pipelines**

- Gas
- Gas and liquids
- Liquids
- Oil play trend
- Gas play

National Park –  
no petroleum access

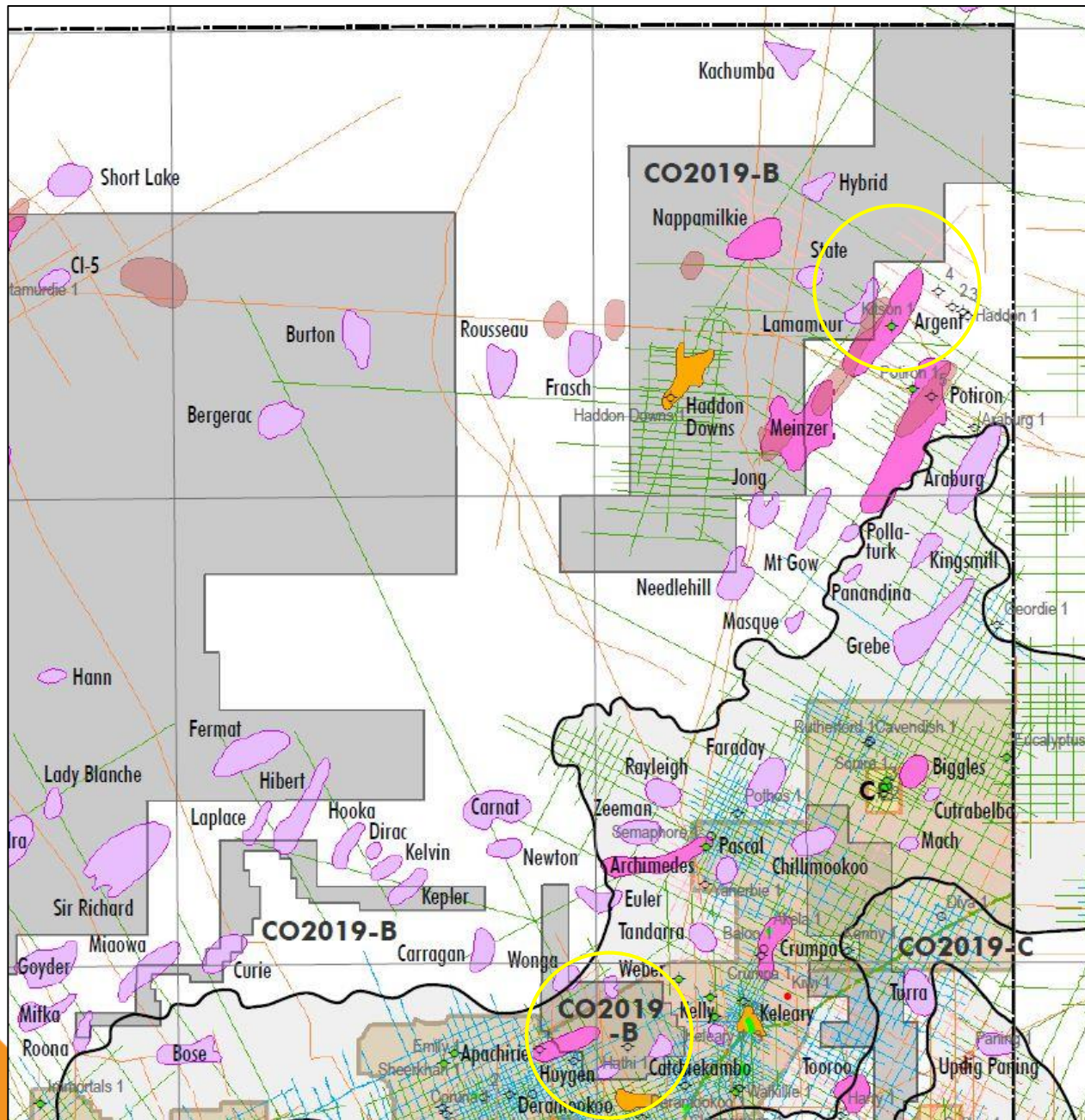
**Petroleum wells**

- Dry hole
- Dry hole with oil shows
- Gas shows
- Gas well
- Gas well with oil shows
- Oil and gas well
- Oil and gas shows
- Oil well
- Proposed or currently drilling



- Department for Energy and Mining

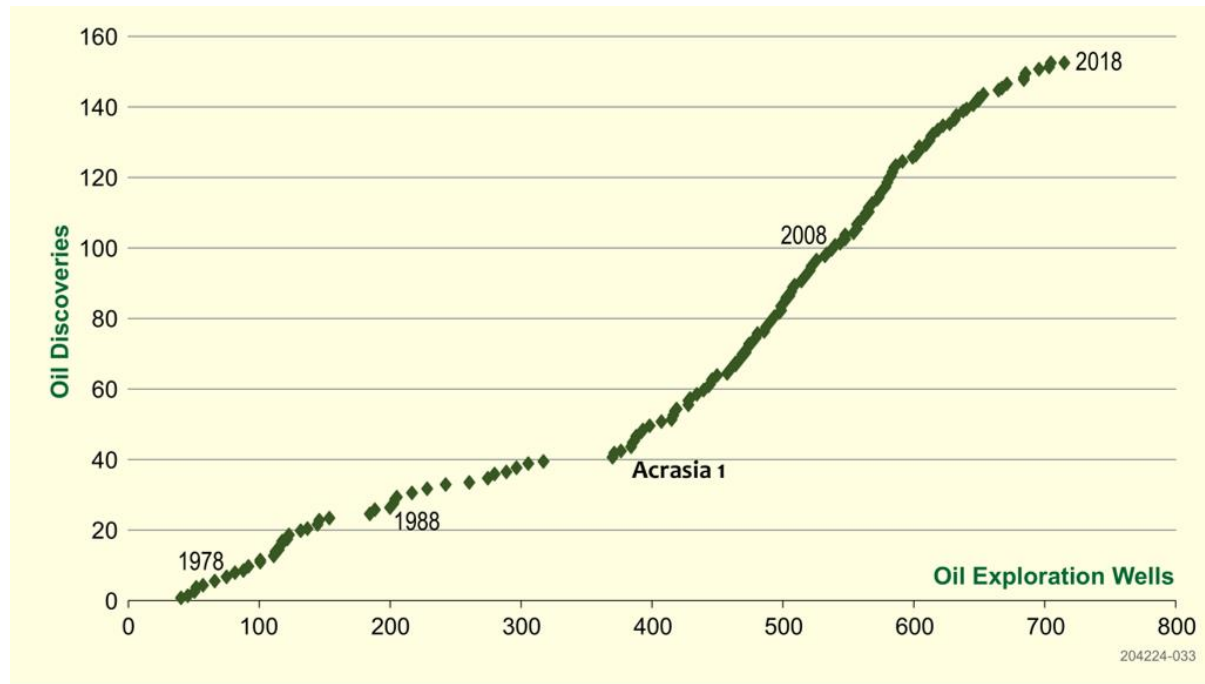




# CO2019 B block

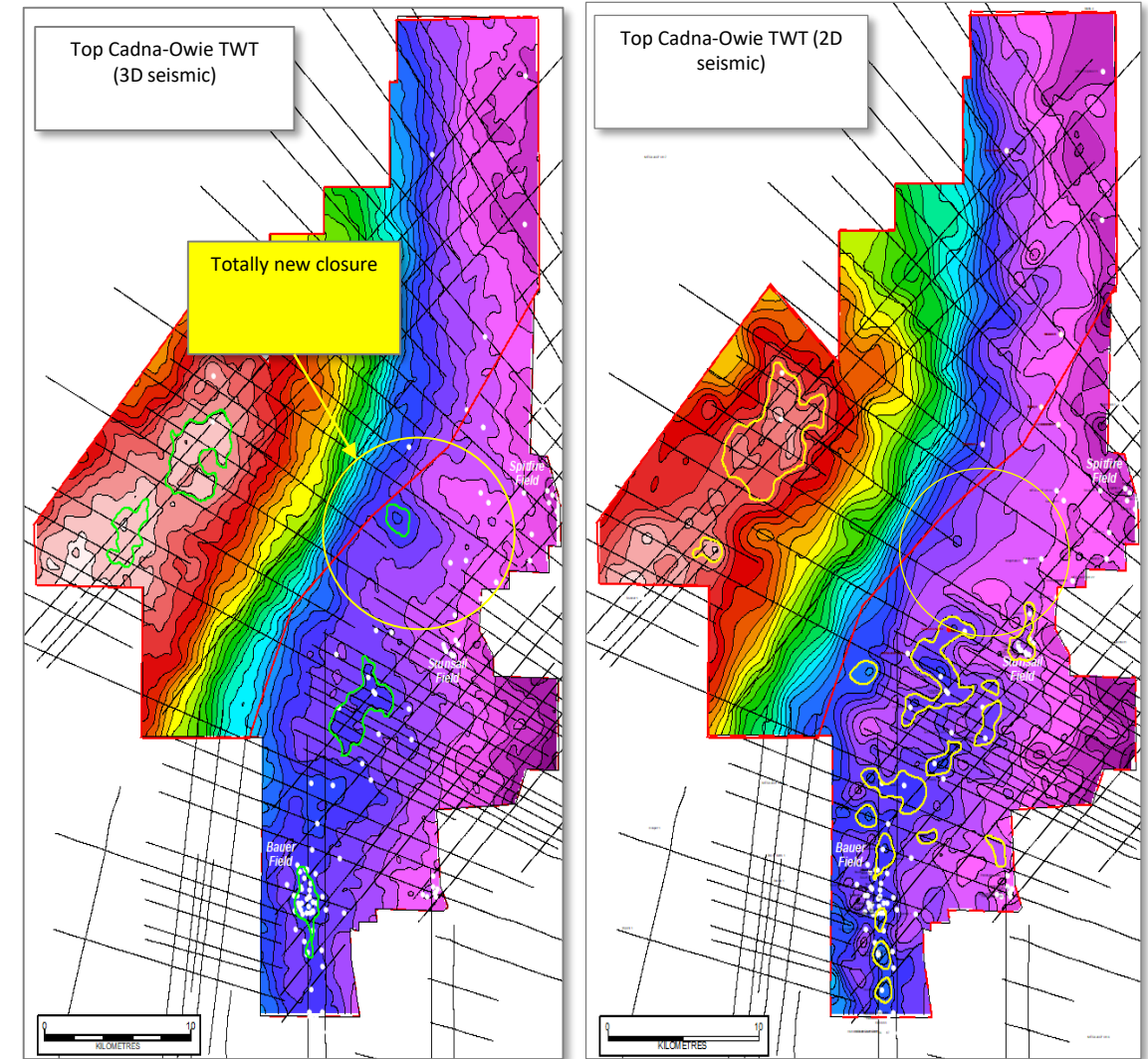
- Total Area (km<sup>2</sup>): ~2009
- Wells within block: 2
- 2D Seismic (Line km): ~1148
- 3D Seismic (km<sup>2</sup>): 125
- Birkhead oil shows in Apachirie 1; Birkhead/Poolowanna oil shows in Kitson 1 wells proximal to block B
- No wells drilled since 1986
- Multiple prospects and leads mapped on pre 1990 2D seismic

# Eromanga Success Rate 3D vs 2D

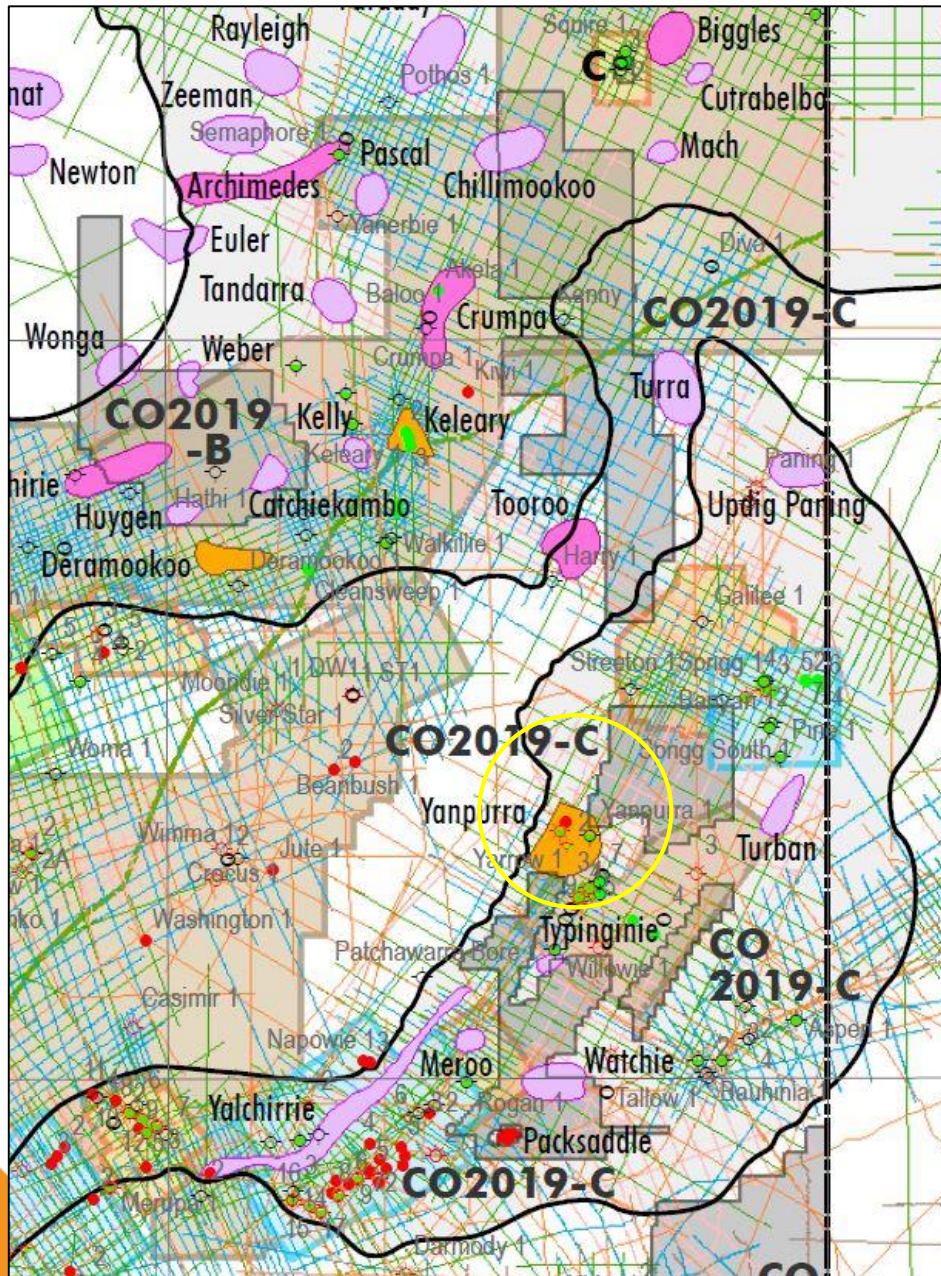


2D Seismic: 26%; 3D Seismic: 43%

Western Flank FSD: Mean 2P recoverable ~2.5 mmbo



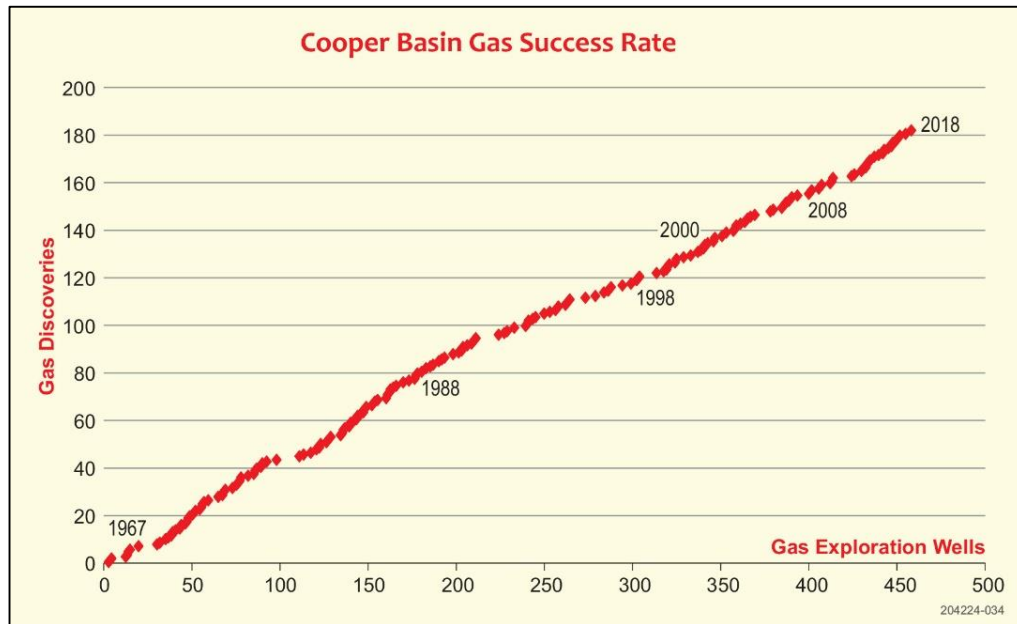




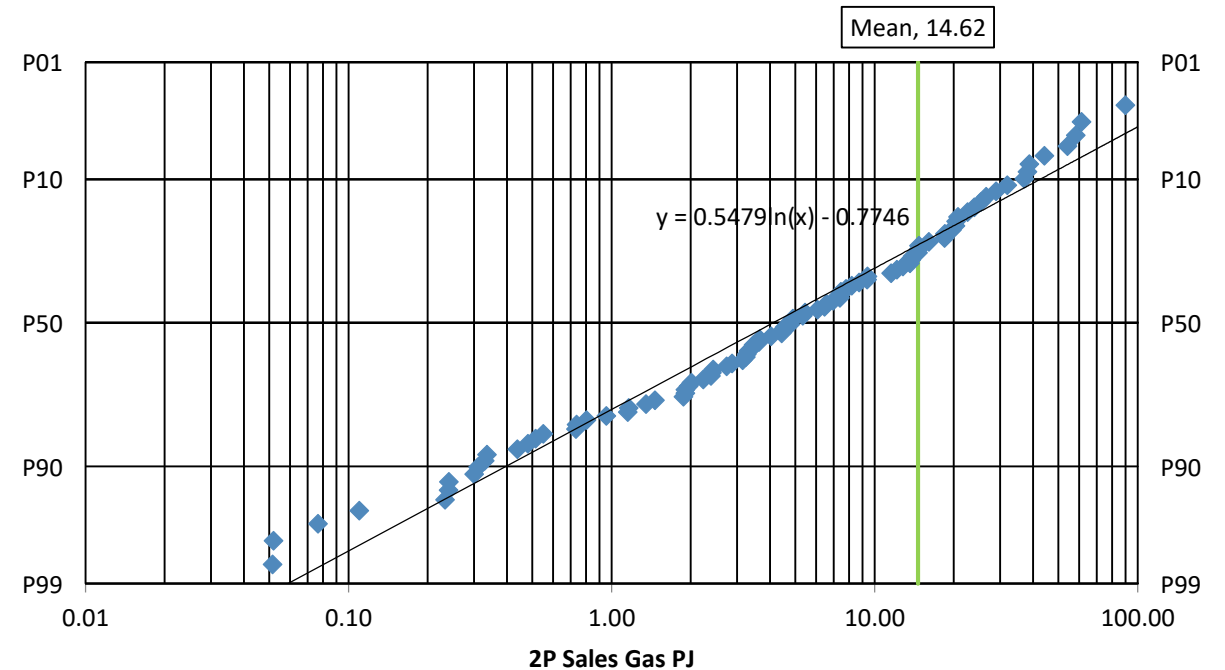
# CO2019 C block

- Total Area (km<sup>2</sup>): ~545
- Wells within block: 1
- 2D Seismic (Line km): ~1181
- 3D Seismic (km<sup>2</sup>): 260
- Patchawarra oil shows in Yanpurra 1 drilled in 1970
- Lies within proven oil and gas trends
- Multiple prospects and leads mapped on pre 1990 2D seismic
- Potential for Warburton Basin pinchout plays on flanks of GMI Trend

# Cooper Gas Success Rate and Field Size Distribution\*



Gas has maintained an historical 40% success rate



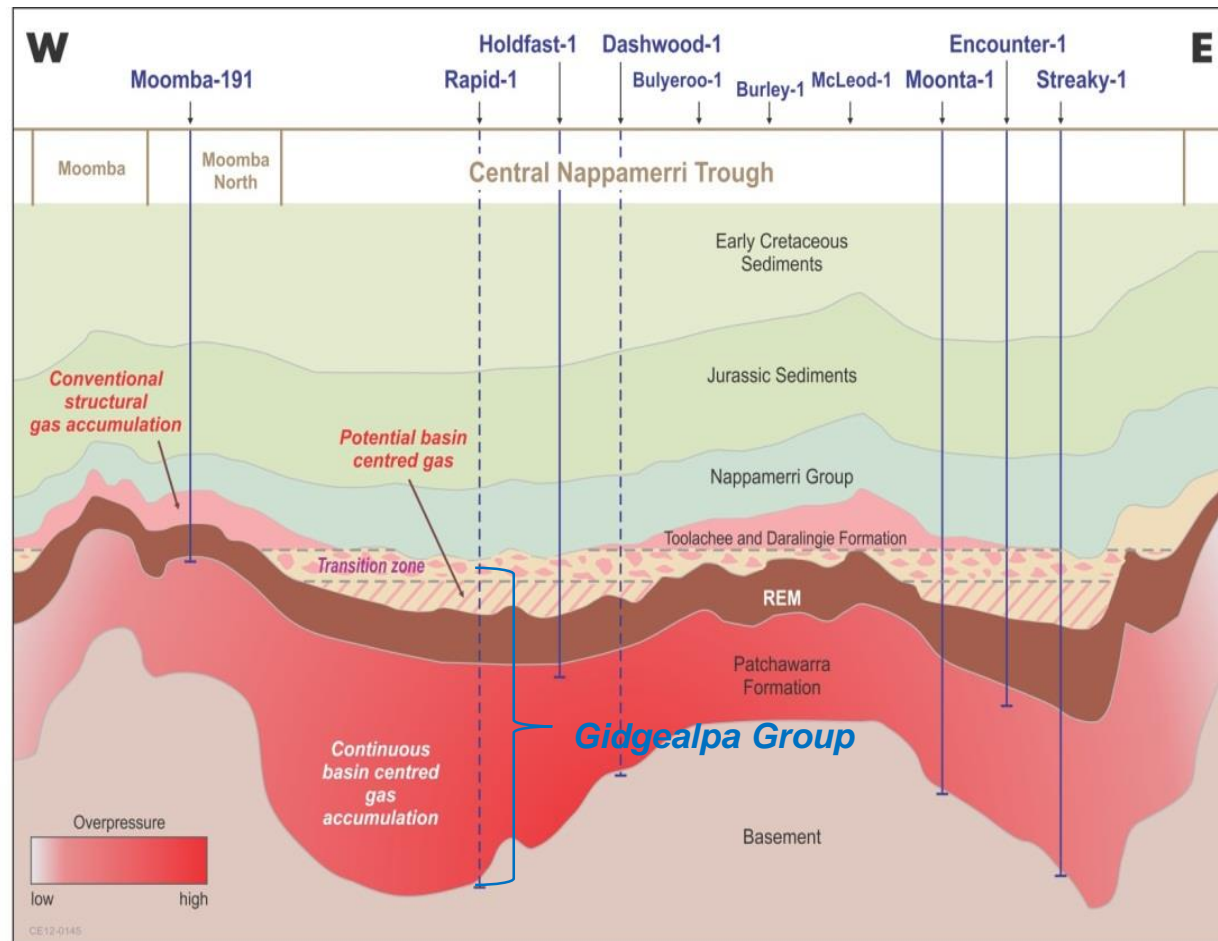
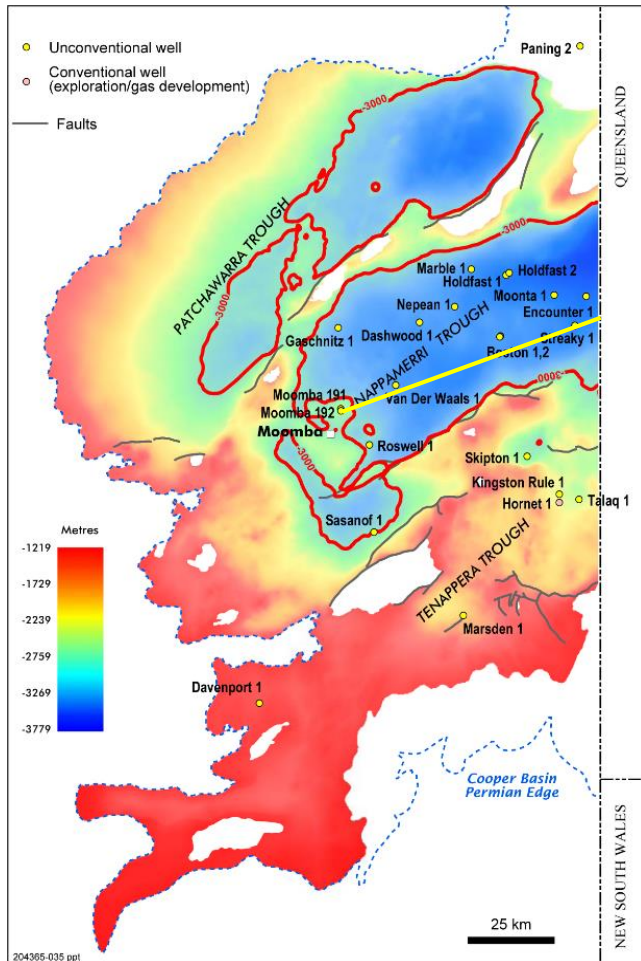
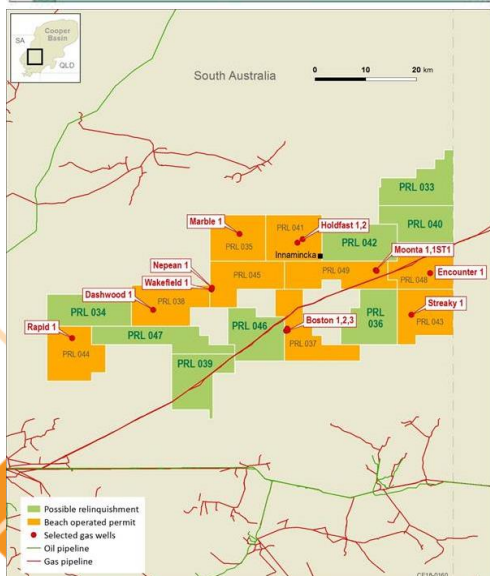
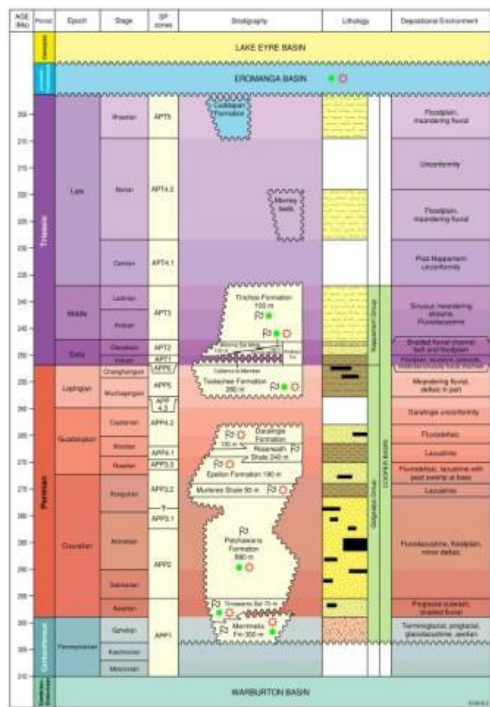
\* Mean 2P Recoverable = 14.62 PJ excluding pre-2000 large gas fields







# Composite Resource Play Fairway



1781 Bcf 2C Contingent Resource<sup>1</sup> assigned to PRLs 33 to 49 adjacent to Block CO2019-D

<sup>1</sup> Contingent Resource as at 31/12/2014 as submitted to ASE 27 March 2015 (reference #020/15)



- Total Area (km<sup>2</sup>): ~393
- Wells within block: 5
- 2D Seismic (Line km): ~687
- 3D Seismic (km<sup>2</sup>): ~14.4
- Lies within proven oil play trend – close to Worrier Oil Field and lies within Boxwood Depression between Dirkala and Dunoon ridges
- Warburton Basin (Pando Fm) oil shows in Karbine 1 (2002); Oil shows (Murta Fm) in Patron 1 (2007); Oil & gas shows (Patchawarra Fm) in Rainbird 1 (2007).





# Cooper Basin Acreage Release Blocks CO2019 A-E

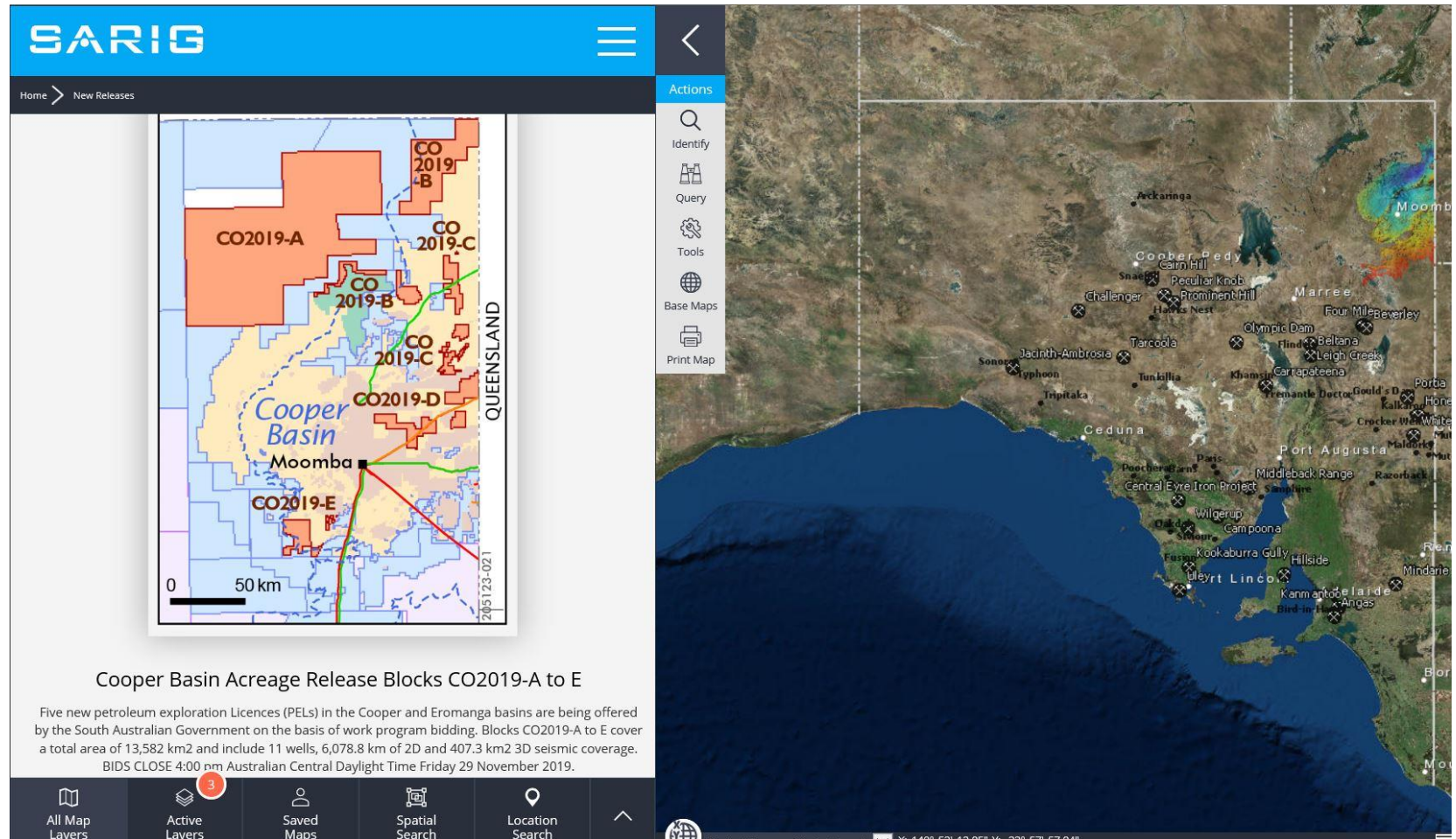
Department for Energy and Mining

South Australia  
**COOPER BASIN**  
Acreage Release  
CO2019 A-E

BIDS CLOSE 4.00 pm ACDT  
Friday 29 November 2019

[www.energymining.sa.gov.au/petroleum](http://www.energymining.sa.gov.au/petroleum)

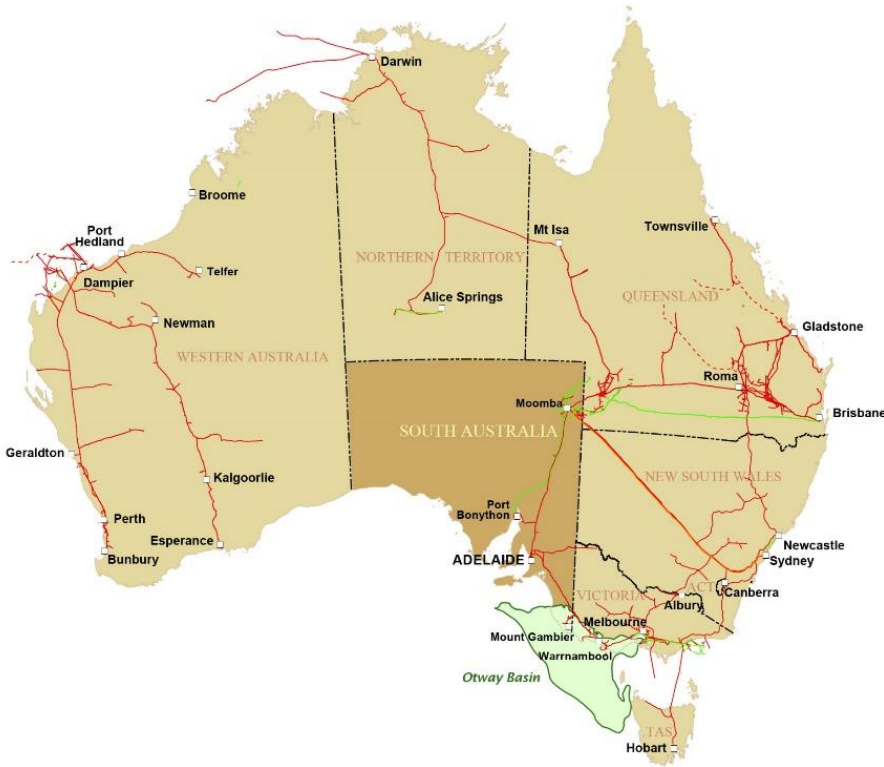


To download Acreage Release brochure and associated data package go to: <https://map.sarig.sa.gov.au/> or visit: [http://energymining.sa.gov.au/petroleum/licensing\\_and\\_land\\_access/acreage\\_releases/co2019\\_cooper\\_basin\\_acreage\\_release](http://energymining.sa.gov.au/petroleum/licensing_and_land_access/acreage_releases/co2019_cooper_basin_acreage_release)



## Department for Energy and Mining

# Otway Basin



- Jurassic – Late Cretaceous rift basin
- Conventional oil and gas plays
- Pipeline infrastructure – potential access to SE Australian gas market
- In excess of 100 onshore wells. 13% overall historic success rate; **42% gas success rate in Penola Trough**
- Commercial gas production from 1991- 2011 from 8 fields
- Produced ~ 71 PJ and 414,000 bbl condensate
- Caroline 1 produced 14 bcf CO<sub>2</sub> (1968-2016) & ~60 bbl heavy oil/yr.
- Haselgrove 3 PACE Gas discovery heralds new Sawpit Sandstone gas play fairway under existing depleted fields; 87 PJ 2C booked resource





# Otway Basin PACE Gas Program

## Round 1

- \$6m awarded to Beach Energy's Haselgrove 3 ST1 well which resulted in new Sawpit Sst gas discovery in 2018 opening up new play fairway underlying existing depleted gas fields

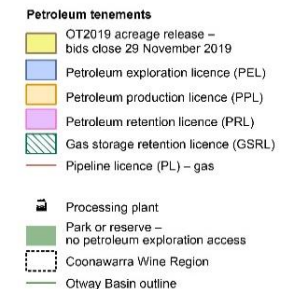
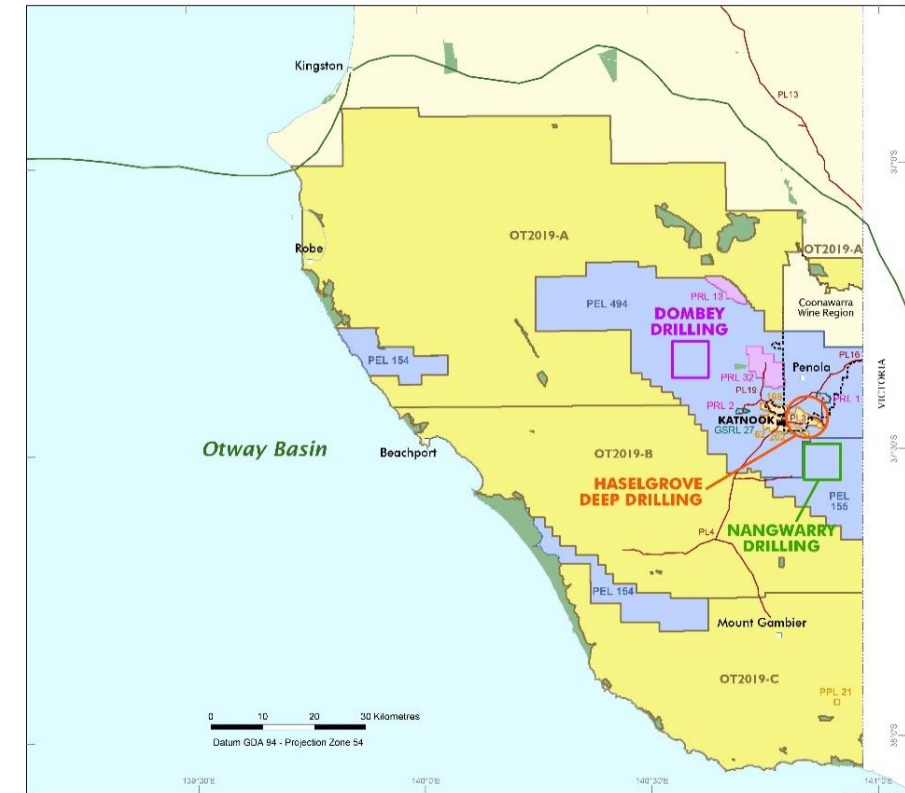
## Round 2

- \$5.26m awarded to Beach Energy's Dombey 1 spudded 11/9/2019
- \$4.95m awarded to Vintage Energy/ Lakes Oil Nangwarry 1 well to be drilled Q4 2019/Q1 2020

## Federal Governments GAP Fund

- \$6m grant awarded to Beach Energy to partly fund new Katnook Gas Processing Facility now under construction and targeting first gas Q4 2019/Q1 2020

Otway Basin, South Australia  
PACE GAS PROJECTS - ROUNDS 1 & 2

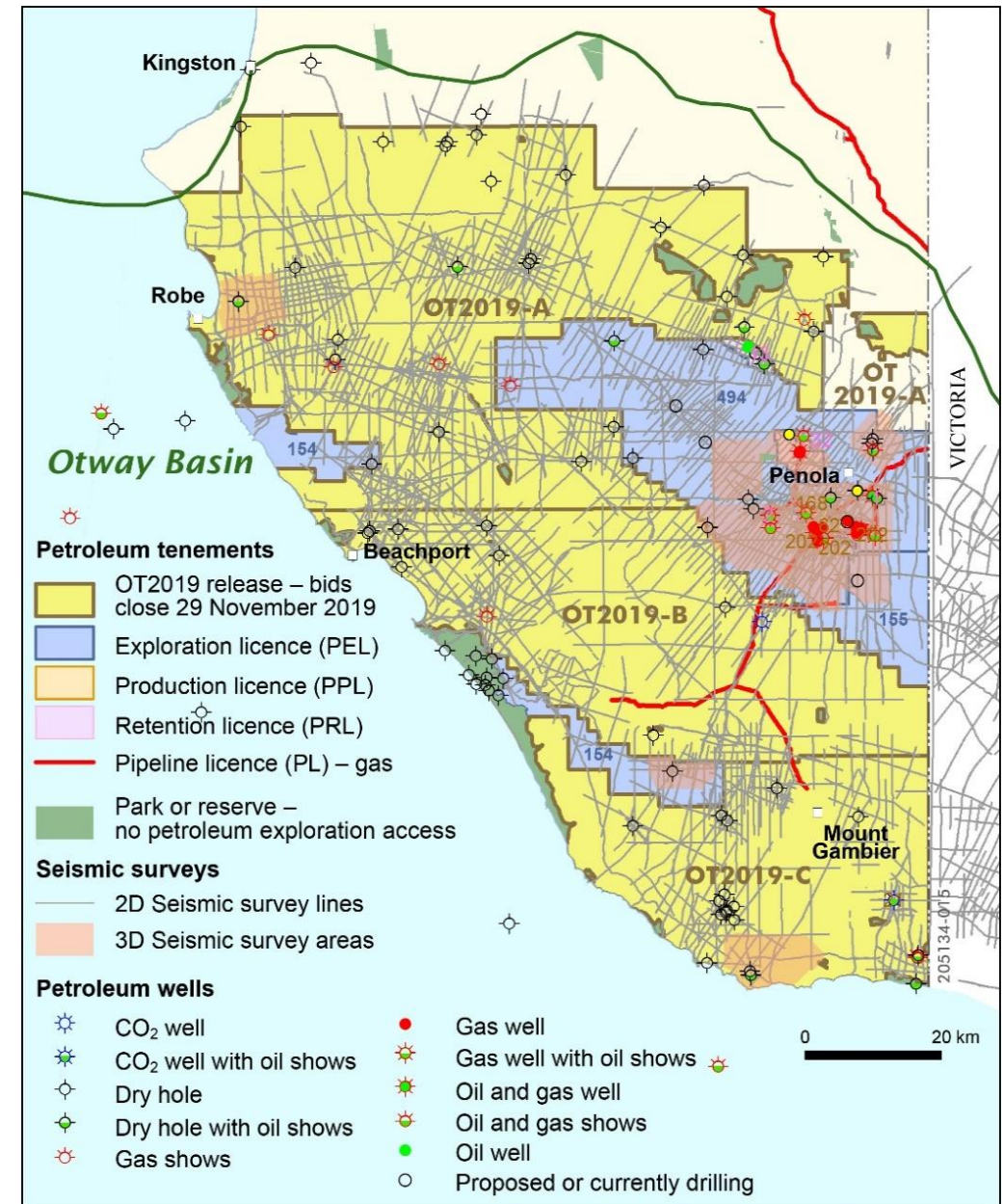


# Otway Basin Acreage Release Blocks OT2019 A-C

- 3 blocks now open for competitive work program bidding for PELs with 3 five year terms
- Oil and gas shows within acreage release areas and historical gas production in adjacent areas
- Potential for conventional Early and Late Cretaceous oil & gas plays

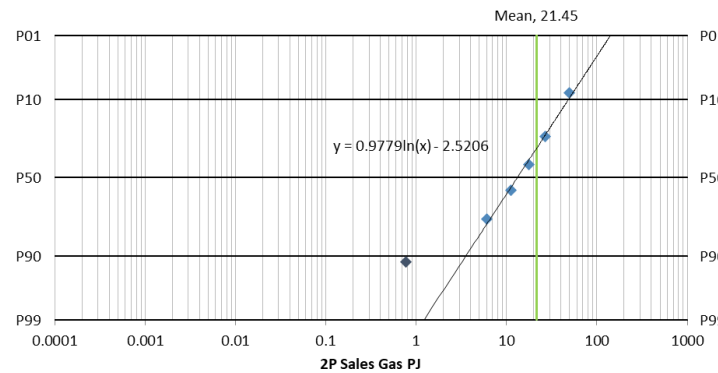
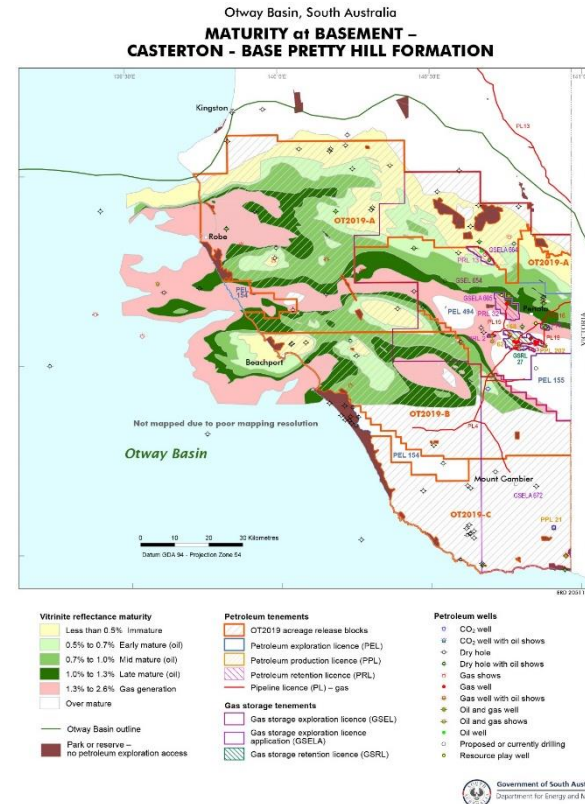
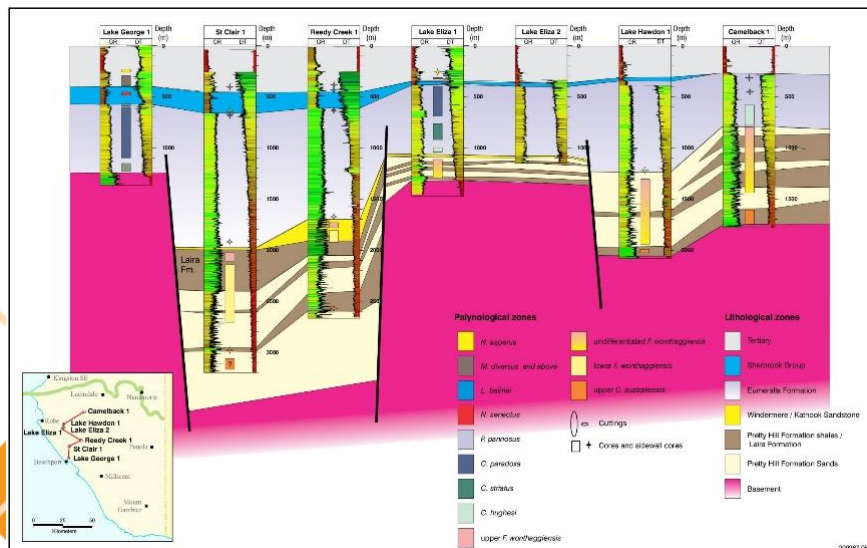
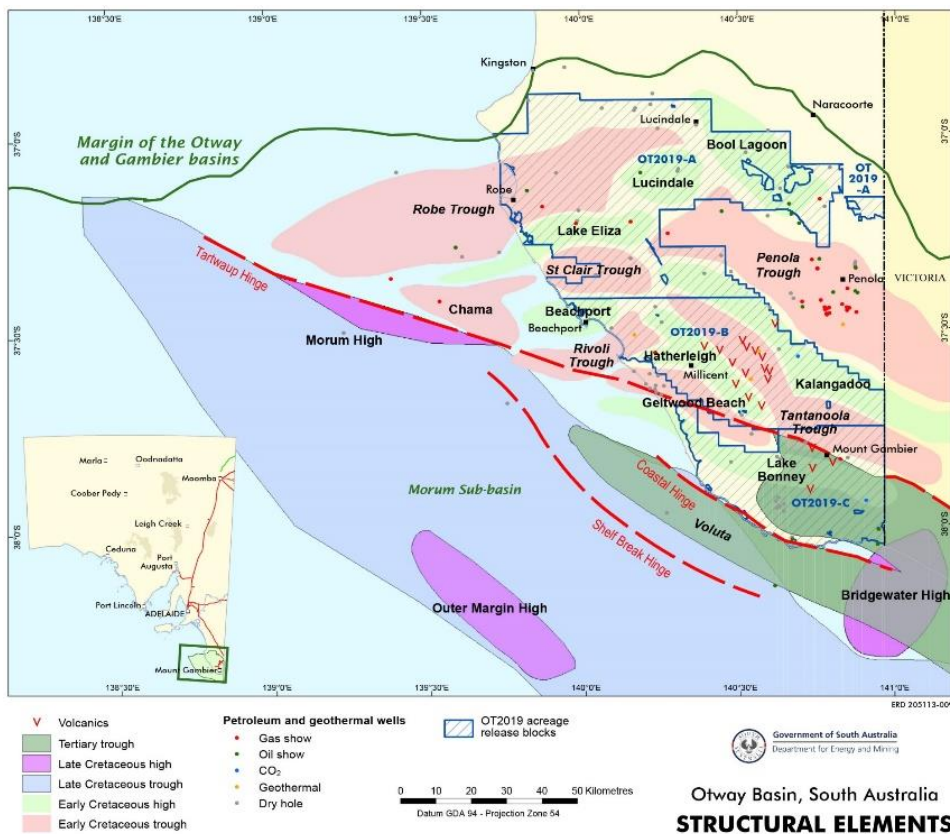
**Bids close Friday 29 November 2019**

Block	Area (km <sup>2</sup> )	Wells	2D Seismic (Line km)	3D seismic (km <sup>2</sup> )	Primary target
OT2019-A	3566.2	18	3727.0	72.1	E. Cretaceous
OT2019-B	1923.0	10	2072.8	6.2	E. Cretaceous
OT2019-C	1460.9	11	1430.4	93.3	L. Cretaceous
	6950.1	39	7230.2	171.6	





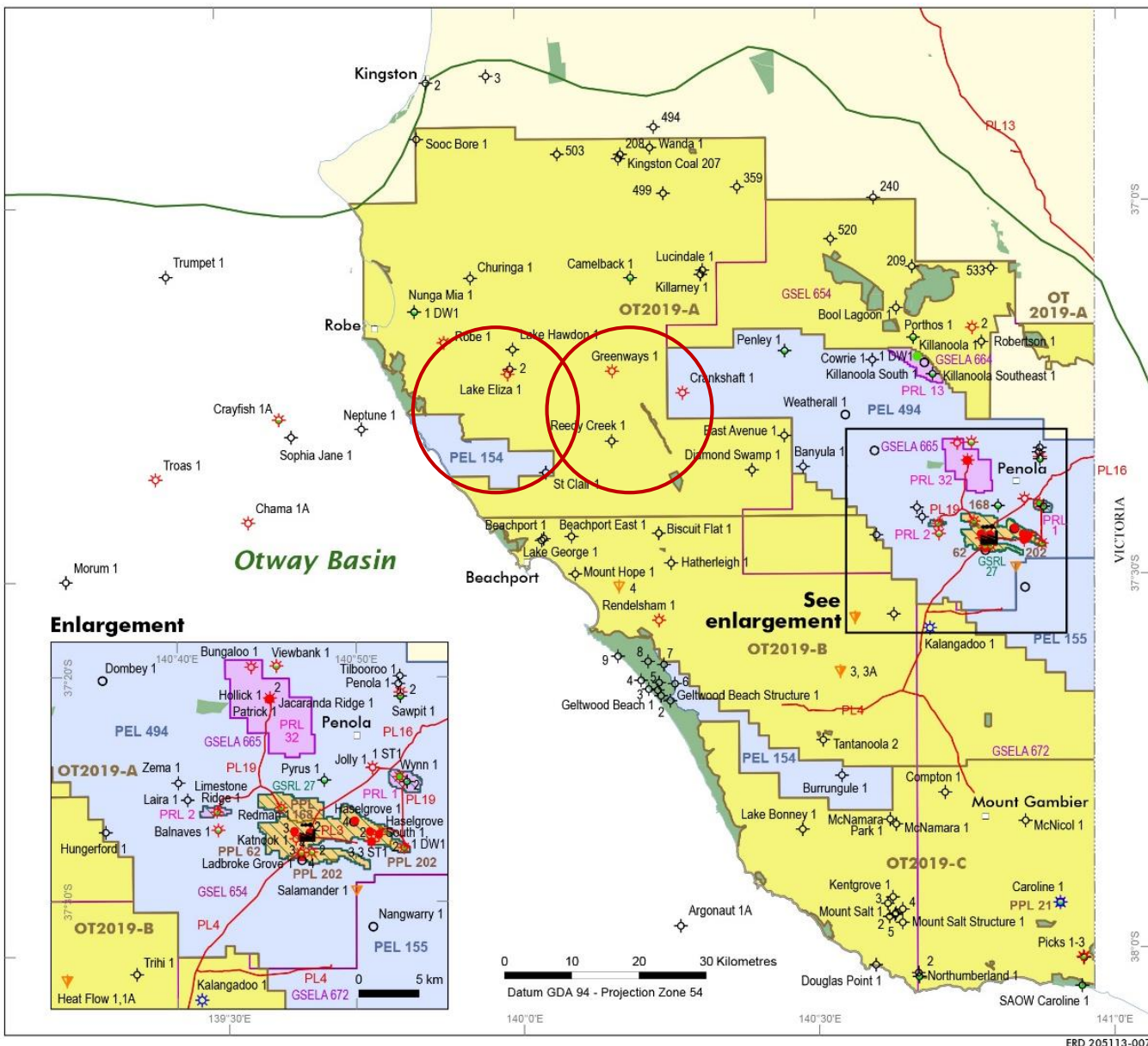
# Blocks OT2019 A-B Prospectivity



- Comprises sparsely drilled Late Jurassic to Early Cretaceous Robe, St Clair, Rivoli and Tantanoola Troughs which have the same potential ingredients that make up proven Crayfish Group oil and gas plays in adjacent Penola Trough
- Historical discovery success 13% across basin; 42% for gas discoveries in Penola Trough; Mean 2P Recoverable = 21.45 PJ\*) \* doesn't include 2P Haselgrove 3 reserve

# Block OT2019 A

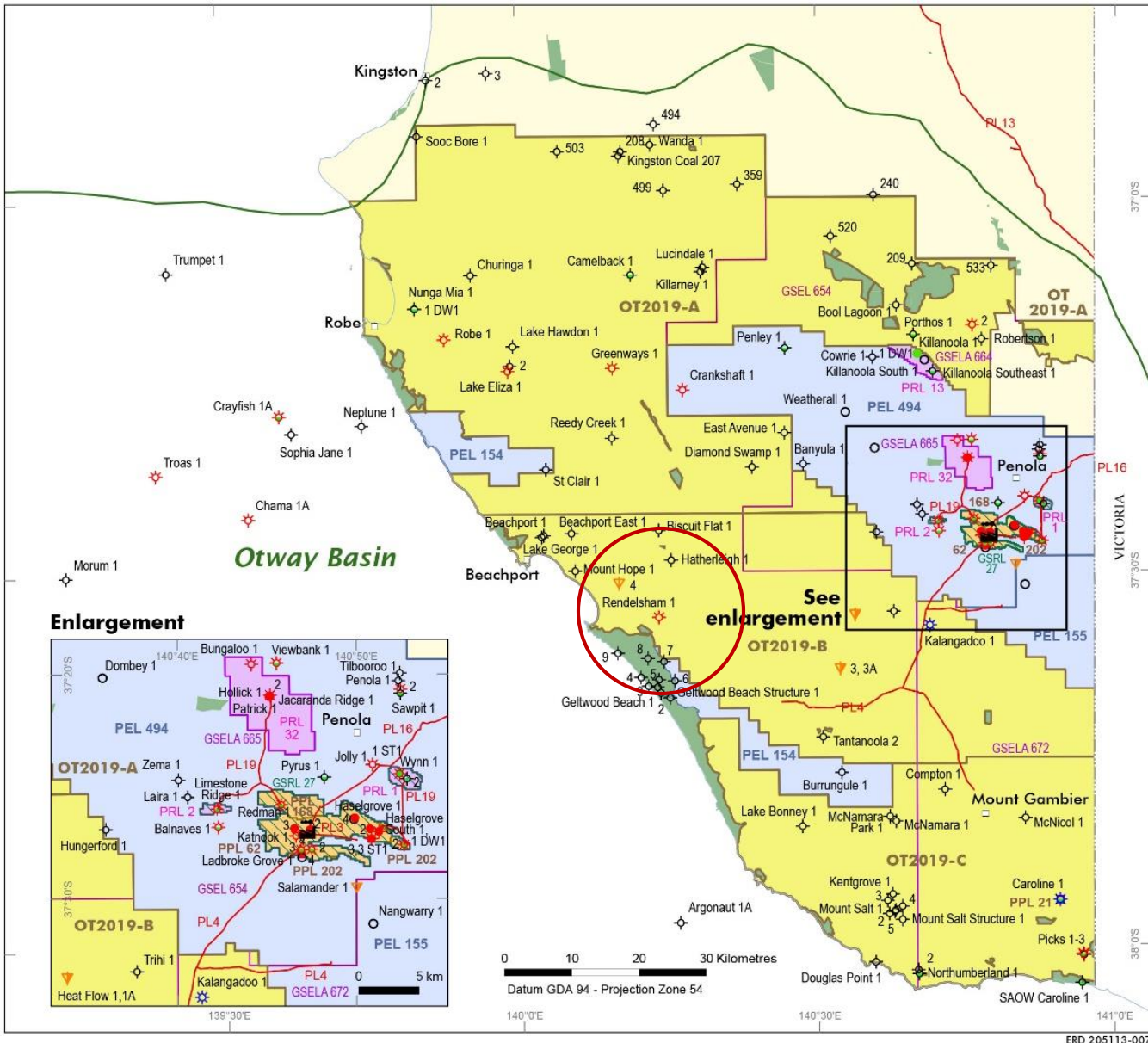
- Total Area (km<sup>2</sup>): ~3566
- Wells within blocks: 18
- 2D Seismic (Line km): ~3727
- 3D Seismic (km<sup>2</sup>): ~72.1
- Early Cretaceous oil and gas potential
- Strong gas shows from (Katnook Sst) in Greenways 1 (1991) – flare lit for 16 mins then watered out; Minor gas shows (Windermere Sst Mbr of Eumeralla Fm) in Lake Eliza 1 (1969)



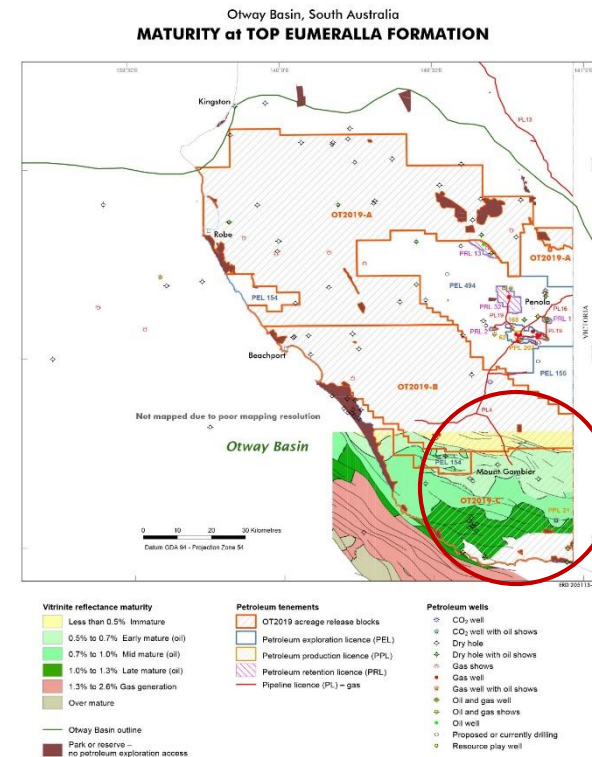
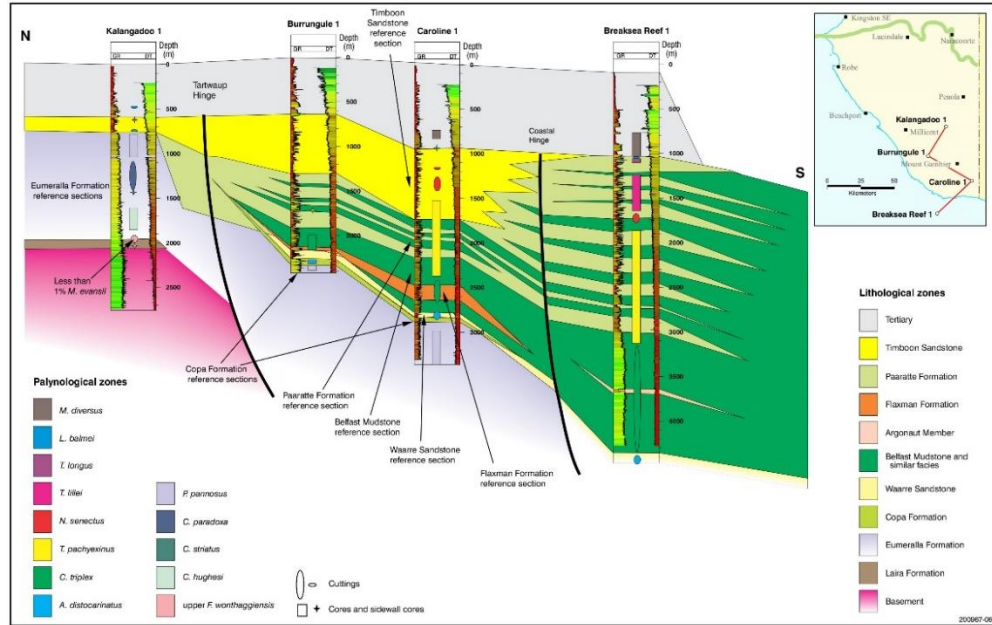


# Block OT2019 B

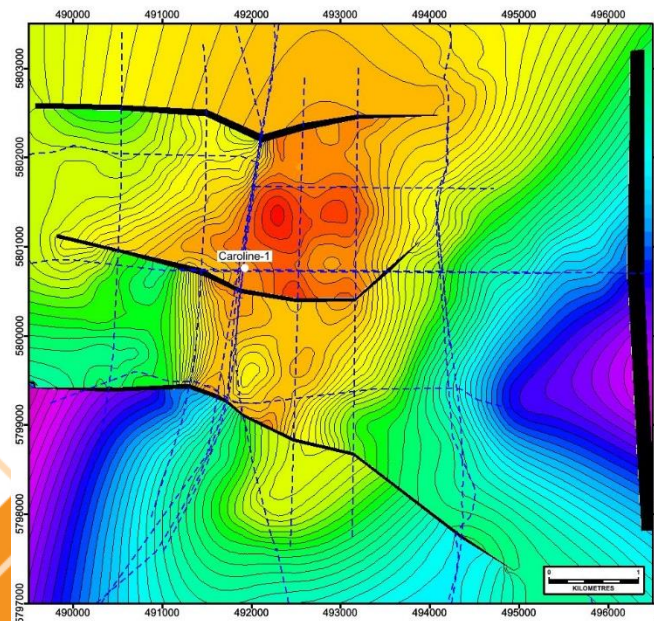
- Total Area (km<sup>2</sup>): ~1923
- Wells within blocks: 10
- 2D Seismic (Line km): ~2073
- 3D Seismic (km<sup>2</sup>): ~6.2
- Early Cretaceous oil and gas potential
- Minor gas shows (Windermere Sst Mbr of Eumeralla Fm) in Rendelsham 1 (1969)



# Block OT2019 C Prospectivity



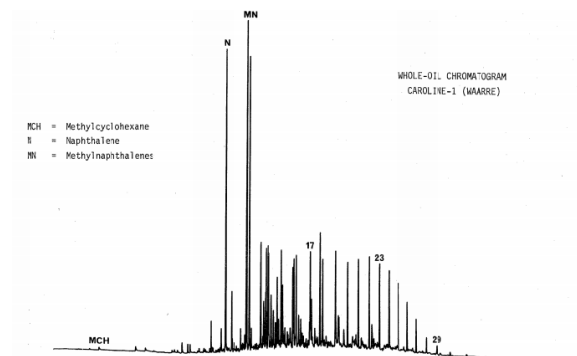
- Block CO2019-C includes recent relinquishment of PPL21 (excluding 1km<sup>2</sup> for Caroline CO<sub>2</sub> Plant)
- Caroline 1 – Air Liquide CO<sub>2</sub> well decommissioned in 2017. Produced 810,800 tonnes CO<sub>2</sub> and up to ~60 bbl heavy oil/yr since 1968
- No seismic since 1990 over PPL21.



The Caroline-1 oil is a heavy (15° API gravity), low sulphur (0.2% S) crude which is essentially devoid of light ends. Gasoline-range hydrocarbons (C<sub>5</sub>-C<sub>10</sub>) comprise less than 2% of the total oil (Table 3) suggesting alteration by water-washing. However, there is no evidence of extensive biodegradation which might otherwise explain the aromatic-intermediate composition of the oil (Fig. 2). An unusual abundance of aromatic hydrocarbons is clearly evident from the whole-oil chromatogram (Fig. 1).

The high pristane/phytane ratio and intermediate pristane/η-heptadecane ratio of the oil (pr/ph = 5.6; pr/η-C<sub>17</sub> = 0.59; Table 4) are consistent with its derivation from woody-herbaceous organic matter deposited in an oxic aquatic environment. The oil's methylphenanthrene index (MPI = 0.59) converts to a calculated source maturity of VR = 0.74% (Table 5).

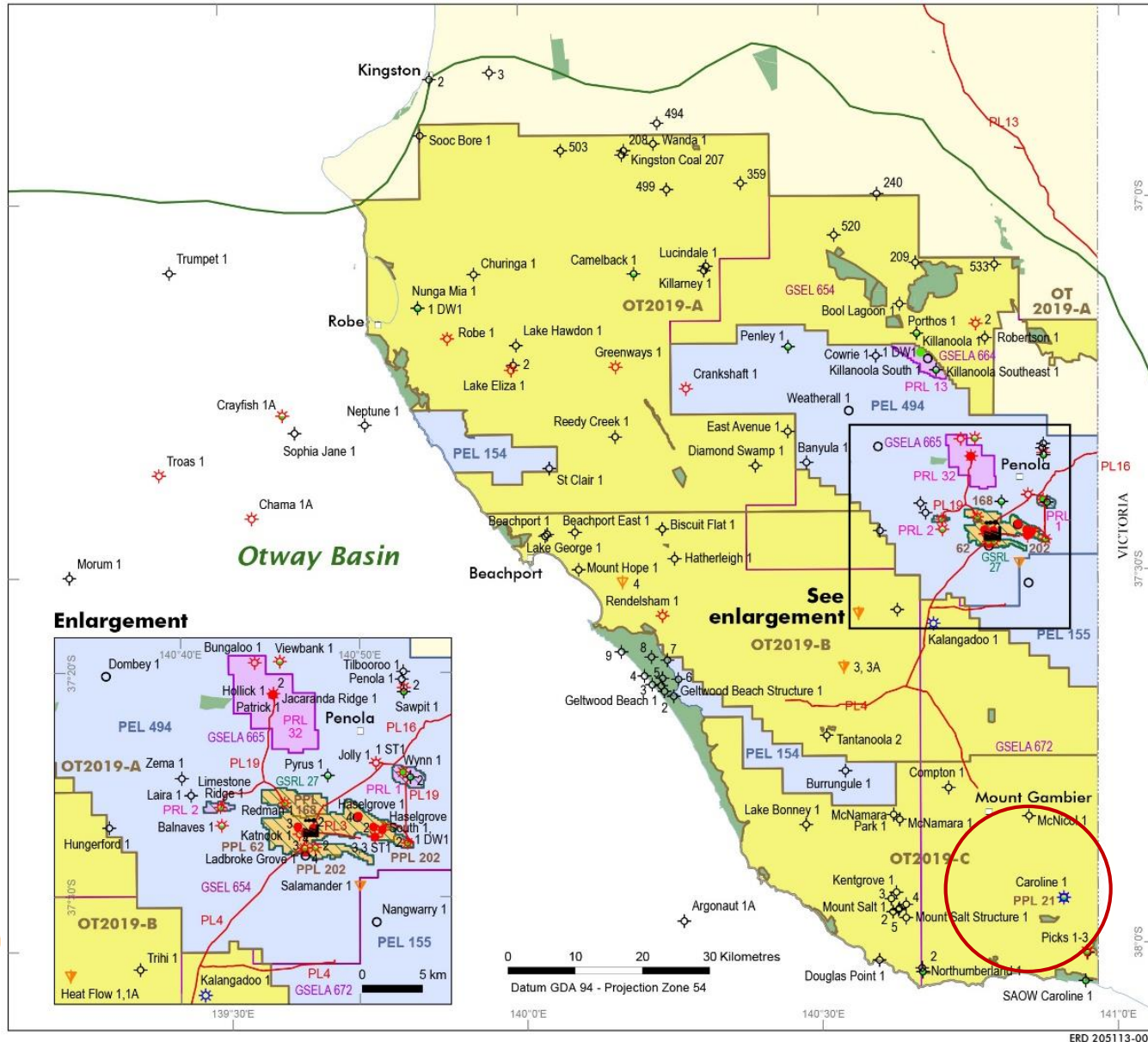
Normal land-plant-sourced oils of such maturity have a paraffinic (or paraffinic-naphthenic) composition. The highly aromatic character of the Caroline-1 crude may reflect the role of CO<sub>2</sub> in its origin. For example, it is conceivable that high pressure magmatic CO<sub>2</sub> (Chivas et al., 1986) stripped small quantities of aromatic and less soluble aliphatic hydrocarbons from marginally mature, poor quality terrestrial kerogen dispersed throughout the Waarra Sandstone. The Late Cretaceous Sandstone is the reservoir formation in the Caroline CO<sub>2</sub> field.





# Block OT2019 C

- Total Area (km<sup>2</sup>): ~1461
- Wells within blocks: 11
- 2D Seismic (Line km): ~1430
- 3D Seismic (km<sup>2</sup>): ~93.3
- Oil associated with CO<sub>2</sub> (Waarre Sst) in Caroline 1 (1968)
- Located south of Tartwaup Hingeline characterised by rapidly thickening Late Cretaceous wedge
- Potential for Late Cretaceous Waarre Sst oil charged from Intra Eumeralla Fm coals away from master faults



# Otway Basin Acreage Release Blocks OT2019 A-C

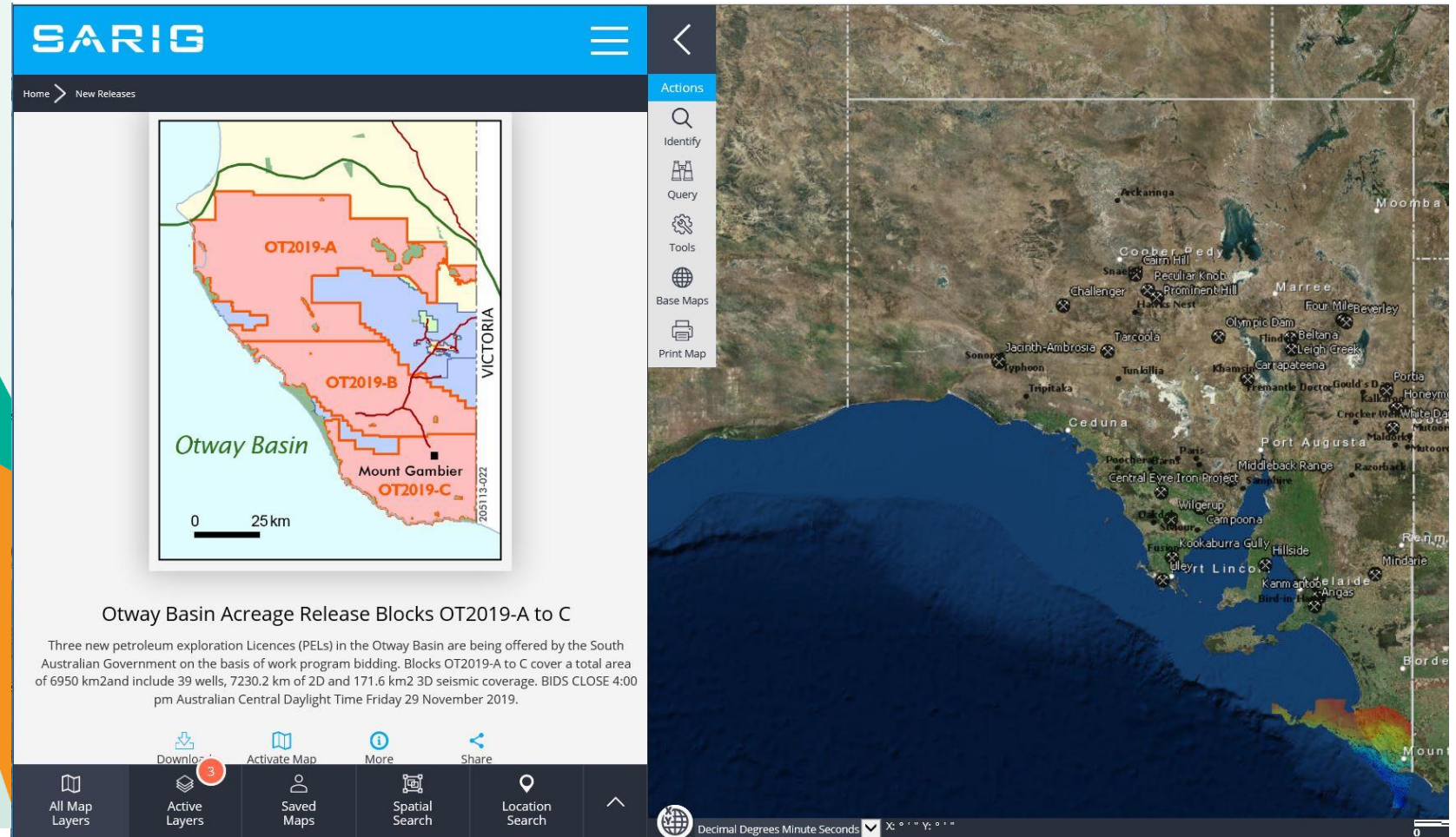
Department for Energy and Mining

South Australia  
**OTWAY BASIN**  
Acreage Release  
OT2019 A-C

BIDS CLOSE 4.00 pm ACDT  
Friday 29 November 2019

[www.energymining.sa.gov.au/petroleum](http://www.energymining.sa.gov.au/petroleum)

 SOUTH AUSTRALIA  
Government of South Australia  
Department for Energy and Mining



To download Acreage Release brochure and associated data package go to: <https://map.sarig.sa.gov.au/> or visit: [http://energymining.sa.gov.au/petroleum/licensing\\_and\\_land\\_access/acreage\\_releases/ot2019\\_otway\\_basin\\_acreage\\_release\\_onshore](http://energymining.sa.gov.au/petroleum/licensing_and_land_access/acreage_releases/ot2019_otway_basin_acreage_release_onshore)



# 10 Year Moratorium on Fracture Stimulation in the Limestone Coast Region

The Petroleum and Geothermal Energy (Ban on Hydraulic Fracturing) Amendment Bill 2018 was proclaimed on 1 November 2018. Hydraulic fracturing across the Limestone Coast Region has been banned for a period of 10 years.

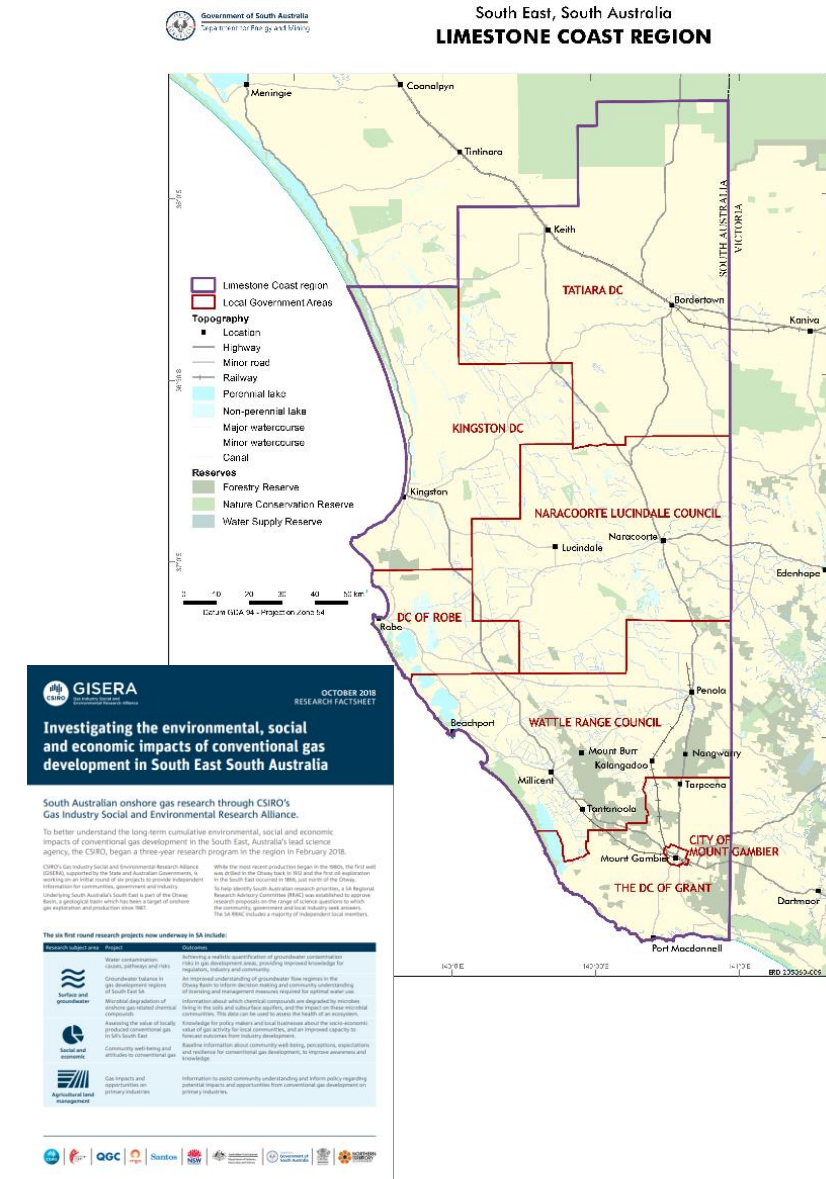
[http://energymining.sa.gov.au/petroleum/latest\\_updates/10\\_year\\_moratorium\\_on\\_fracture\\_stimulation\\_in\\_limestone\\_coast\\_region\\_sa](http://energymining.sa.gov.au/petroleum/latest_updates/10_year_moratorium_on_fracture_stimulation_in_limestone_coast_region_sa)

However it is business as usual for conventional petroleum exploration and development.

## Stakeholder Engagement

In 2018, the State Government partnered with the Commonwealth Scientific and Research Organisation (CSIRO), through the Gas Industry Social and Environment Research Alliance (GISERA), to undertake social and environmental research on the potential impacts and opportunities of onshore gas development on the environment and communities in the Otway Basin in South Australia's South East. For more information go to:

<https://gisera.csiro.au/states/sa/>



# Easy access to data

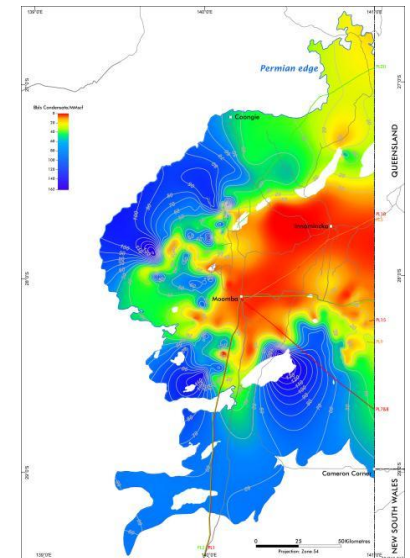
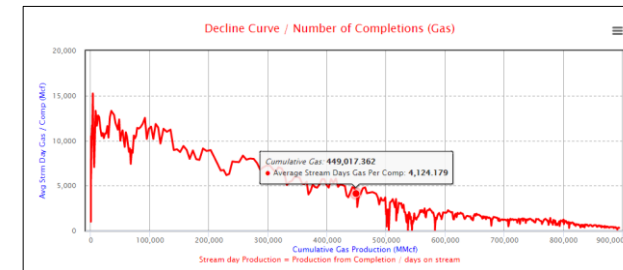
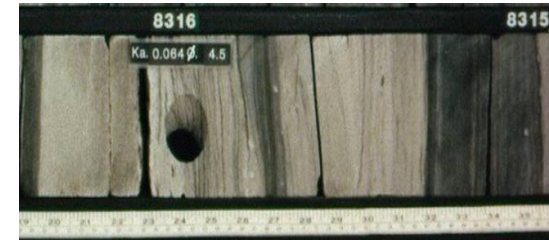
## Free Downloads:

- WCRs - include scanned mud logs & composite logs
- Well log LAS files
- Digital well logs + images
- 2D & 3D seismic data
- Maps, GIS - Cooper isolith, isopach, gas wetness etc.
- Core & thin section photo databases via free downloads
- SARIG – our online spatial database.

## Other data:

- Field, edit tapes, cased hole, digital mudlogs, image logs – free web access to logs via PEPS online in future
- Core and cuttings available for viewing and sampling
- OT2019 & CO2019 Acreage Release brochures contain **dedicated cloud storage link** to selected basin specific datasets including SEG-Y seismic data, logs, reports, GIS Project etc.

The screenshot shows the PEPS website with a blue header containing the logo and navigation links: About, Contact Us, User Feedback. Below the header is a dark grey bar with a menu: Licensing, Wells, Geophysics, Operation Sites, Compliance, Production, Reports, Data Library, System Tools. The main content area is titled 'Petroleum and Geothermal Information' and features a grid of six image-based links: Licensing (document with pen), Wells (oilfield landscape), Geophysics (seismic map), Compliance (worker at rig), Production (oil pumpjack), and Legislation / Reports (chart). Below this grid are three columns: 'Favourites' (Production: Oil Reservoir Data), 'Recently Viewed' (a list of documents like 'Alisma 002 - Overview'), and 'Recently Edited' (Data Library, Core Inspections).





# South Australia's door is open.



**Visit us at our booth**

**[www.energymining.sa.gov.au/petroleum](http://www.energymining.sa.gov.au/petroleum)**

