



decisions with confidence

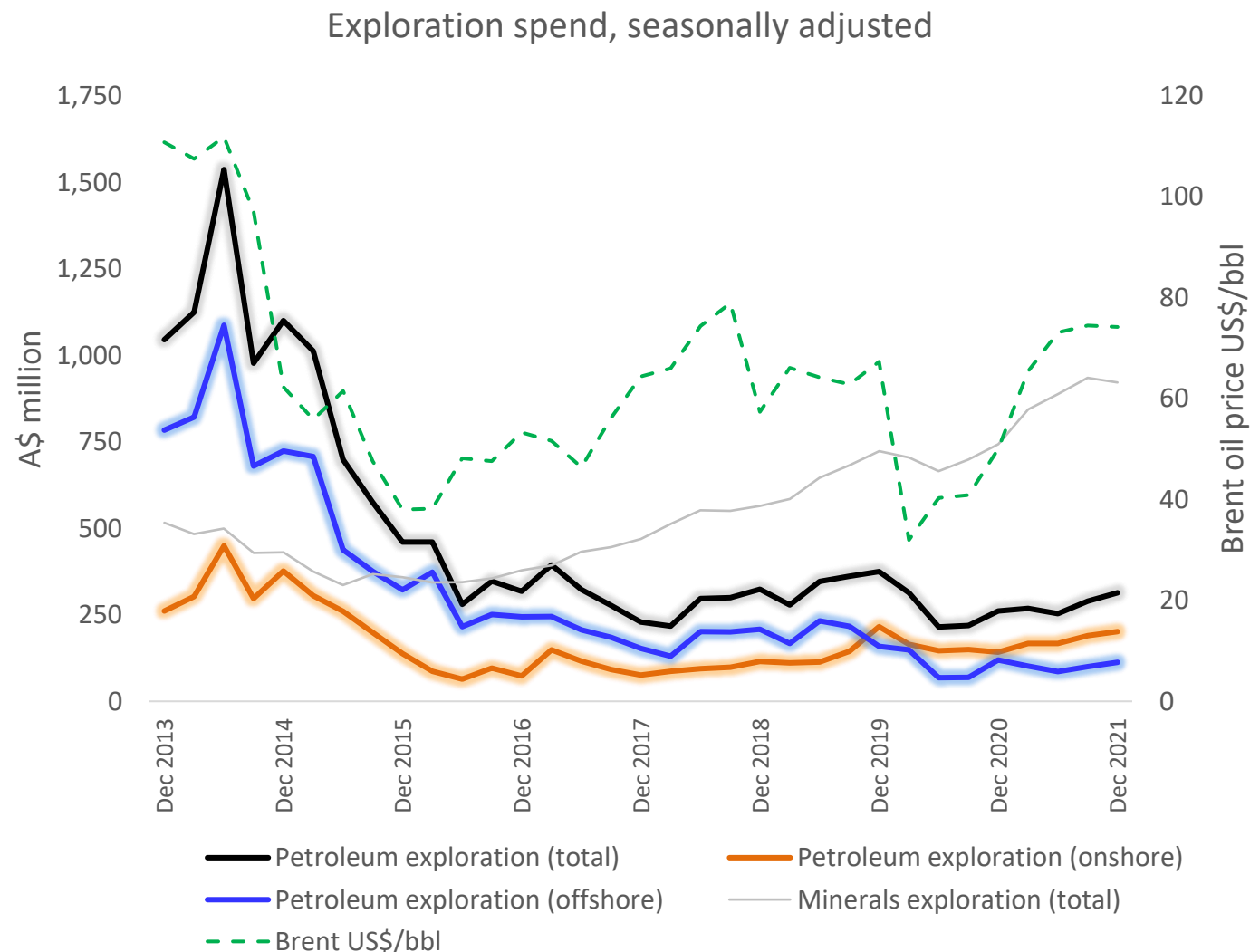
2021 Exploration & Appraisal Year in Review

Adam Craig APPEA Conference 2022



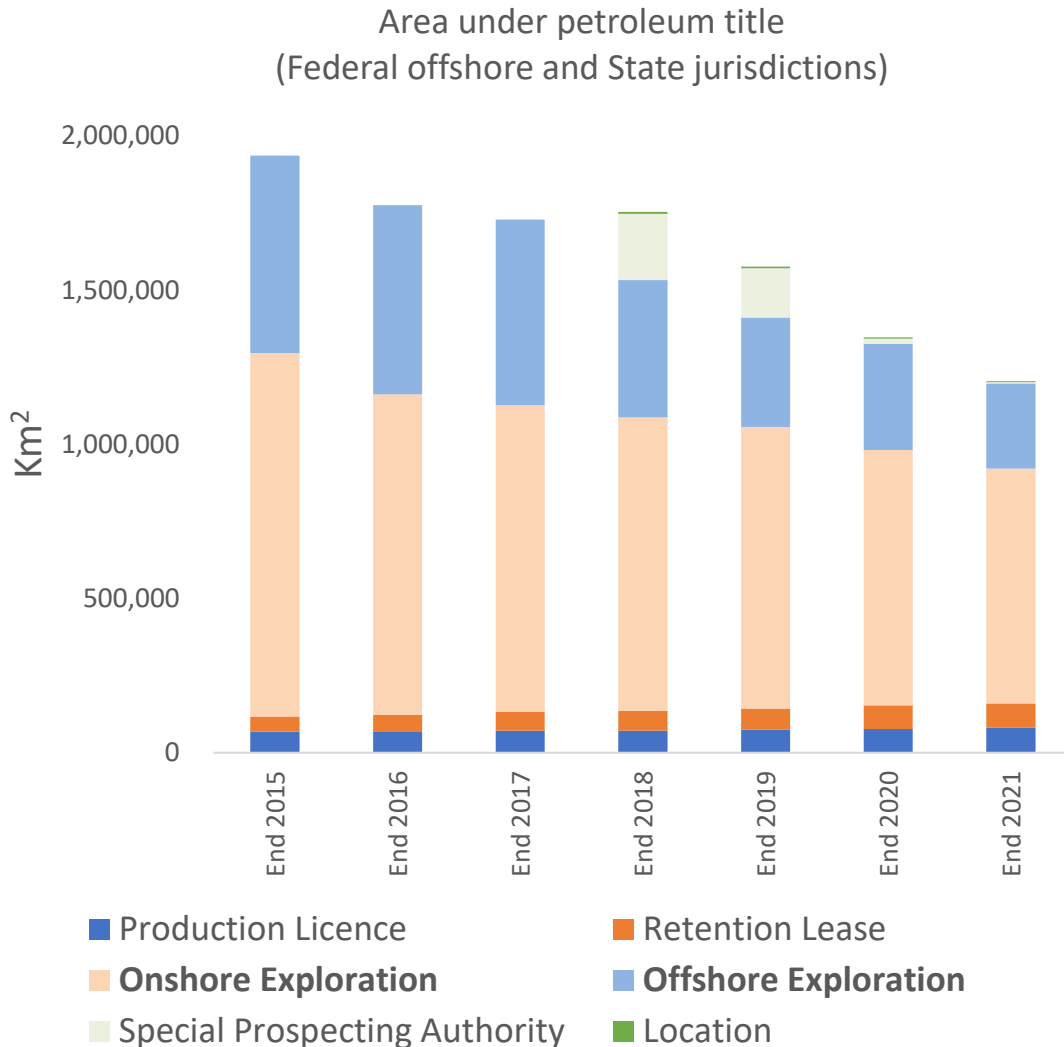
- Petroleum exploration spend, *trends and observations*
- Area under petroleum title, *trends and observations*
- Federal Offshore Release Round bids and awards, *analysis and observations*
- Summary of exploration acreage releases and permits awarded
- Summary of exploration transactions & farmins
- Summary of exploration & appraisal activity – wells and surveys
- Key exploration and appraisal well summaries
- Summary, key take-aways & acknowledgements

Petroleum Exploration Spend



- **Petroleum exploration spend in total rose 8.3% (A\$24.2 million) to A\$314.1 million**
- **Onshore exploration spend rose 6% (A\$11.4 million) to A\$201.3 million**
- **Offshore exploration spend rose 12.7% (A\$12.7 million) to A\$112.7 million**
- **Onshore exploration spend has been greater than offshore spend since late-2019**
- **For comparison, minerals exploration spend for 2021 was A\$921.5 million**

Australian Petroleum Titles

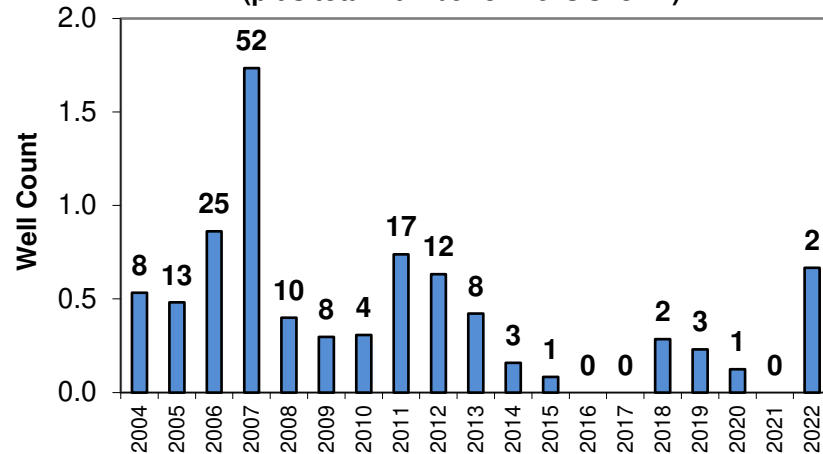


- The only things going up are production licenses and retention licenses
- Area under production licenses has grown 18% over 6-years, on average 3-4% per annum
- Area under retention lease has grown 63% over 6-years, on average 9% per annum
- **Area under exploration license has decreased 43% over 6-years**
 - -35% onshore, on average -7% per annum
 - -57% offshore, on average -13% per annum
- Offshore exploration licenses represented 35-38% of the total (2015-2018) declining ever since to 27% in 2021

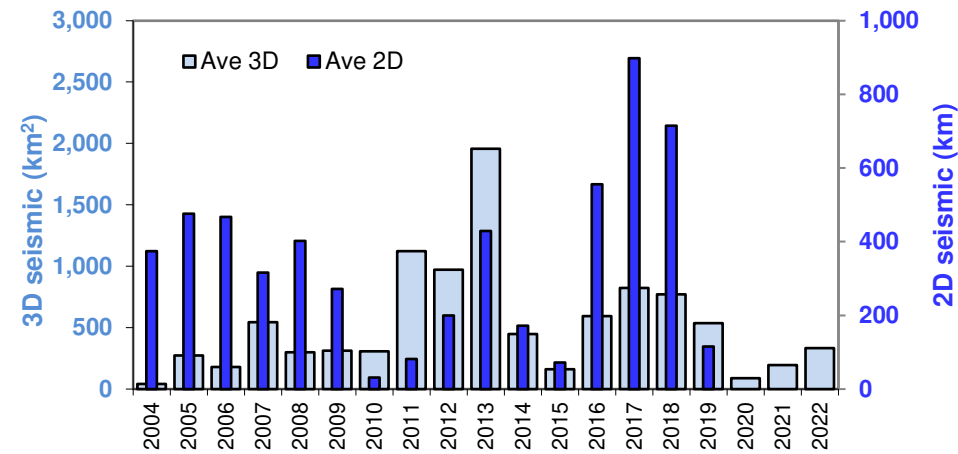
Federal Offshore Release Round Bids & Awards



Average commitment wells bid per award
(plus total number of wells shown)



Average seismic commitment bid per award



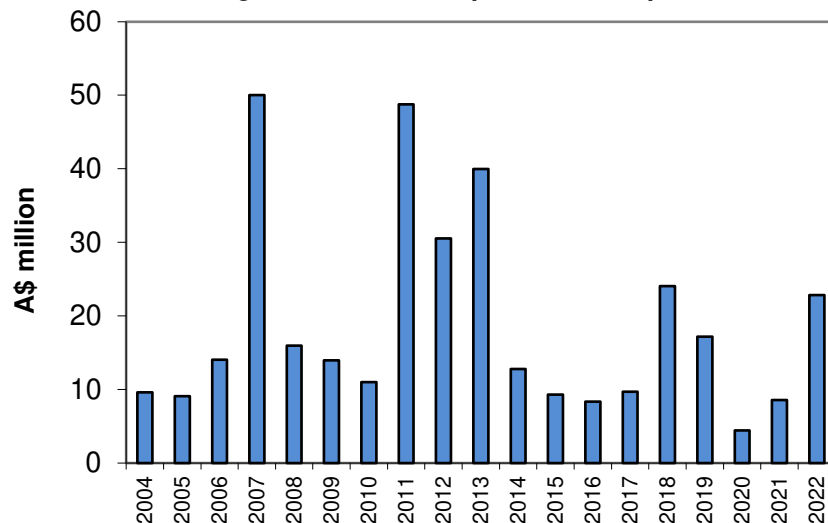
In 2021.....

- 8 Federal offshore exploration licenses awarded
- No firm wells in guaranteed work program
- 1,362 km² of 3D
- A\$60.2 million in total firm expenditure
- 2 awards in Gippsland, 2 awards in Bonaparte, 3 awards in Carnarvon and 1 in the Vulcan
- 6 awards from 2019 release round (bids closed March 2020)
- 2 awards from 2020 release round (bids closed June 2021)

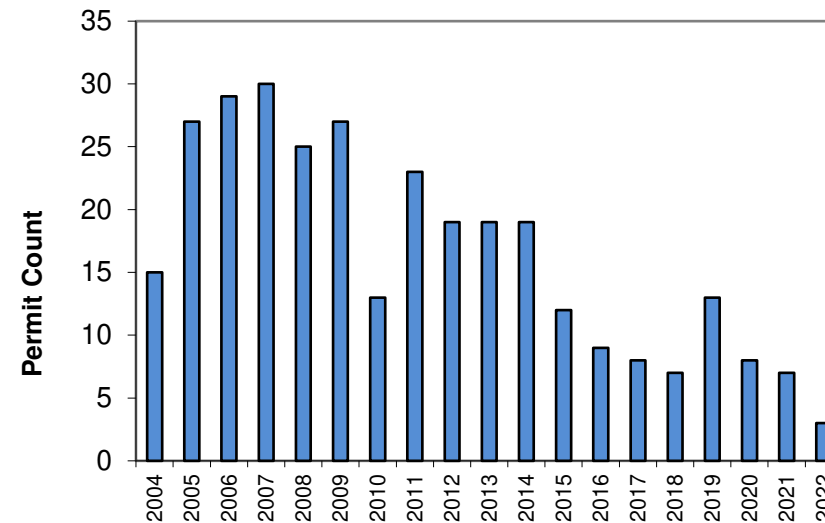
In 2022 so far

- 3 awards
- 2 firm exploration wells
- 1,000 km² firm 3D

Average commitment expenditure bid per award



Exploration titles awarded per year



Exploration Acreage Releases 2021



Federal Offshore Release Round

21 release areas

Opened June 2021, Closed 3 March 2022

(10 bids)

Federal Offshore GHG Storage Release Round

5 release areas

Opened 6 Dec 2021, Closed 10 March 2022

(9 bids)

Northern Territory Release Round

2 release areas – Georgina Basin

Opened 16 June 2021, Closed 16 Nov 2021

Queensland Release Round

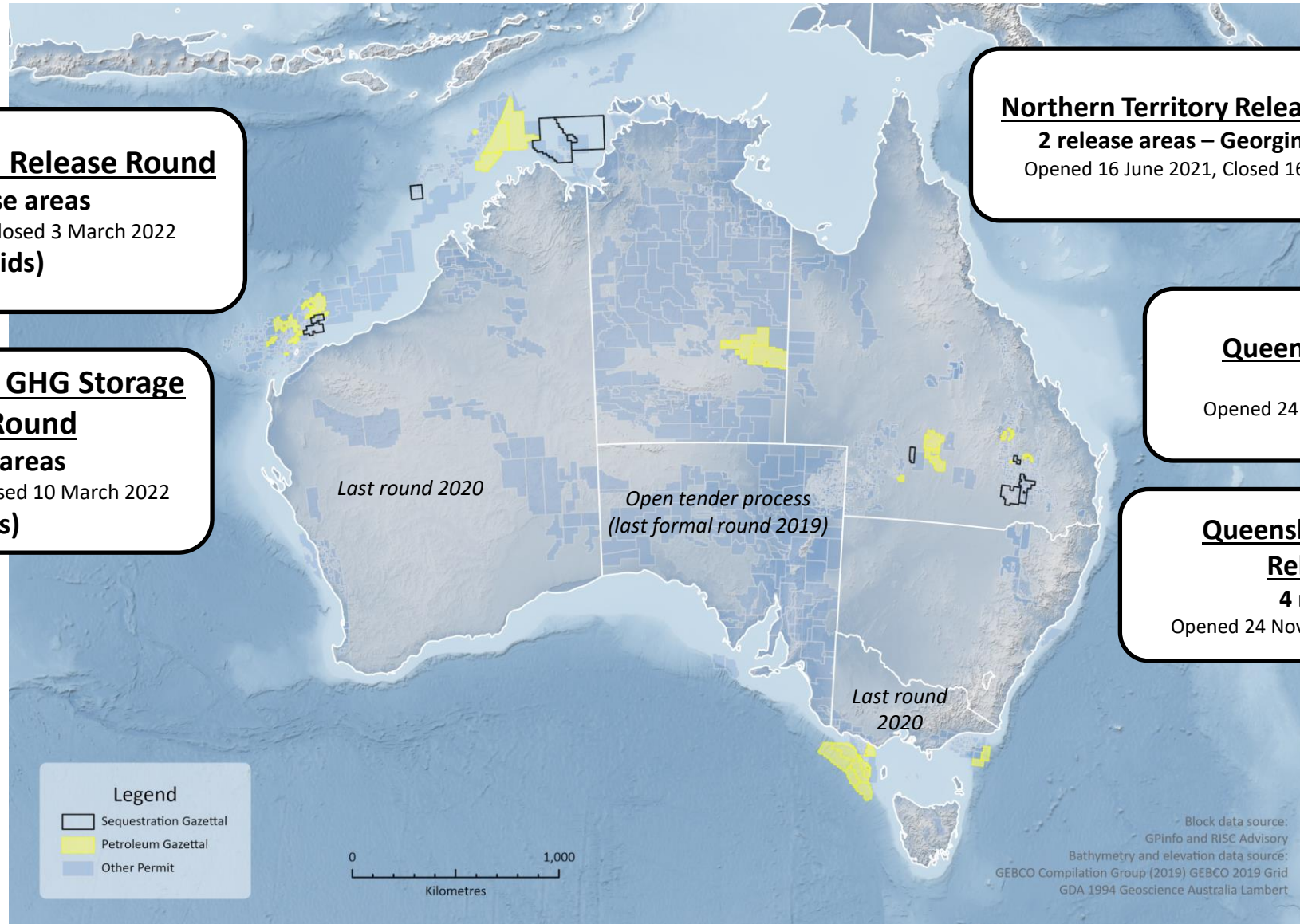
8 release areas

Opened 24 Nov 2021, Closed 4 March 2022

Queensland GHG Storage Release Round

4 release areas

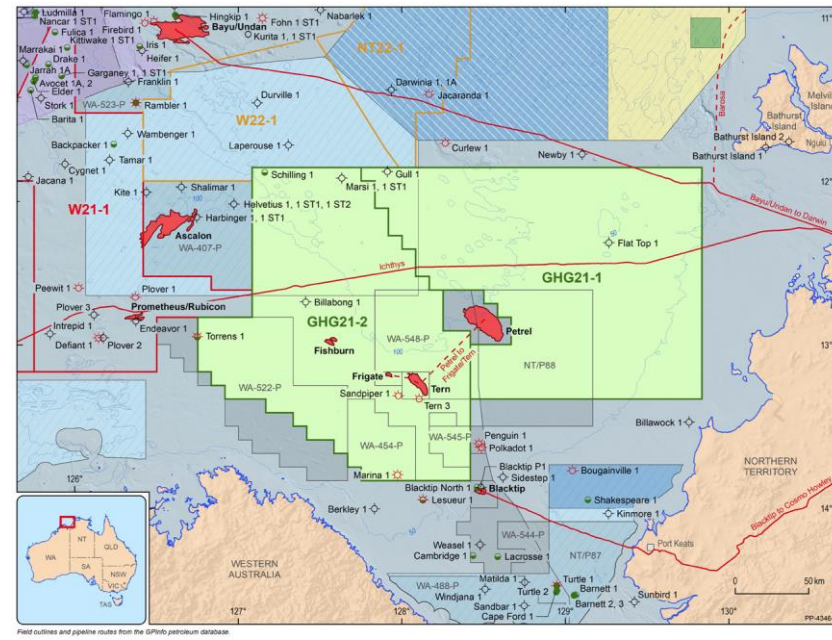
Opened 24 Nov 2021, Closed 7 March 2022



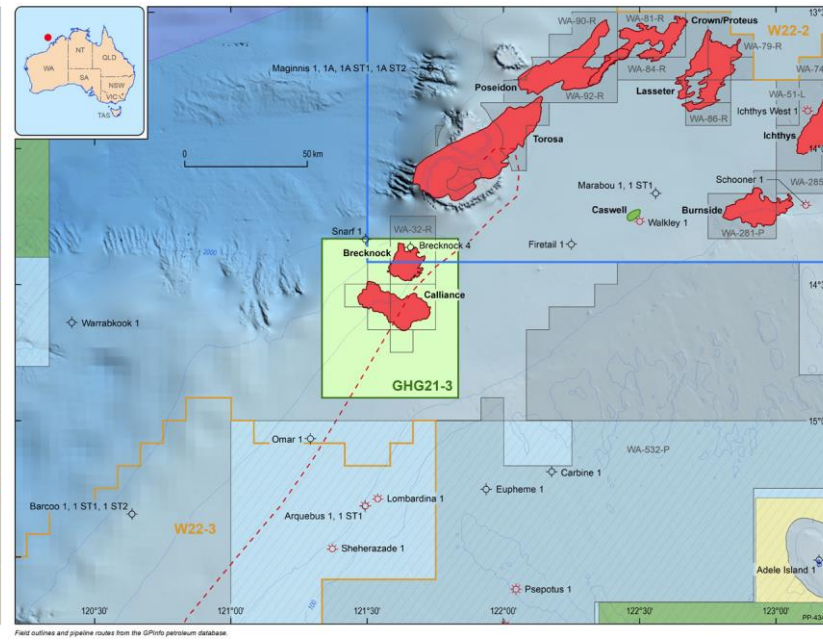
Offshore GHG Storage Release Round 2021



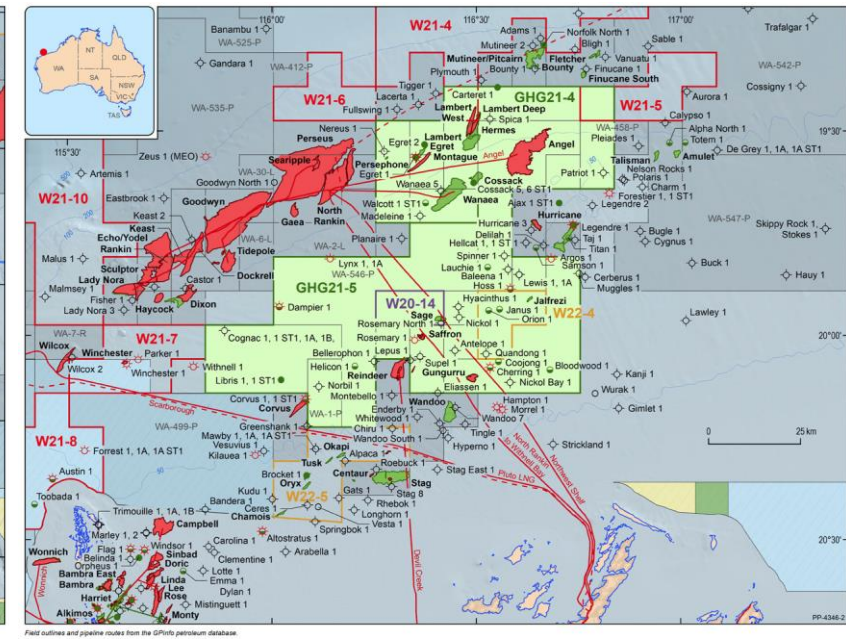
Bonaparte Basin



Browse Basin

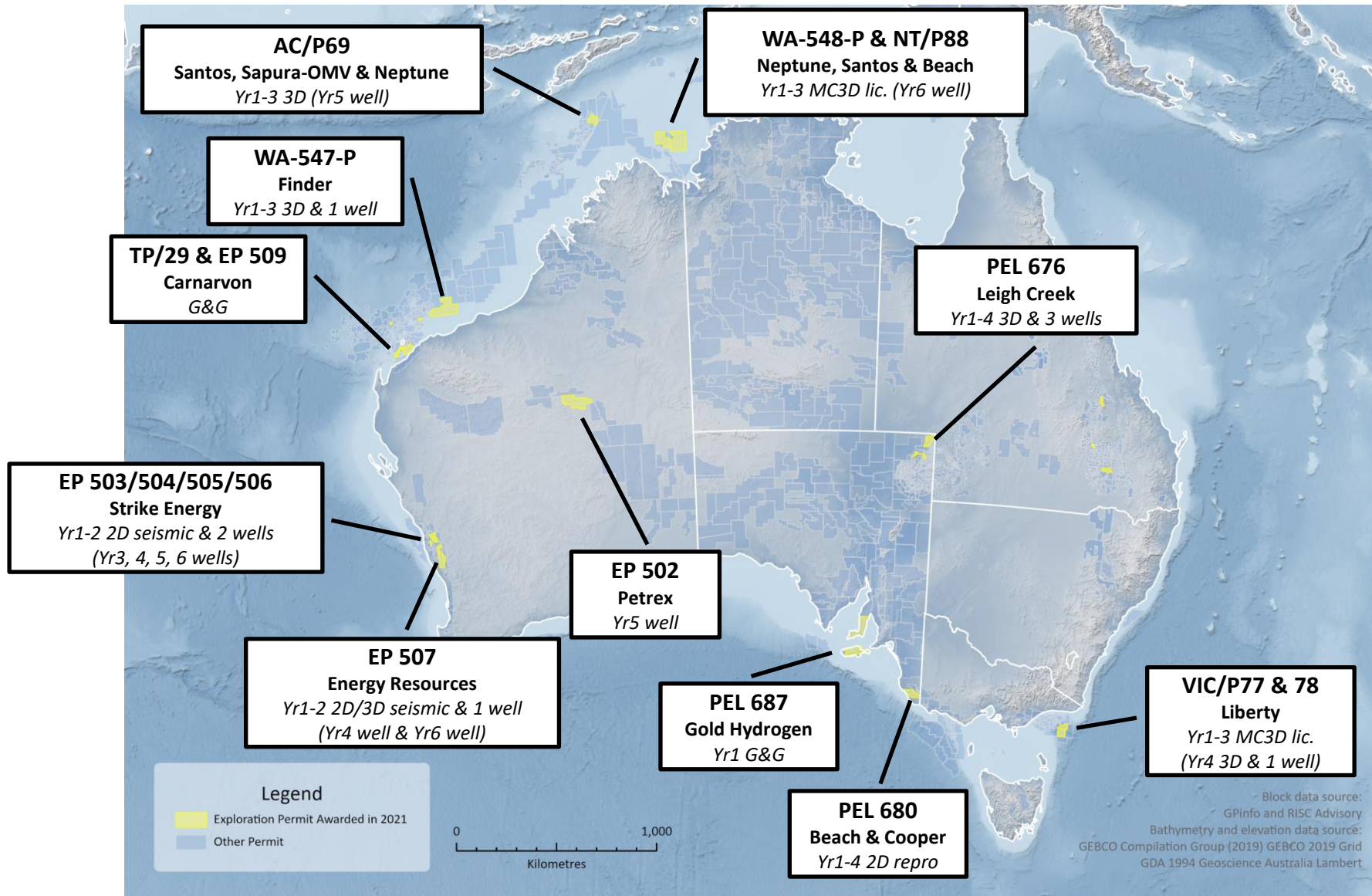


Northern Carnarvon Basin



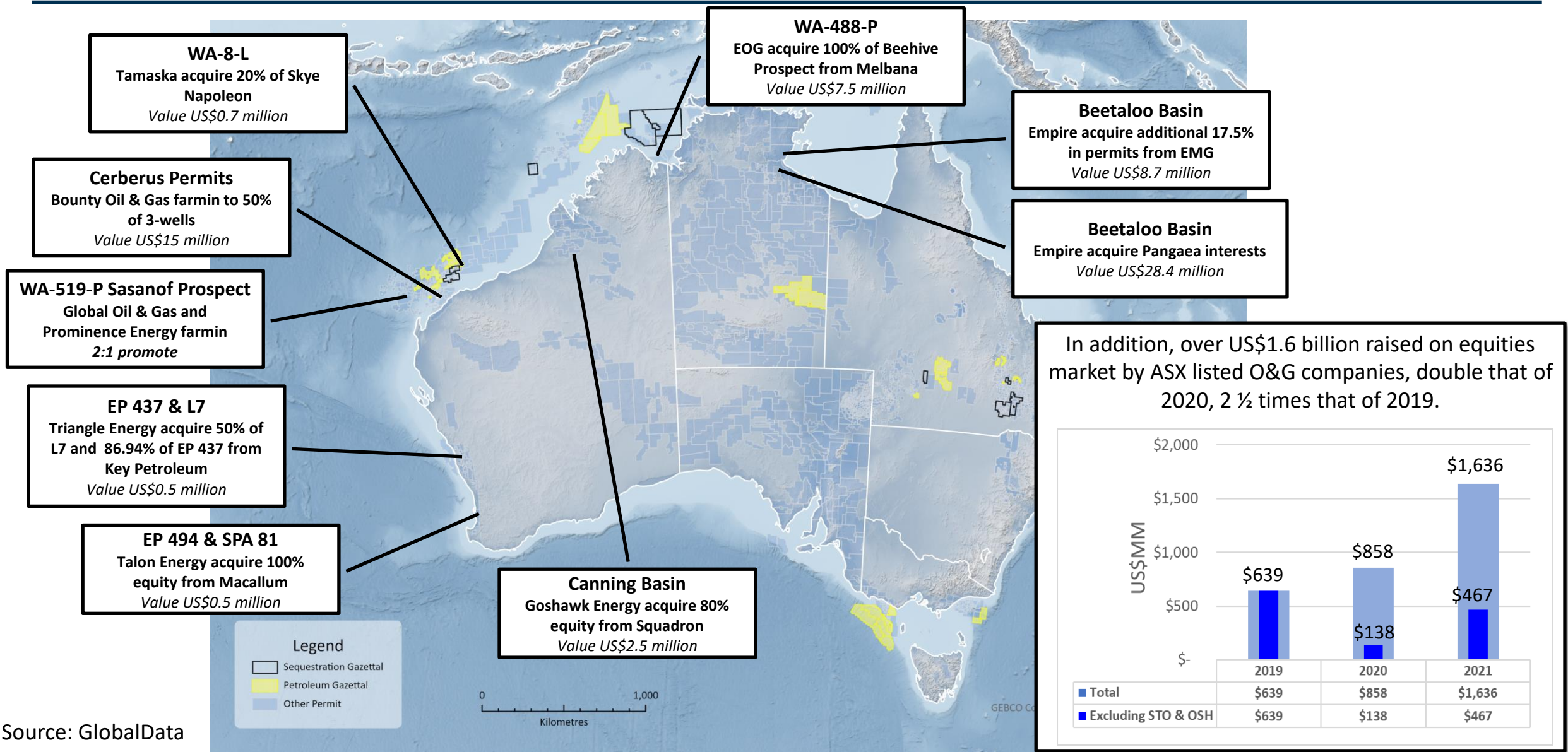
- First time offering of GHG Storage release areas under the OPGGSA (2006)
- 5 release areas
- Round opened 6 December 2021 (bids were due 10 March 2022)
- 9 bids (retrieved from NEATS)
- No awards as yet

Exploration Permits Granted 2021



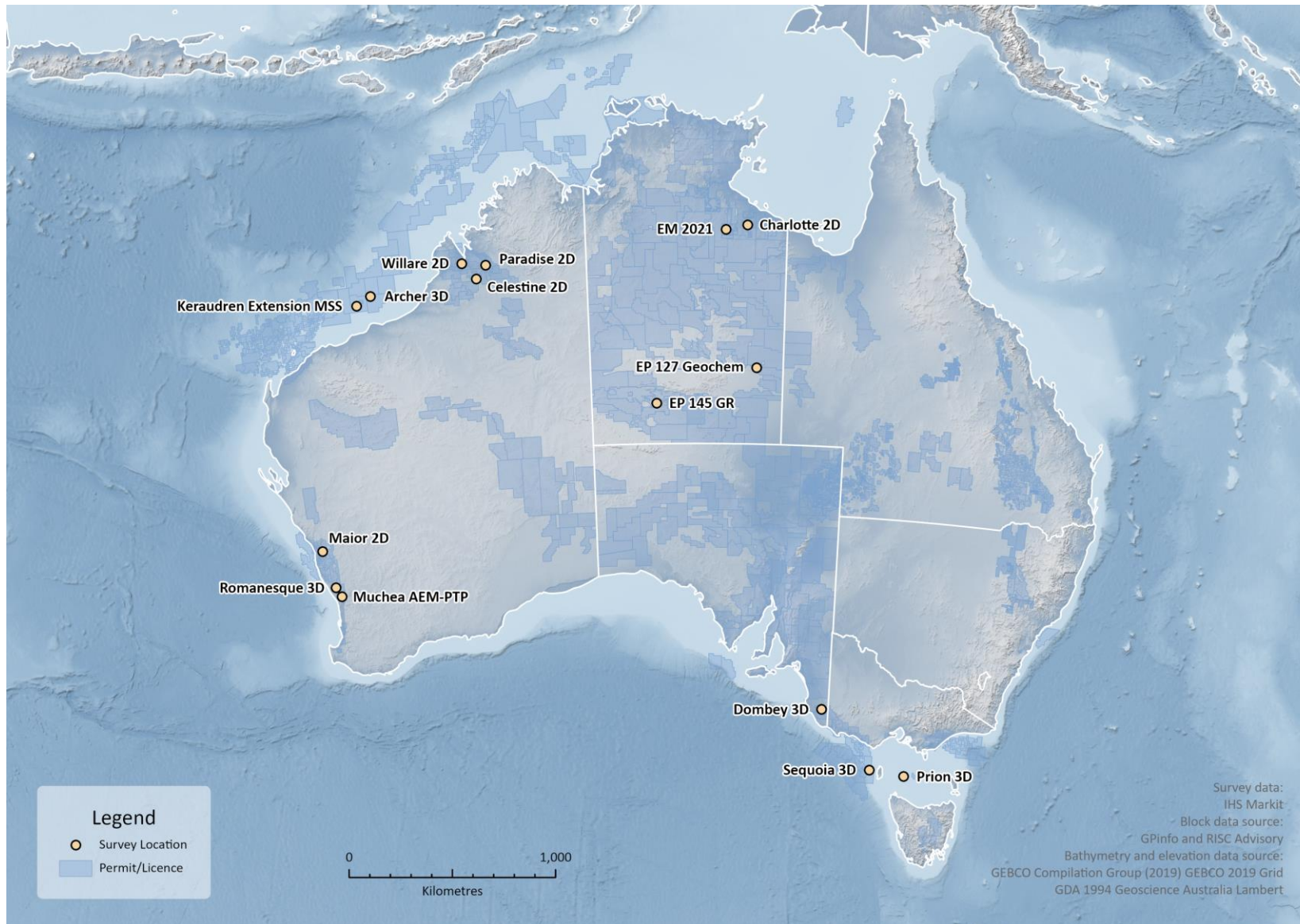
- 8 Federal offshore exploration licenses awarded in 2021
- 3 offshore in WA state waters
- 6 onshore WA permits
- 3 onshore WA SPA's
- 4 onshore Queensland
- 3 onshore SA

Exploration Deals 2021

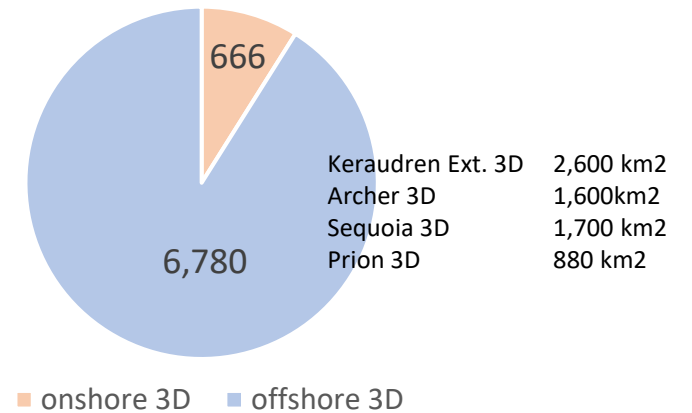


Source: GlobalData

Surveys Acquired in 2021

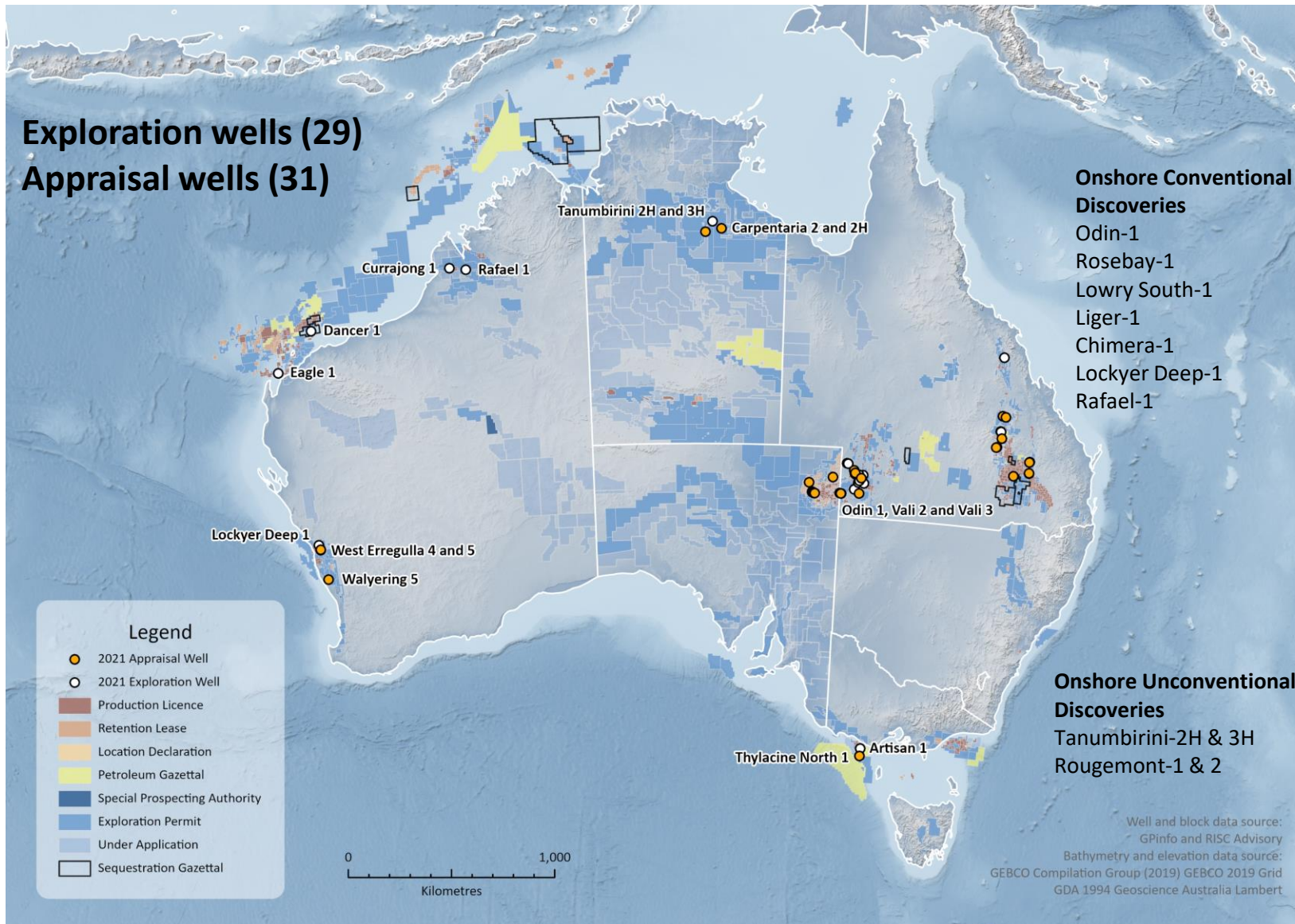


3D seismic (km²)

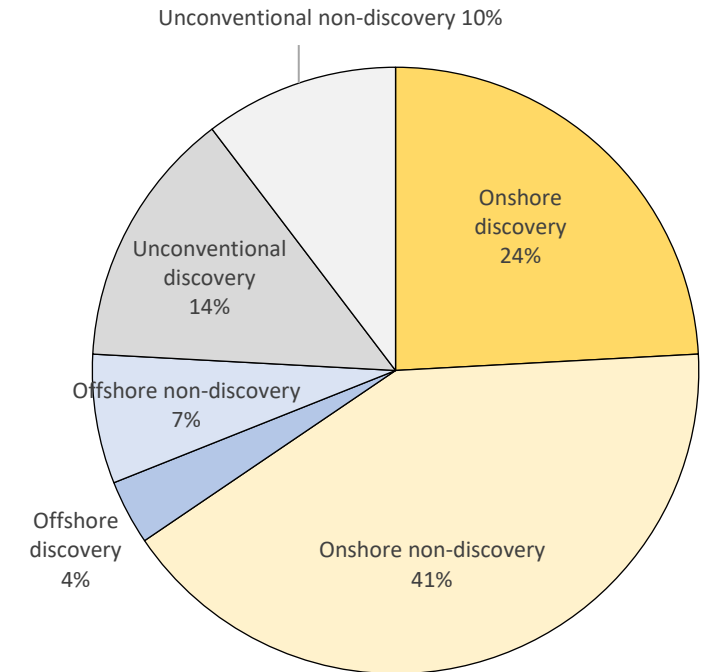


- Offshore 3D surveys = 3
- Onshore 3D surveys = 1
- Onshore 2D surveys = 6 (1,460 km)
- Other (EM, Geochem, Gravity) = 4

Exploration and Appraisal Wells Drilled 2021

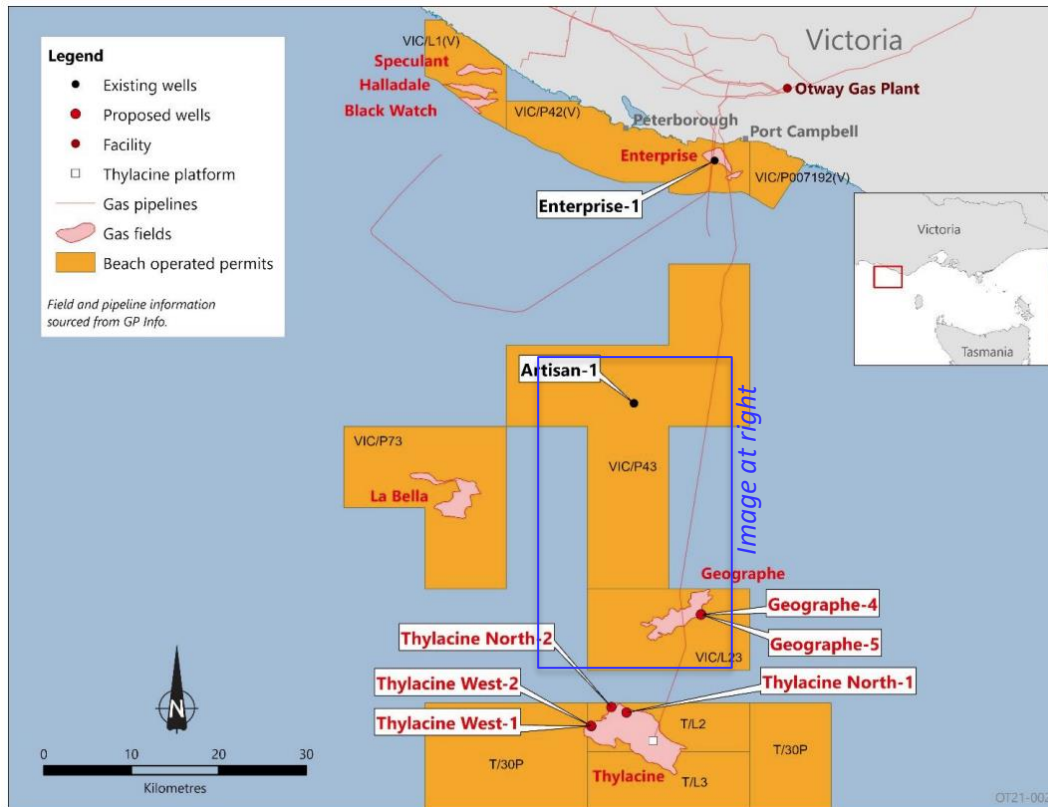


Exploration wells (n= 29)



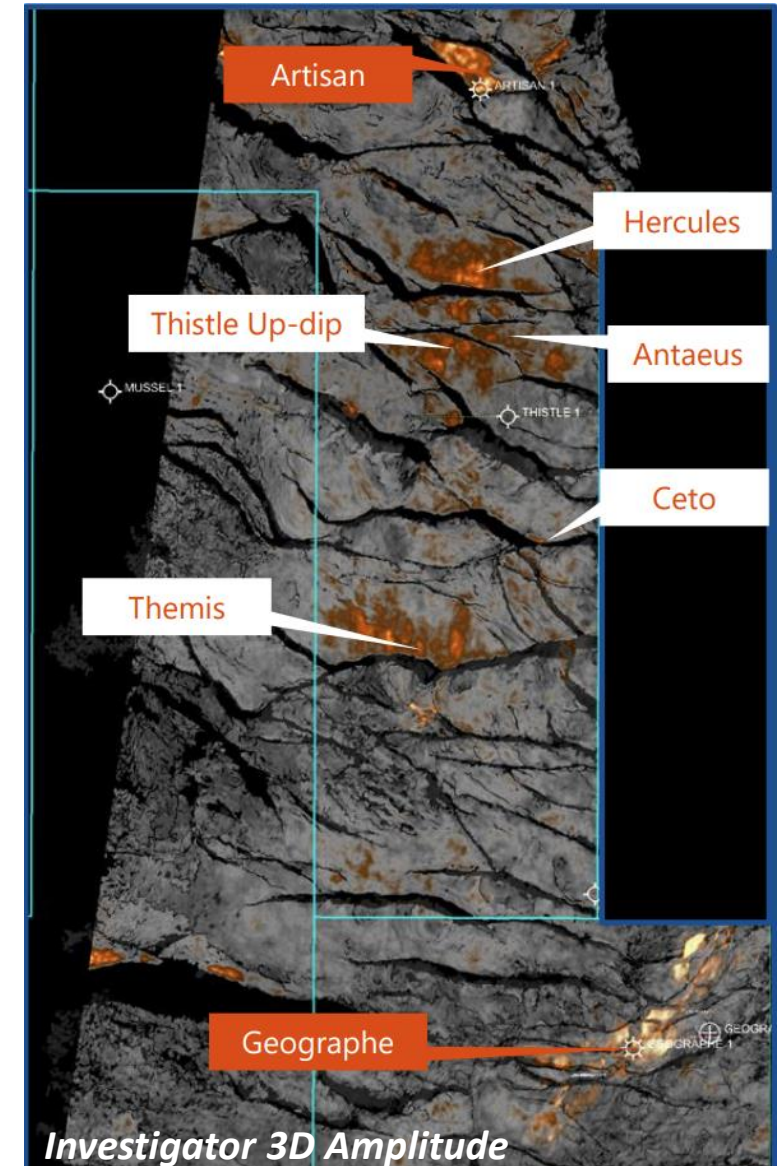
- Offshore exploration wells = 3
- Offshore discoveries = 1
- Onshore exploration wells = 26
- Onshore conventional discoveries = 7
- Onshore unconventional discoveries = 4

Artisan-1

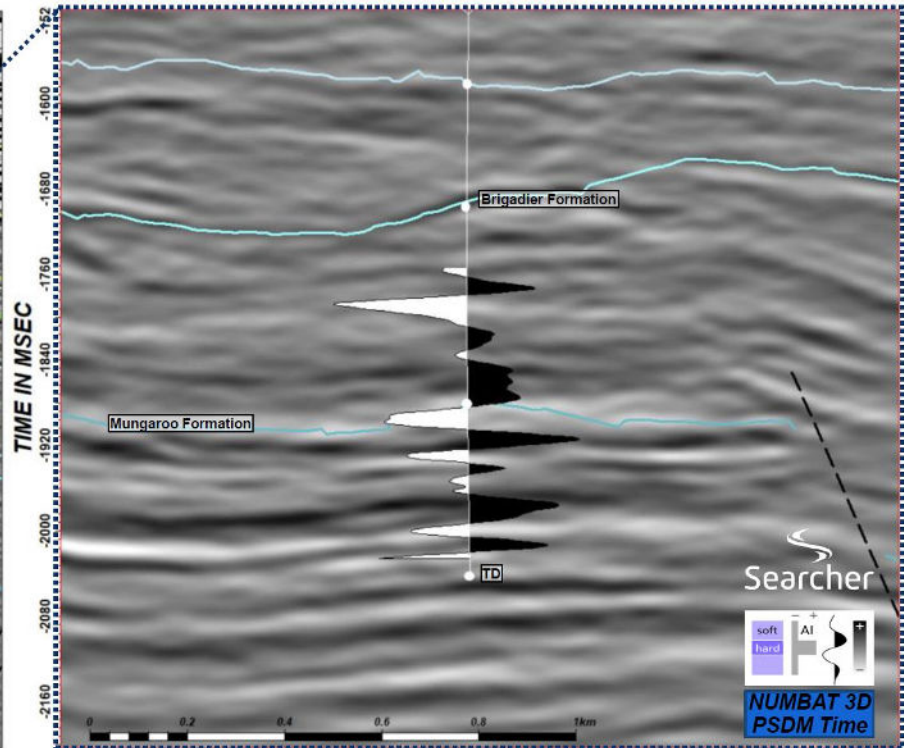
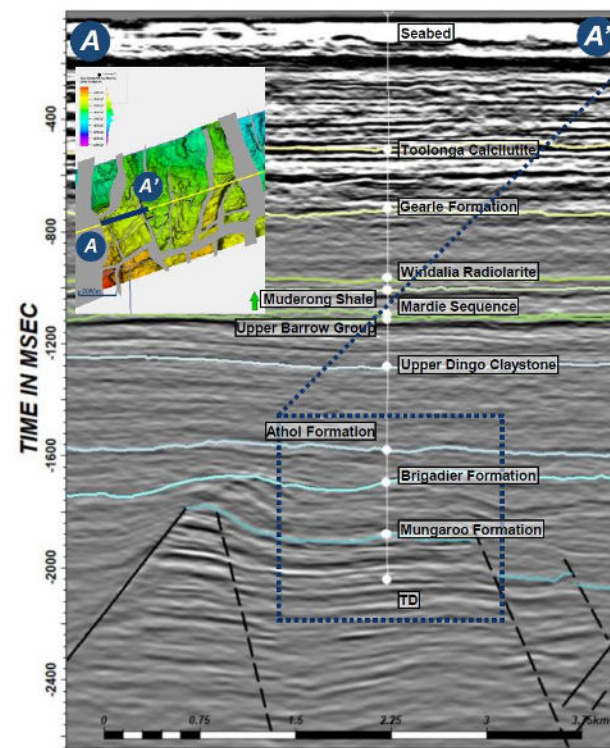
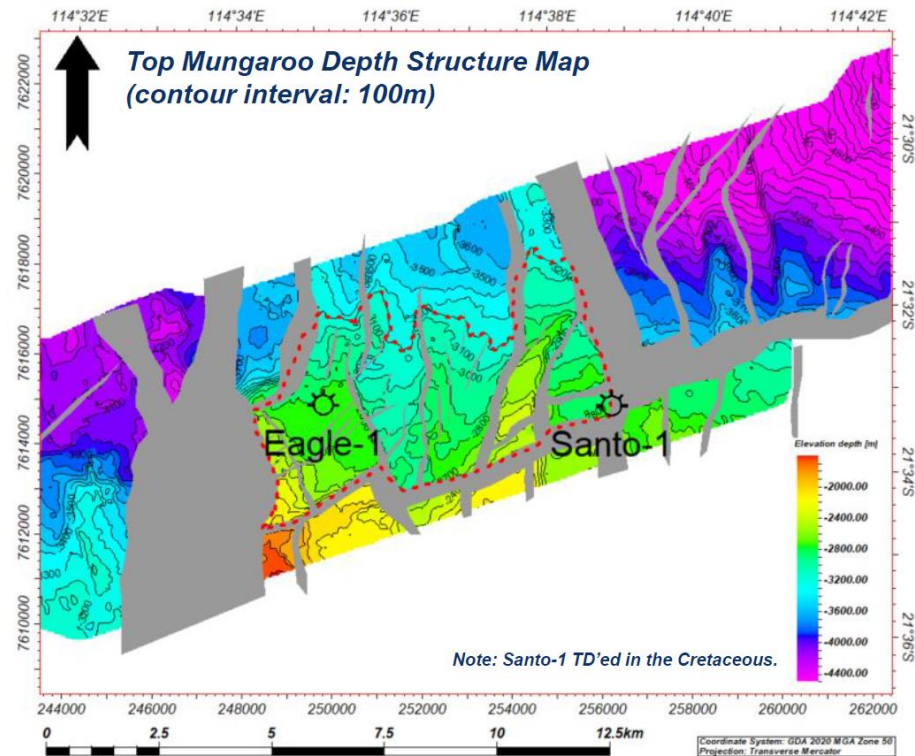


- Artisan-1 drilled February – March (VIC/P43) in 71 m water depth by Beach Energy
- Amplitude supported
- 69.5 m gross gas column in Upper Waarre Formation (90% NTG)
- 20.9 m gross gas column in Flaxman Formation (22% NTG)
- TD of 2,205 m
- EUR 11 MMboe gross (66 BCF)

Source: Beach Energy ASX releases and corporate presentations



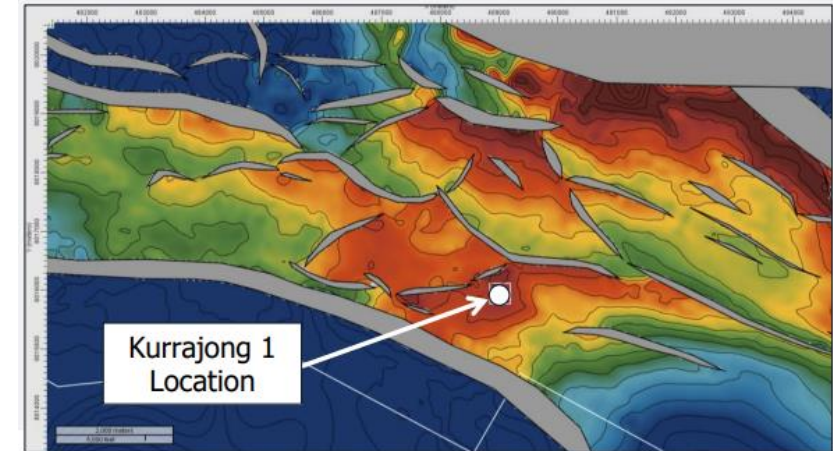
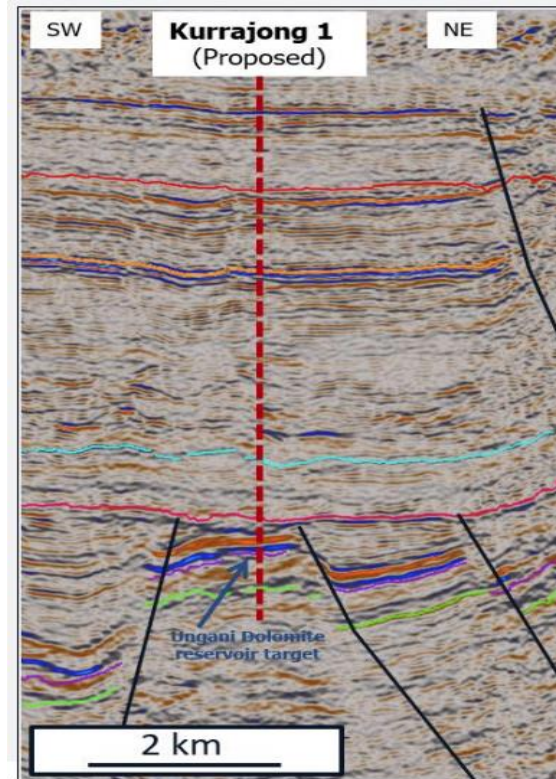
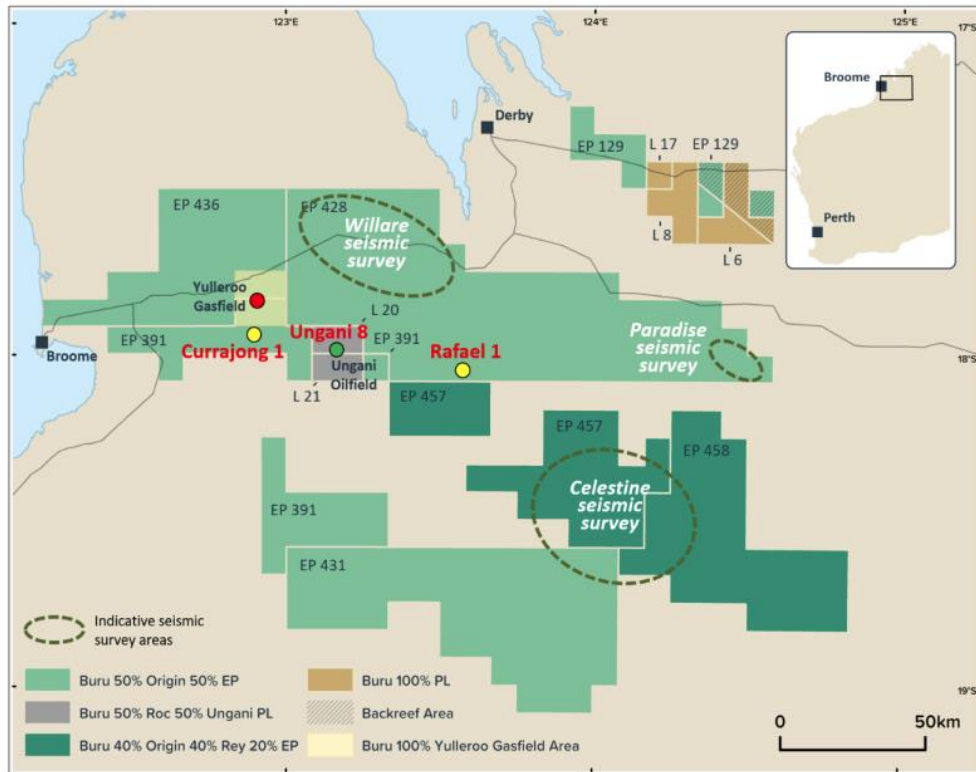
Eagle-1



Source: Sapura-OMV and Finder Energy

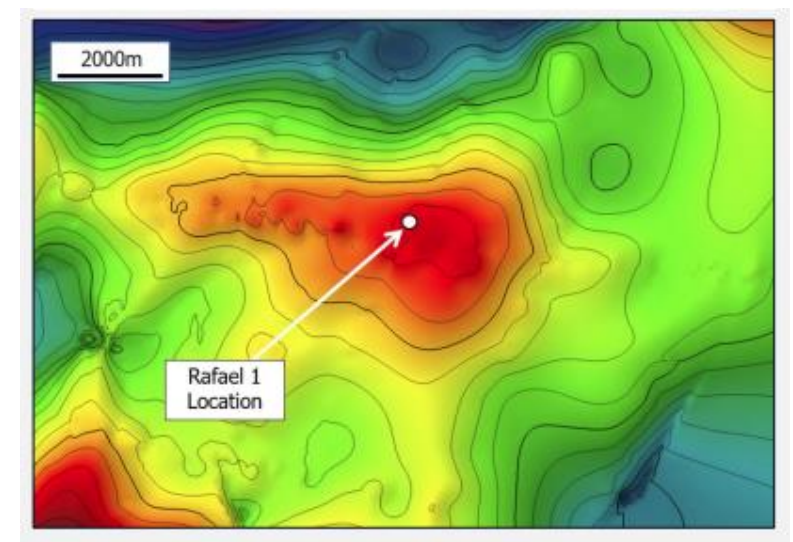
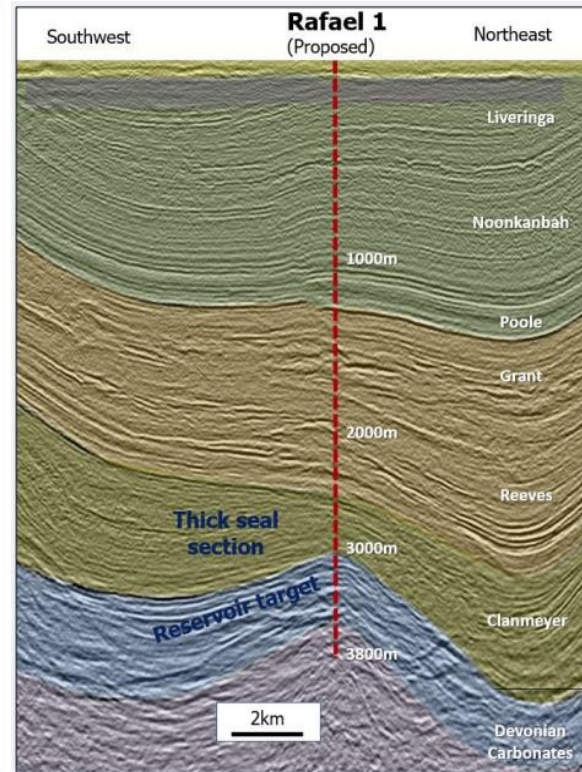
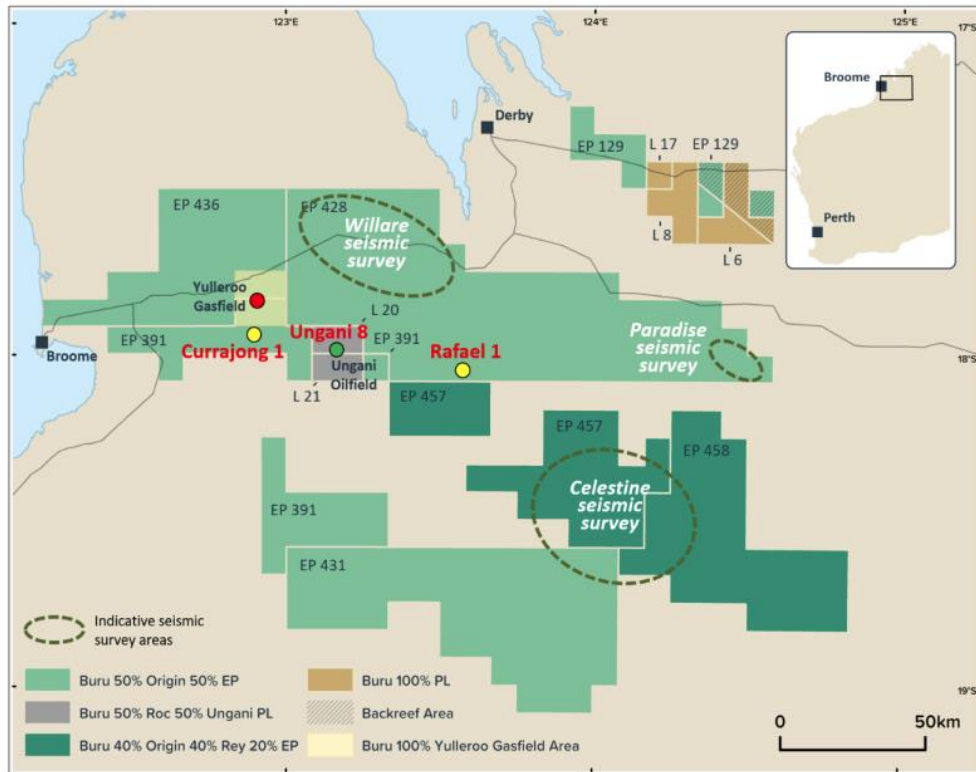
- Drilled May – June 2021 in TP/25 by Sapura-OMV and Finder Energy
- Tested Brigadier – Mungaroo Formation in a downthrown fault-dependent structural closure in the Long Island fault zone
- Intersected good to very good quality Mungaroo Formation reservoir sands with residual hydrocarbon shows
- Well failure attributed to breach of fault-seal

Currajong-1 & Raphael-1



- Currajong-1 drilled July – August (EP 391) and Raphael-1 drilled August – December (EP 428)
- Buru Energy Operator, Origin farmin wells
- Ungani Dolomite equivalent targets
- Currajong-1 intersected interpreted oil saturations in vugular porosity at Top Ungani Dolomite and within the lower Dolomite
- 4 zones tested, all zones water bearing
- Up to 6% natural hydrogen gas detected

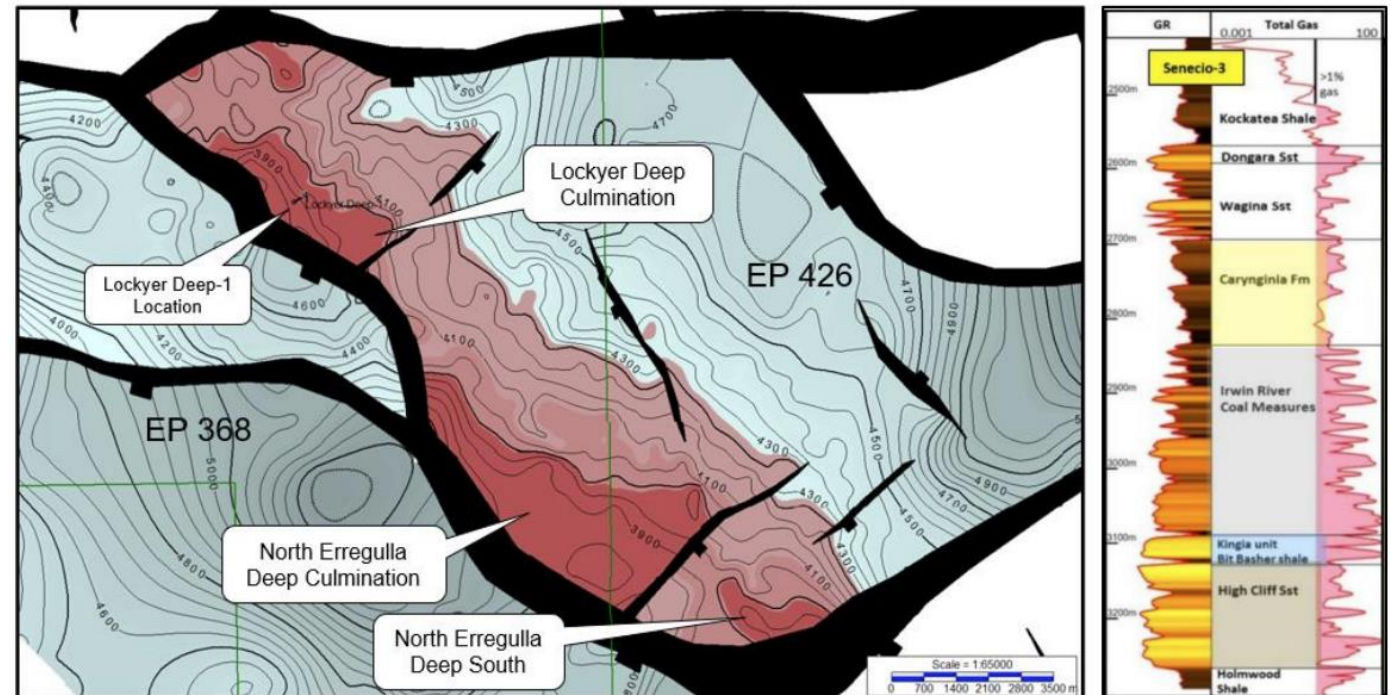
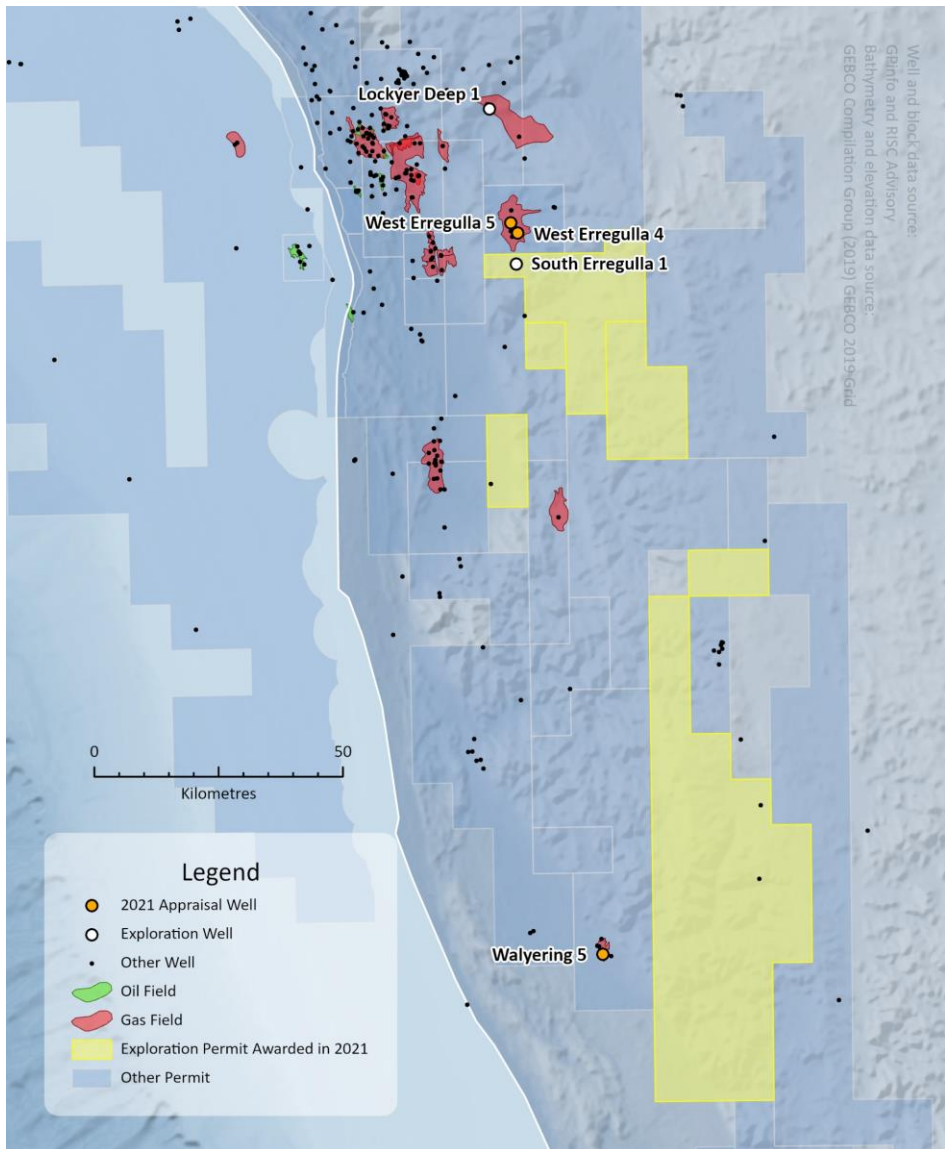
Currajong-1 & Raphael-1



- Currajong-1 drilled July – August (EP 391) and Raphael-1 drilled August – December (EP 428)
- Buru Energy Operator, Origin farmin wells
- Ungani Dolomite equivalent targets

- Raphael-1 intersected an interpreted 165 metre gas column (3,785 – 3,950 mMD) in Ungani Dolomite
- Gas down to evaluated
- Over-pressured interval
- Tested at rates up to 7.6 MMcf/d
- CGR of 40 bbl/MMcf
- Additional gas zones interpreted in Upper Laurel Dolomite and Anderson Formation

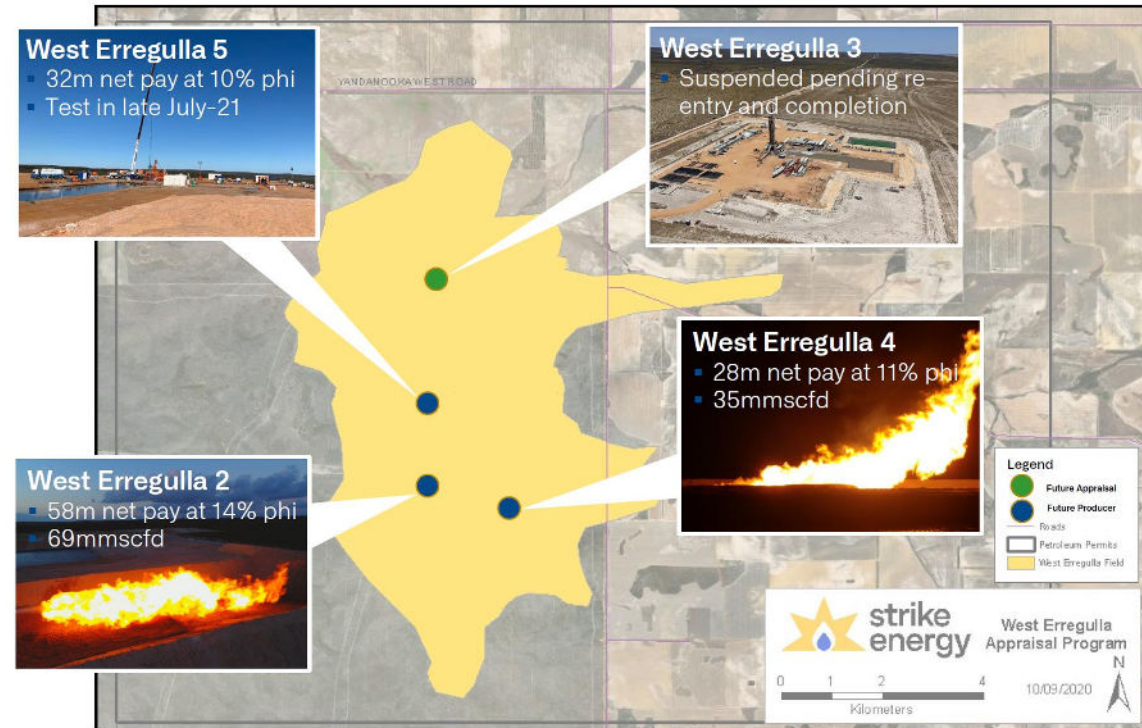
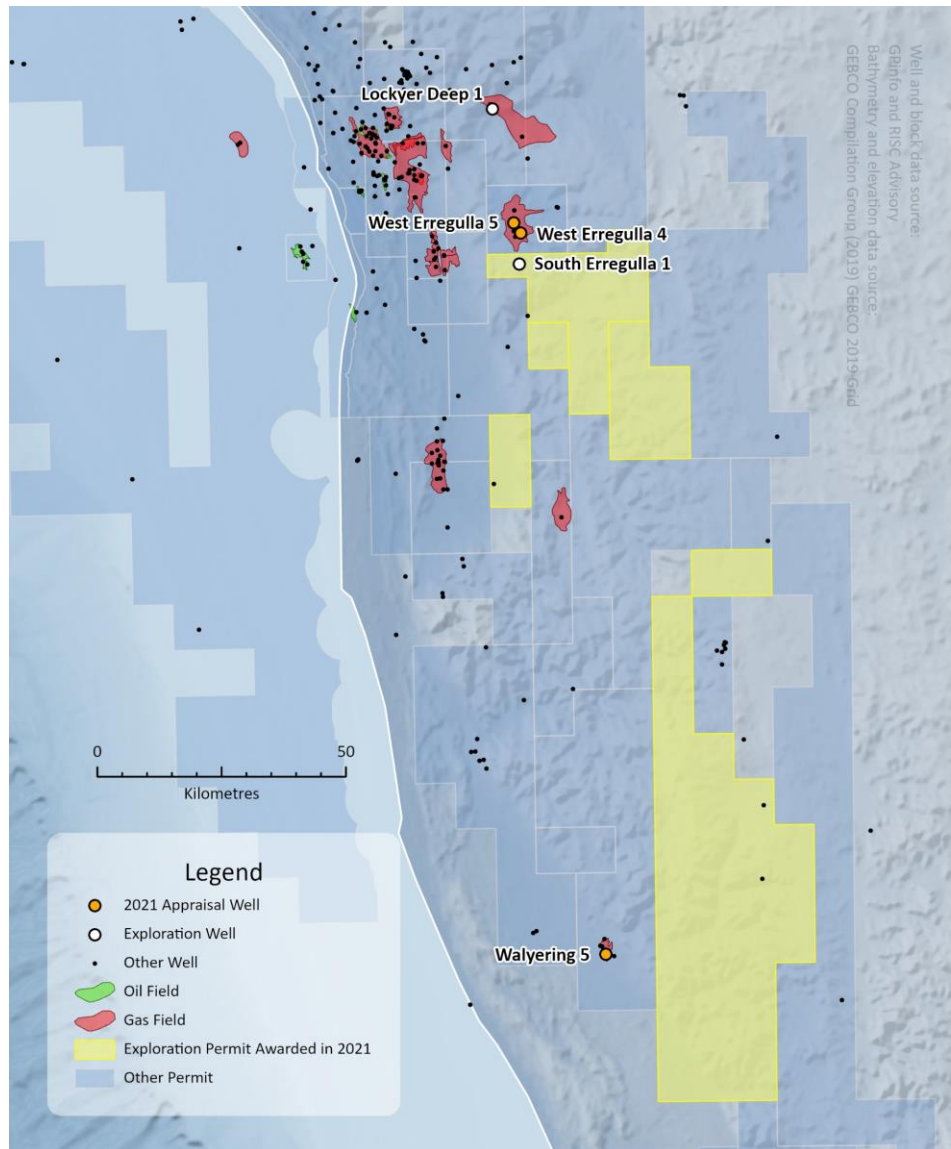
Perth Basin Drilling 2021: Lockyer Deep-1



Source: Energy Resources

- Lockyer Deep-1 drilled over July – November in EP 368 by Energy Resources and Norwest Energy
- 34 m gross gas interval with 20.2 m net pay in Kingia Sandstone
- 16% average porosity and estimated average permeability of 500 mD
- Reservoir pressure indicating potential long gas column
- Tested at rates up to 117 MMscf/d (sustained flow rate 102 MMscf/d)

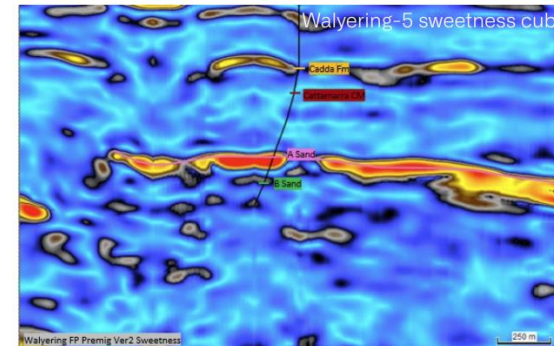
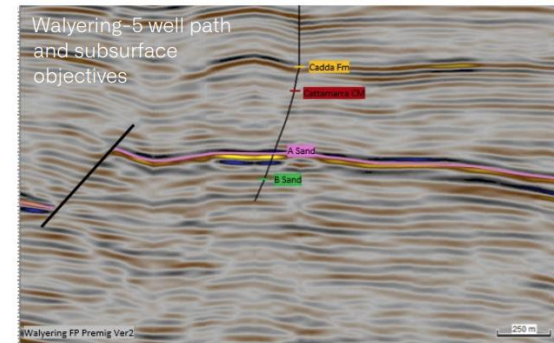
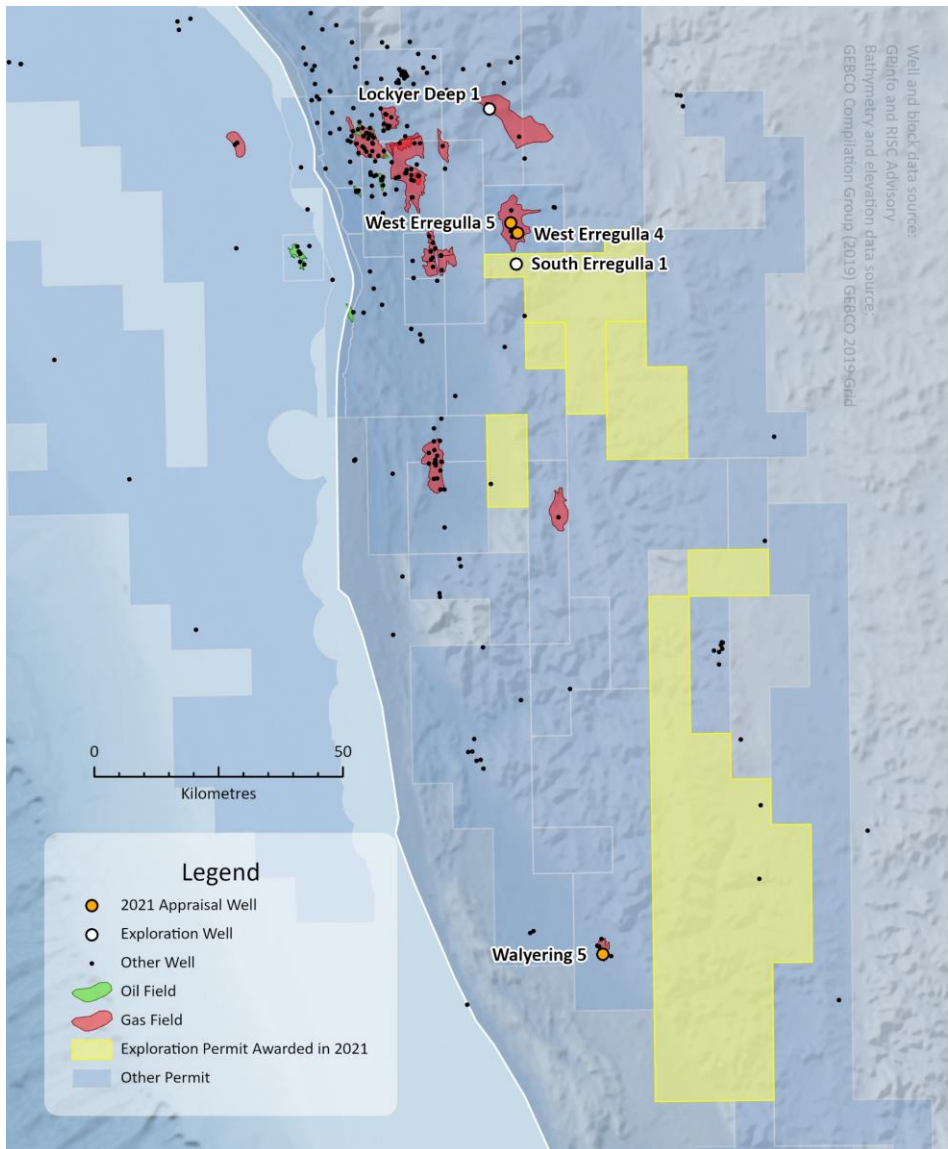
Perth Basin Drilling 2021: West Erregulla Appraisal



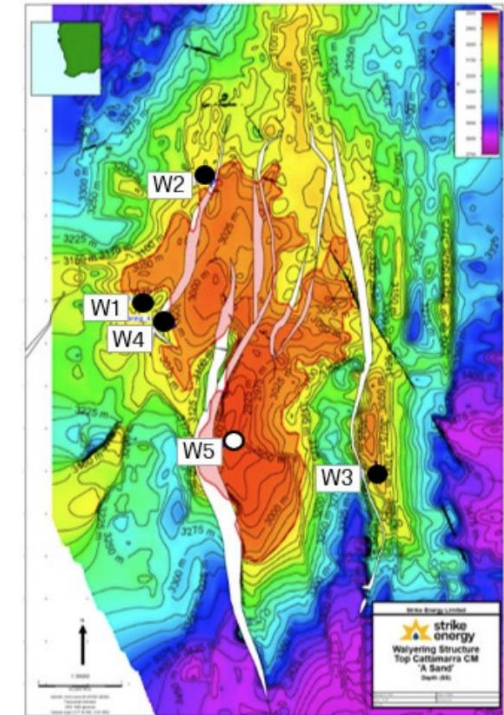
Source: Strike Energy

- West Erregulla-4 drilled over January – April, West Erregulla-5 over May – July
- Appraisal drilling following West Erregulla-2 discovery of gas in the Kingia and High Cliff Sandstones (2019). West Erregulla-3 suspended in January 2021 before reaching objective.
- West Erregulla-4 tested at rates up to 35 MMscf/d
- West Erregulla-5 tested at rates up to 13.1 MMscf/d

Perth Basin Drilling 2021: Walyering-5

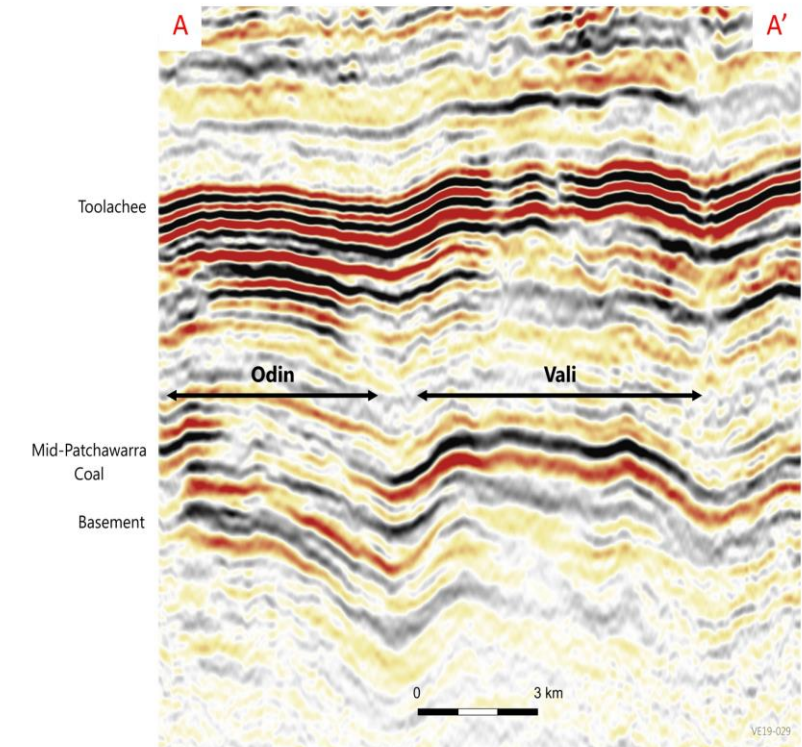
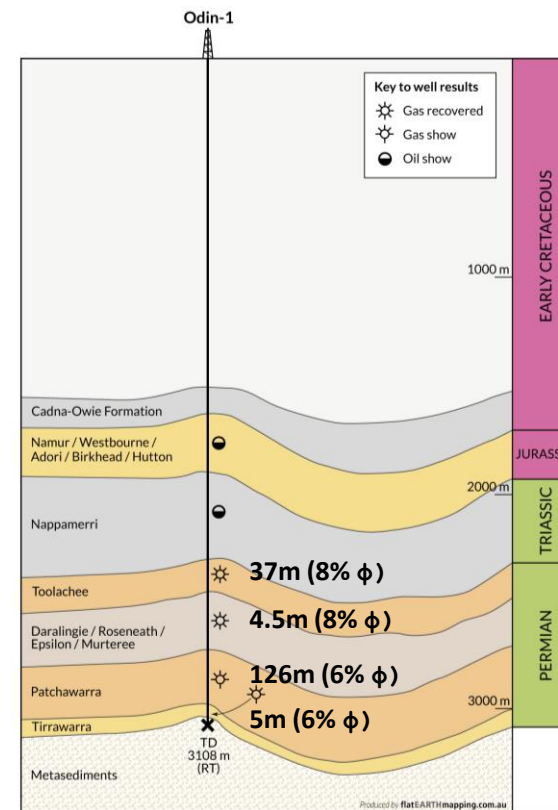
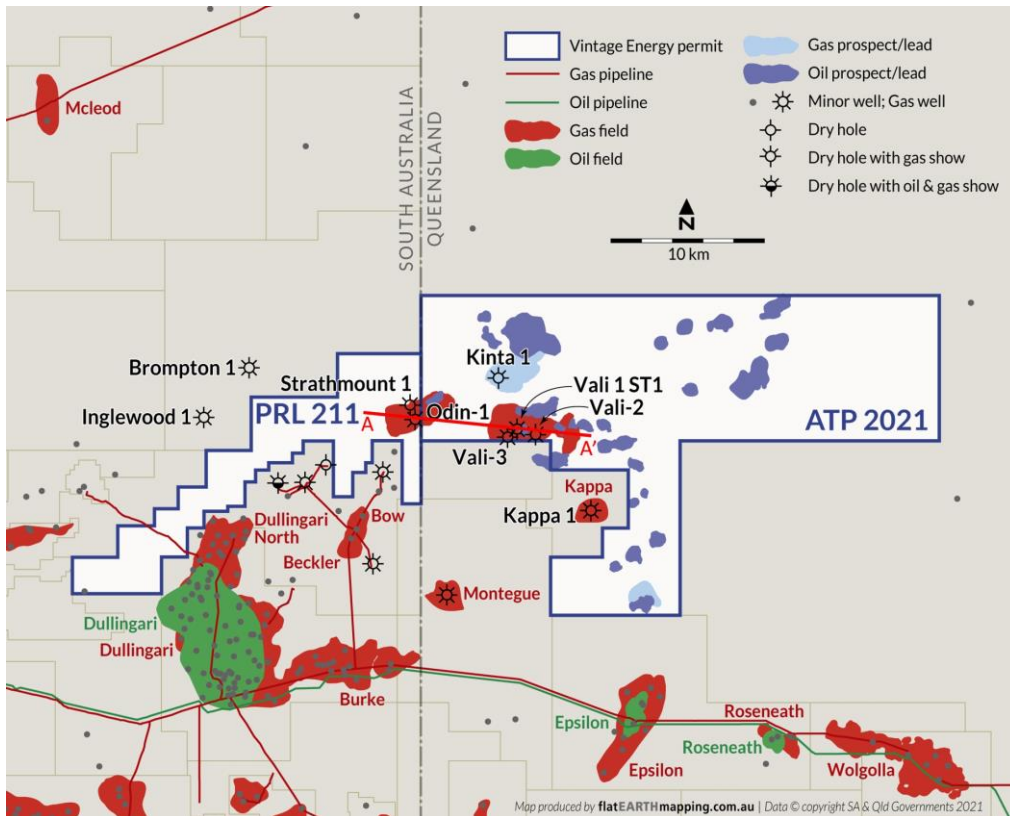


Source: Strike Energy



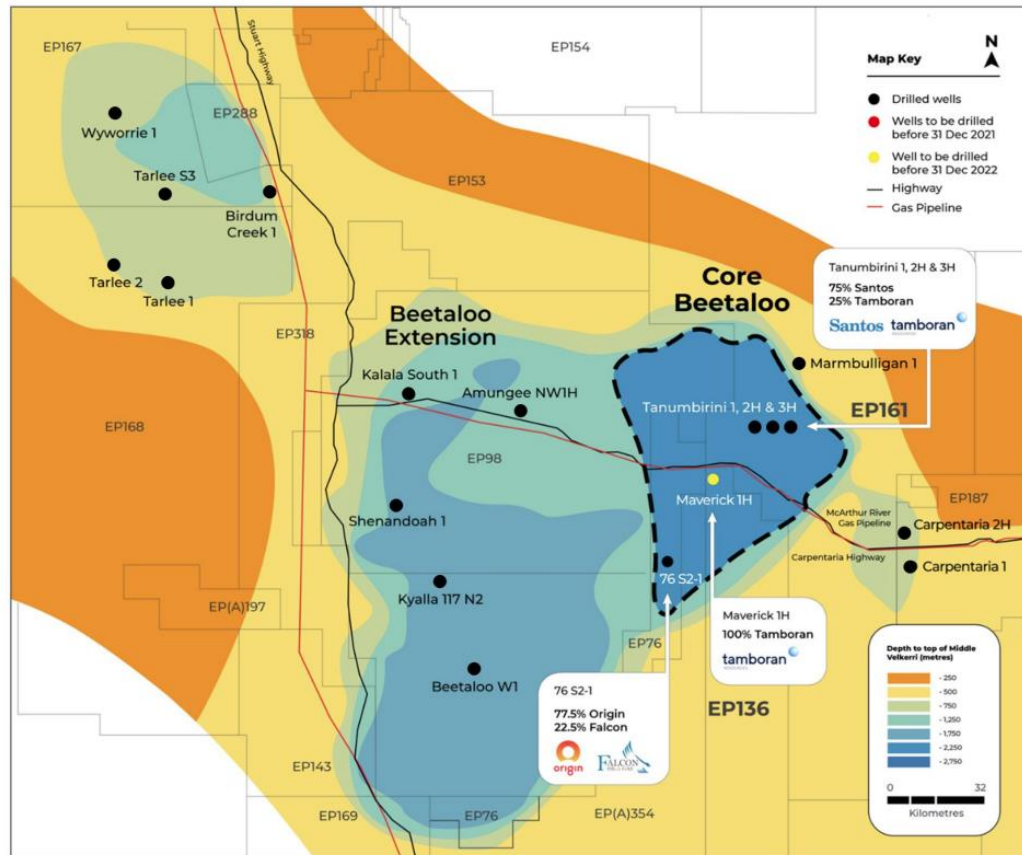
- Walyering-5 drilled over November – December in EP 447 by Strike Energy and Talon Energy
- Appraisal of Walyering gas field following 3D acquisition (2019)
- 4 gas zones in Jurassic Caddamra Coal Measures A, B, C & D-sands. 51m net gas pay
- A-sand primary reservoir with 17.3% average porosity

Odin-1, Vali-2 & 3



- Vali-2 & 3 drilled over April – May in ATP 2021 by Vintage Energy. Appraisal wells to Vali-1 exploration success (2019)
- Gas in Patchawarra Formation, shows in Lower Nappamerri Group, Toolachee Formation, Epsilon Formation and Tirrawarra Sandstone
- Gross 2P reserves of 92 Bcf
- Odin-1 drilled over May – June in PRL 211. 40% gPOS pre-drill.
- 172 m of net gas pay in Toolachee Formation, Epsilon Formation and Patchawarra Formation. Tested at rates up to 6.5 MMscf/d
- Gross 2C of 36.4 Bcf

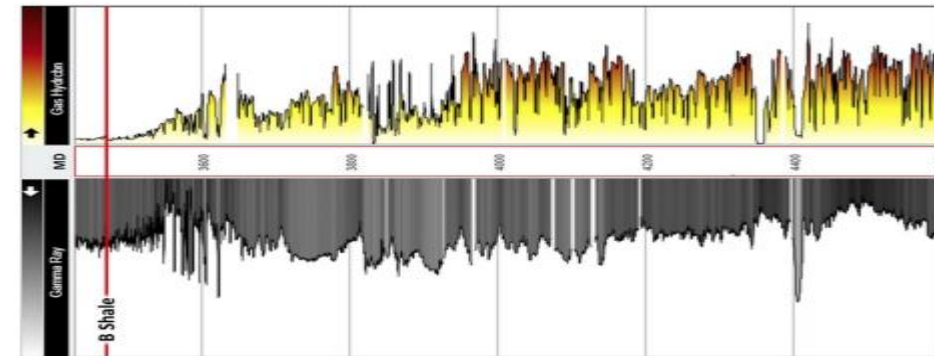
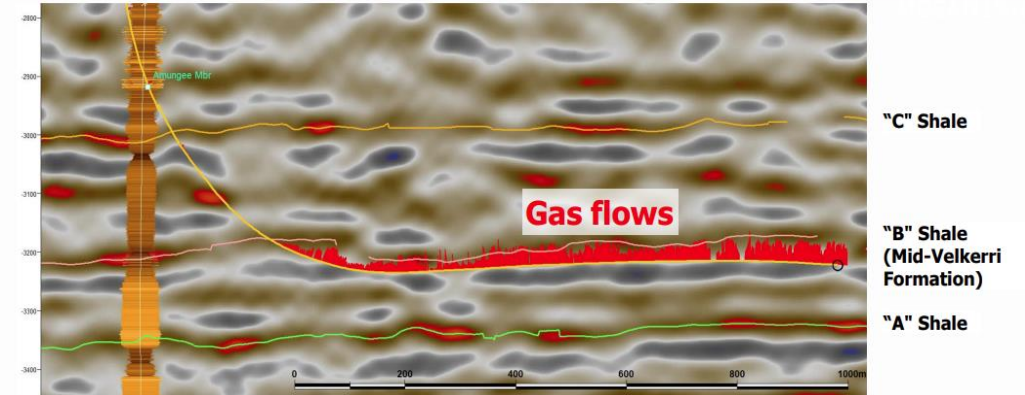
Tanumbirini 2H & 3H



T2H & T3H flow testing



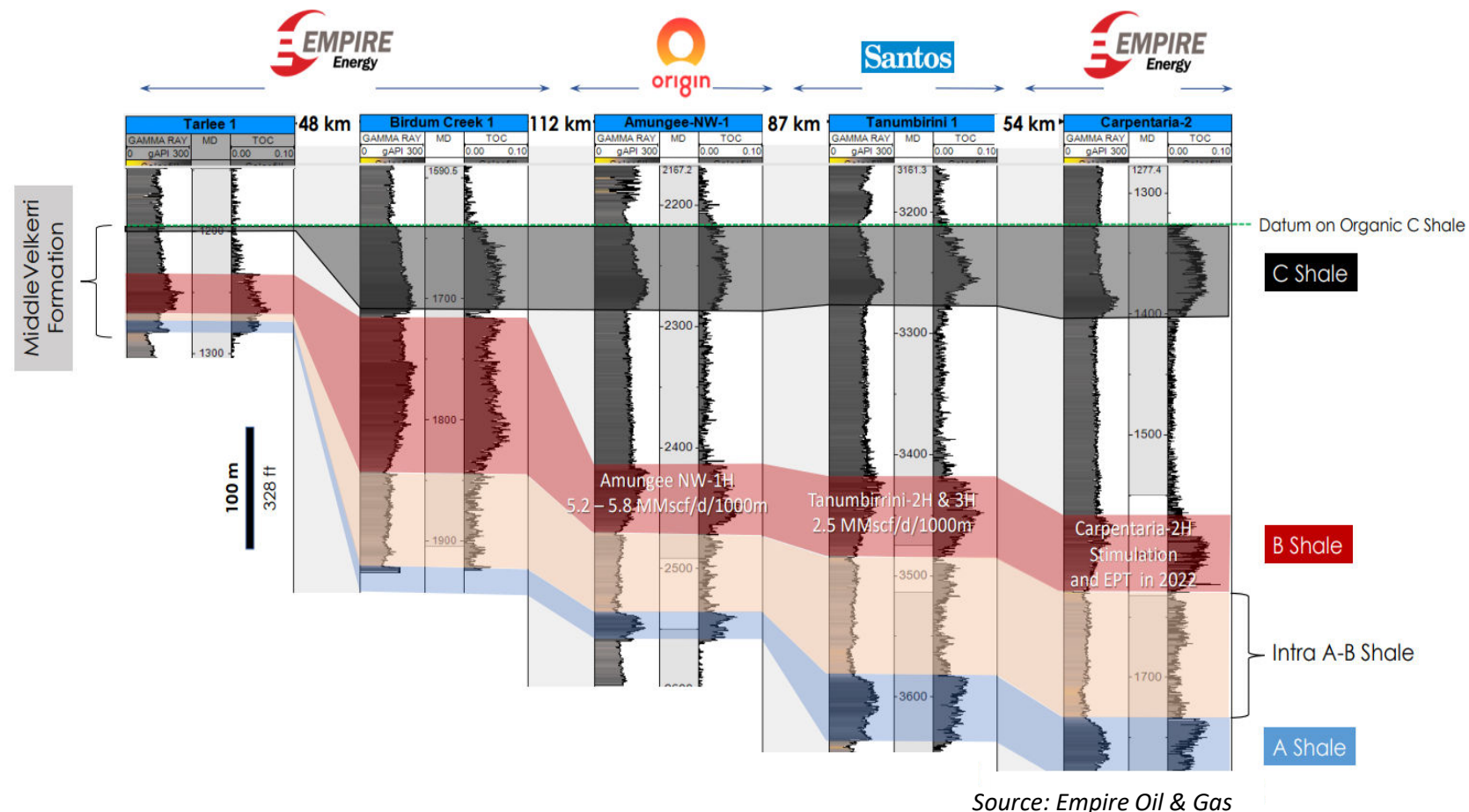
Tanumbirini 2H seismic cross-section and gas flows



- Tanumbirini-2H drilled over May – August
- TD of 4,598 mMD
- Tanumbirini-3H drilled over August – November
- TD of 4,857 mMD

- Velkerri 'B' Shale objective
- Horizontal sections over 1,000 m each
- Wells fracture stimulated and flowed gas to surface (2 MMscf/d)
- Peak rates reported up to 10 MMscf/d

Carpentaria-2 / 2H



- Carpentaria-2 & 2H drilled over November – December in EP 187 by Empire Energy
- Step-out exploration/appraisal of Carpentaria-1 (2020)
- 11 km to the north and down-dip
- Carpentaria-2 drilled to a TD of 1,835 mMD
- 192 metres net Velkerri Formation shale gas pay in Carpentaria-2

- Carpentaria-2H drilled to a TD of 3,150 mMD
- 1,345 metre horizontal in Velkerri B shale,
- Fracture stimulation and production test in 2022

- **Petroleum exploration spend increased and is trending upwards.** Onshore exploration spend has exceeded offshore since 2019. Petroleum exploration spend lags behind mineral exploration spend, and the gap is growing.
- **Total area under petroleum exploration title is decreasing.**
- 8 Federal offshore exploration permits were awarded in 2021, with no firm exploration wells. However, spend and seismic commitment is trending upwards.
- 9 exploration permits and 3 SPA's were awarded in WA, 4 exploration permits were awarded in QLD and 3 were awarded in SA.
- 21 areas release in the annual Federal offshore petroleum exploration acreage release round and 5 GHG areas released.
- Exploration acreage releases in WA, NT and QLD with acreage open for application in SA.
- **1 offshore and 7 onshore conventional petroleum discoveries.**
- 29 exploration (3 offshore) and 31 appraisal (1 offshore) wells drilled.

Key take-aways

- Petroleum exploration titles and bids/awards are decreasing.
- However, recent Federal offshore release round bids contained an increase in exploration commitments and firm wells.
- Petroleum exploration is very much focussed on the onshore basins.
- Petroleum exploration spend is 1/3 of minerals exploration.
- Onshore Perth Basin continues its renaissance with Lockyer Deep gas discovery, West Erregulla and Walyering appraisal.
- The Cooper – Eromanga continues to yield exploration discoveries.
- The Beetaloo Basin is the focus for unconventional exploration .

I would like to acknowledge the following people for their assistance and input to the preparation of this paper and presentation:

- Simon Barber (RISC)
- Craig Gumley (Consultant)
- Matthew Quinn (IHS)
- Paul Larsen (Searcher Seismic)
- Paul Owen and Alex Wunderlich (OMV)
- Danny Burns (Vintage)
- Sam Algar (Beach Energy)
- Rhys Simpson (EurozHartleys)
- Peter Cameron (Aust. O&G Research)



www.riscadvisory.com

Perth

Level 2
1138 Hay Street
WEST PERTH WA 6005
P. +61 8 9420 6660
F. +61 8 9420 6690
E. admin@riscadvisory.com

Brisbane

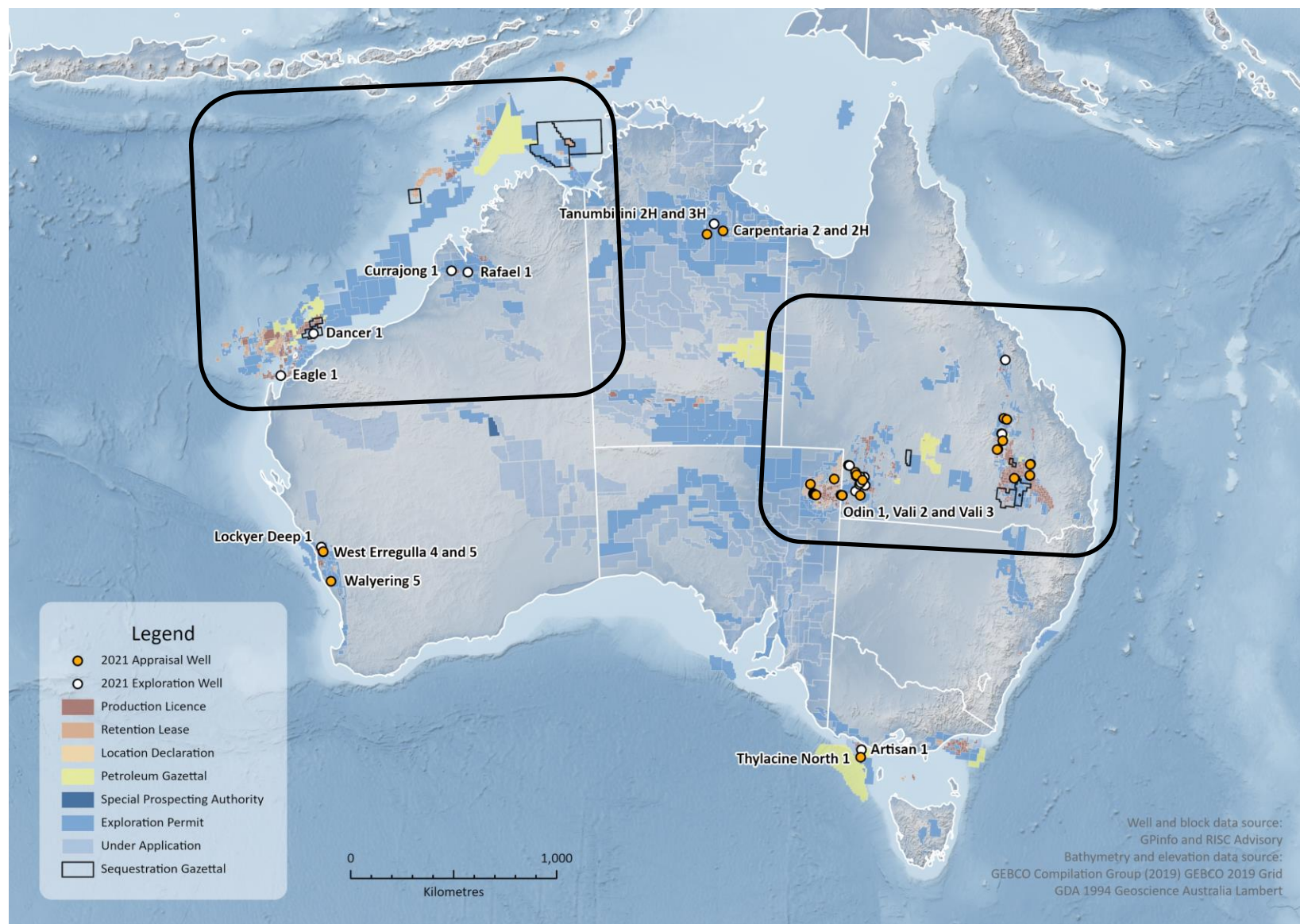
Level 10
239 George Street
BRISBANE QLD 4000
P. +61 7 3025 3397
F. +61 7 3188 5777
E. admin@riscadvisory.com

London

4th floor Rex House
10 Regent Street
LONDON UK SW1Y 4PE
P. +44 203 356 2960
F. +44 203 356 2701
E. admin@riscadvisory.com

South East Asia

Jakarta
Indonesia
P. +61 8 9420 6660
F. +61 8 9420 6690
E. admin@riscadvisory.com



In 2021.....

- 21 offshore release areas (petroleum)
- 5 offshore release areas (GHG storage)

