A FRESH LOOK AT THE SOUTH AUSTRALIAN ONSHORE OTWAY BASIN

POWERFUL INSIGHTS FROM DEM’s PETROLEUM SYSTEMS MODEL PROJECT
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Otway Basin: Project Aim

Aim:
- Generate new datasets
- Generate new exploration concepts
- Stimulate the next phase of gas exploration in the onshore Otway Basin to supply South Australian customers

- Commenced: 2020
- Completion: Q4 2023
Project Fast Facts

Whole of Basin PSM
- Petroleum system model
- Expulsion maps per key intervals

Seismic & Wells
- Stratigraphic framework – 80 wells
- 7965km seismic interpretation

Cores & Maps
- 772m of core interpreted
- 6 geology maps constrained
Otway Basin

- Oil and gas production from 6 hydrocarbon fields
- ~63 BCF of natural gas produced
- The Katnook gas facility is currently mothballed
The Otway Basin is made up of a series of (curvi-linear) buried hills and valleys (troughs) that have been filled in over time. A lot of time ~ 30 million years.
The Penola Trough extends to the west and includes the St Clair Trough.

The Tantanoola Trough is a distinct depositional centre.

The Robe Trough is more extensive and deeper than previously understood.
A New Approach to Otway Well-Based Stratigraphy

• Consistent stratigraphic markers (arrows) were correlateble in key wells.
• Subsequent seismic interpretations have been unable to ‘break” chemostratigraphic interpretations

[From – Bendall et al APPEA| 2023]
A new understanding of the stratigraphic order of petroleum source and reservoir rocks has been developed.

This provides for the fundamental understanding of drilling depth to potential new targets.
Core: Reservoir and Source Rocks

~770m of core from 23 wells across the basin in all intervals

Conventional reservoir rocks are deposited in fluvial channel fairways

- Good quality source rocks are deposited in deep rift lakes (algal)
- Moderate quality source rocks were deposited on flood plains associated with fluvial channel fairways
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Pretty Hill Fm.

Core Description
Katnook 2

Department for Energy and Mining: South Australia

Covered Area: Australia (South Australia)
Basin: Daly (Shoreline SA)
Flume: CRU
Well Operator: Ulantron

Stud Date: 6/12/2009
KBB: 47
TR: D.2
Lithology: Ultratran
Depth Shif: C2-2-4.5 & C3-1.5m

Author: Ulantron & P. Strong (OREM July 2003)
Scale: 1:40

Table and Diagram provided for geological analysis.
Pretty Hill Fm.

Core Description
Katnook 2

Department of Energy and Water, South Australia

Pretty Hill Fm.

Fluvial channels
- Anastomosing
- Braid
- Flood plain
- Lakes (lacustrine)

~ Churinga 1

Coaty delta plain
Delta plain
Pretty Hill Fm. Distribution

- Pretty Hill Fm. sediments enter the basin via canyons near Wanda 1 and disperse to the west (Robe Trough) and east (Penola Trough)
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Lower Sawpit Shale [McEachern Sandstone]: A Fresh Look

- A new interpretation has been made for the McEachern Sandstone intervals of the Lower Sawpit Shale interval.

- Previously interpreted as terrestrial crevasse splays, a fresh look at the McEachern Sst interval has revealed an extensive interbedded deep lacustrine turbidite package.
McEachern Sst Distribution: Sediment Input
McEachern Sst Distribution
A New Play Concept

• Deep lacustrine turbidite intervals were interpreted in three regions of the Lower Sawpit/McEachern interval (core and seismic facies)
• Lake Thingvallavatn in Iceland is a good analogue
McEachern Sst Distribution
A New Play Concept
Lower Sawpit Shale/McEachern Sst Distribution

There is spare capacity to take discovered gas to the market.
Otway: 1D PSM Modelling - Wells

All source Rock Information was verified and used as model inputs:
• TOC/HI/Vitrinite
• Wireline/Core/Tops
• Seismic
• Temperature/Pressure

PSM workflow and metrics:
• 15 1D (dimensional) models were built
Otway: 1D PSM Modelling - Wells

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Onset of overpressure around 2700mSS

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Otway: 1D PSM Modelling - Wells
Expulsion: Lower Sawpit/McEachern Sst [Robe Trough]

DEM’s modelling reveals
- Previously unknown gas expulsion from the Lower & Upper Sawpit Shale in the Robe Trough (~ the Penola Trough)

The Robe Trough has:
- Reasonable seismic coverage
- A small number of peripheral wells
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Expulsion: Laira Formation [Tantanoola Trough]

DEM’s modelling reveals significant gas expulsion from the Laira Formation in the Tantanoola Trough.

The Tantanoola Trough (TT) has:
- Limited seismic coverage (no through lines!) [red dash area]
- No wells [red dash area]
- The TT is ~30km from the Katnook gas plant
Otway Basin Total Gas Expulsion

Gas expulsion occurs from four intervals:
- Laira Formation
- Upper Sawpit Shale
- Lower Sawpit Shale/McEachern Sst
- Casterton Formation

Gas expulsion occurs mainly from the:
- Lower Sawpit Shale/McEachern Sst
Otway Basin Total Gas Expulsion

- Significant potential remaining in the Penola Trough (grey)

- Two regions (yellow) have been identified with significant unexplored gas expulsion
DEM will be presenting its latest technical analysis of the onshore Otway Basin (SA) and highlighting regions of prospectivity. This release will include:

- Petroleum systems modelling (PSM) – Trinity files, movies and summaries
- Regional seismic interpretation – Horizons, faults, grids
- Chemostrat-based well tops – all wells
- Integrated core logs – from 23 wells
- Detailed and missing core imagery
- GDE maps – of all key intervals covered
- Arcmap and Petrosys projects
Upcoming Publications:

- **APPEA 2024 - PSM**
- **APPEA 2024 – McEachern Sandstone turbidites**
- **APPEA 2024 - GDE**

In Press!
Final Messages

A significant DEM study has revealed that SA’s onshore Otway has……

• Significant potential remaining in the Penola Trough
• Two regions (yellow) have been identified with significant un-explored gas expulsion

All data and modelling files associated with the PSM modelling will be released to the public
Acknowledgements!

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