West Malita Graben
The Ugly Duckling or another Phoenix

SEAPEX 2019 – Session 4-4
West Malita Graben: The Ugly Duckling?

Agenda

- Location & Setting
- Why the Ugly Duckling
- Appearances can be deceiving
- Spectrum Database - Kyranis MC3D
  - Data Quality uplift & Challenges
  - Chuditch-1
  - Durville-1
- Prospectivity Overview
- Conclusion

Note: This is a high level overview due to the time allowed. For a more detailed presentation please do not hesitate to contact the SpectrumGeo Team in Perth.
West Malita Graben: Location & Setting

- Halfway between Australia & East Timor (≈ 250km)
- Only two minor discoveries
  - Chuditch in Plover Fm
  - Durville in Sandpiper
- Review focuses on the Kyranis MC3D

The Malita Graben is SW-NE trending Late Carboniferous – Early Permian rift that overprinted the NW-SE Precambrian-Paleozoic Petrel Basin

- A broad post rift sag basin developed during the Triassic through to Middle Jurassic
- A second phase of rifting commenced in the Callovian (JC) during Pangea continental break-up
- Post rift sag followed in the early Cretaceous

Top Elang/Plover Fm Sand Play (Oxfordian Unc., JO) TWT map, showing the regional setting of Malita Graben and location of the Kyranis Multi-client 3D
West Malita Graben: The Ugly Duckling

1. Early wells targeted big structures
2. A lot of CO₂
3. Boundary with Timor L’Este in dispute

Drilling History
- Newby first well in area (1969 – Aust. Aquitaine)
- Heron-1 first discovery (1971 - Arco) CO₂: 40%
- Laperouse-1 last well (2011 - Total)
- Kanase-1 Drilling (ENI) Testing Jur. & Triassic

Top Elang/Plover Fm Sand Play (Oxfordian Unc., JO) TWT map, showing the regional setting of Malita Graben and location of the Kyranis Multi-client 3D
Nth Bonaparte: Multiple Petroleum Systems?

- Paleozoic Petroleum system mainly seen in the Petrel Basin but there is clearly some contribution around the flanks of the West Malita Graben that should not be ignored, (Kelp Deep).
- Mid Jurassic Plover is the main gas drive for the region.
- Petroleum Geochemistry supports the presence of an Echuca Shoals source – often invoked as a driver for an oil play, seen in several wells in the region, ie.; Bard, Beluga, Blackwood, Chuditch, Cornea, Firebird, Elang West.
- Heron-2 supports the presence of a Frigate SR.

Stable carbon isotope signatures have the advantage over molecular composition in that they are not affect by phase fractionation. Chuditch-1 shows a disconnect indicating the gas & oil sampled come from different kitchens and source rocks.

Appearances can be deceiving.
Regional Seismic Database

Kyranis MC3D (2012-2013)

Total PreSTM area: 9,023km²

- Acquired By Fugro-Geoteam
  - Source: 2 X 4070 cu. In. (separation 50m)
  - Streamers: 10 X 6km (separation 100m @ 7m)
  - No. of Groups 480/streamer (12.5m interval)
  - Nominal Fold: 80
- Processed by Fugro/CGG

LEGEND

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East Malita Graben

West Malita Graben
Kyranis MC3D: Sea floor velocity artefacts

Near Top Hibernia (Eoc.) TWT Map (ms)

Shows over print of the sea floor and shallow strong lateral velocity variations – Main causes are the rugose sea floor topography and the drowned carbonate platform below present day un-compacted silt.

Subsurface imaging

- Very challenging, particularly for 2D time data
- Structures have a large uncertainty in depth
Data Quality: Chuditch-1 with Legacy 2D

- Major distortion due to shallow high velocity layers
- Low signal to noise
- Main reservoir objective levels (Sandpiper/Elang/Plover) hard to map and see any character
- Permo-Triassic hard to map below graben bounding fault
- Note Shell 2D depth map with bumpy relief
Data Quality: Chuditch-1 with Kyranis PreSTM

- Improved water bottom statics (Replacement & residual statics)
- Improvement in signal to noise
- Marked improvement at main reservoir objective levels (Sandpiper/Flamingo/Elang/Plover)
- Can now map and see character in the deeper sediments (Permo-Triassic)
- Note Kyranis 3D TWT map - much smoother and simpler
Data Quality: Chuditch-1 with Interpretation

Multi-client Seismic Image Masked for distribution

Note: No direct calibration of events within the Malita Graben
**Objective**
Structural fault closure at top Elang/Plover but **Not Reached**

**Results**
- Discovered 36m Gas column (CGR not known, 38% CO₂)
- Possible residual oil column > 40m in Sandpiper Fm
  - Oil shows noted on core sample & fluorescence present on core photographs with slightly elevated resistivity profile. Possibly due to invasion during coring?
  - Tests: No DSTs – MDT samples recovered
Durville-1: Untested Play & Up-dip Gas

- Sandpiper 2 gas up dip?
- Elang/Plover play remains untested
- Fault shadow makes the panel look faulted
- Perhaps deeper objectives (ENI currently testing Triassic to north at Kanase-1)
Chuditch Area: Shell Vols & Deeper Objectives

2D mapping suggests a series of small bumpy structures
3D time mapping suggests broader subtle structures that appear to partially coalesce

Possibility of stacked objectives
- Elang/Plover Sands
- Triassic Sands? (Ascalon Stt. Early Triassic)
  - Lower shoreface could extend further or
  - Basin floor turbidite fans could be present
- Permian Sands (Upper most Cape Hay)
- Fractured Carbonates (Darwin, Pearce... ?)

Shallow Gas Volume Summary, 2000
(uncharted in place volumes bcf)

Elang/Plover Sands
- Elang/Plover Sands (cutoff POS MSV PS5 P15)
  - Chuditch
    - POS: 100, MSV: 1170, PS5: 1070, P15: 1430
  - Chuditch-West
    - POS: 93, MSV: 530, PS5: 396, P15: 668
  - Bilby
    - POS: 100, MSV: 190, PS5: 198, P15: 247
  - Wombat
    - POS: 100, MSV: 775, PS5: 401, P15: 1136
  - Total: 2671

Gross depositional environment palaeogeographic reconstruction of the Ascalon sandstones (*K. saeptatus* - earliest Triassic) for the Petrel Basin

Source:
Permo-Triassic reservoir fairways of the Petrel Sub-basin, Timor Sea
Paul H. Robinson1 and Kim B. McInerney2
Timor Sea Symposium 2003
Sanpiper 2 Sands (Berr-Tith): Paleogeography?

**Durville & Laperouse:**
- **Reservoir:** Thick submarine fan deposits – West Malita subsided early
- **Seal:** Tight overlying Sandpiper 1 sands, Flamingo Shales and Cretaceous Bathurst Gp exceeds 2000m in Graben
- **Source:** Paleo Oil Column?

**Beluga-1**
- **Reservoir:** Shelfal Fan deposits - Sediments from north – Sahul Platform
- **Seal:** Flamingo Shales and Cretaceous Bathurst Gp exceeds 2000m in Graben
- **Source:** Light oil/wet gas shows - Flamingo Group & Elang Fm. (early mature)
- **AVO?** High amplitude anomalies in the Tithonian down-dip (SANTOS having a 2nd look)

**Caldita-1 & 2:** supports syn-rift thickening (Sands present)

**Evans Shoal & ES Sth** has just the Cleia Fm (restricted deep Marine silt/claystones) sands absent or bypassed

**Heron-2:** Supports more liquid prone basal Flamingo (Frigate) SR
Key Challenges

- Map sands (Seismic quality for QI)
- Find undrilled structures (Depth conversion issue)
- Show reservoir presence and preservation at depth (understanding porosity preservation processes better)
Conclusion

• All the ingredients are there for the area to rise from the ashes.
• Multiple functioning petroleum systems
• The area has a complex history and is under explored
• Plenty of potential for a good surprise
• Kyranis 3D to be reprocessed with a modern flow
• Perhaps like the Bedout Basin with the Phoenix South discovery then Roc, knowledge improves & confidence builds . . . . . . Leading to Dorado

“Discovery consists of looking at the same thing as everyone else and thinking something Different”

Albert Szent Gyorgi

Thank you to the Spectrum APAC team for their support & management for allowing me to present seismic images from the Kyranis MC3D