West Malita Graben
The Ugly Duckling or another Phoenix

SEAPEX 2019 – Session 4-4

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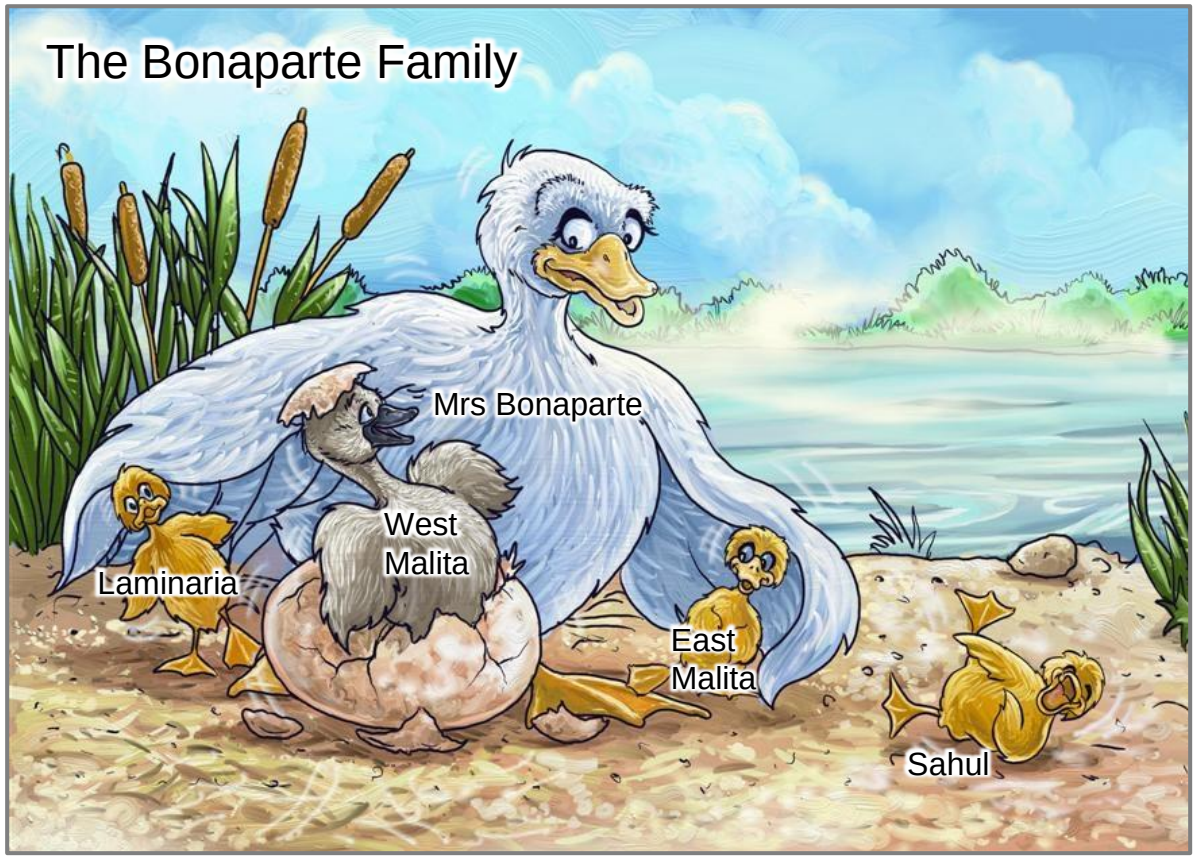
West Malita Graben: The Ugly Duckling ?

Agenda

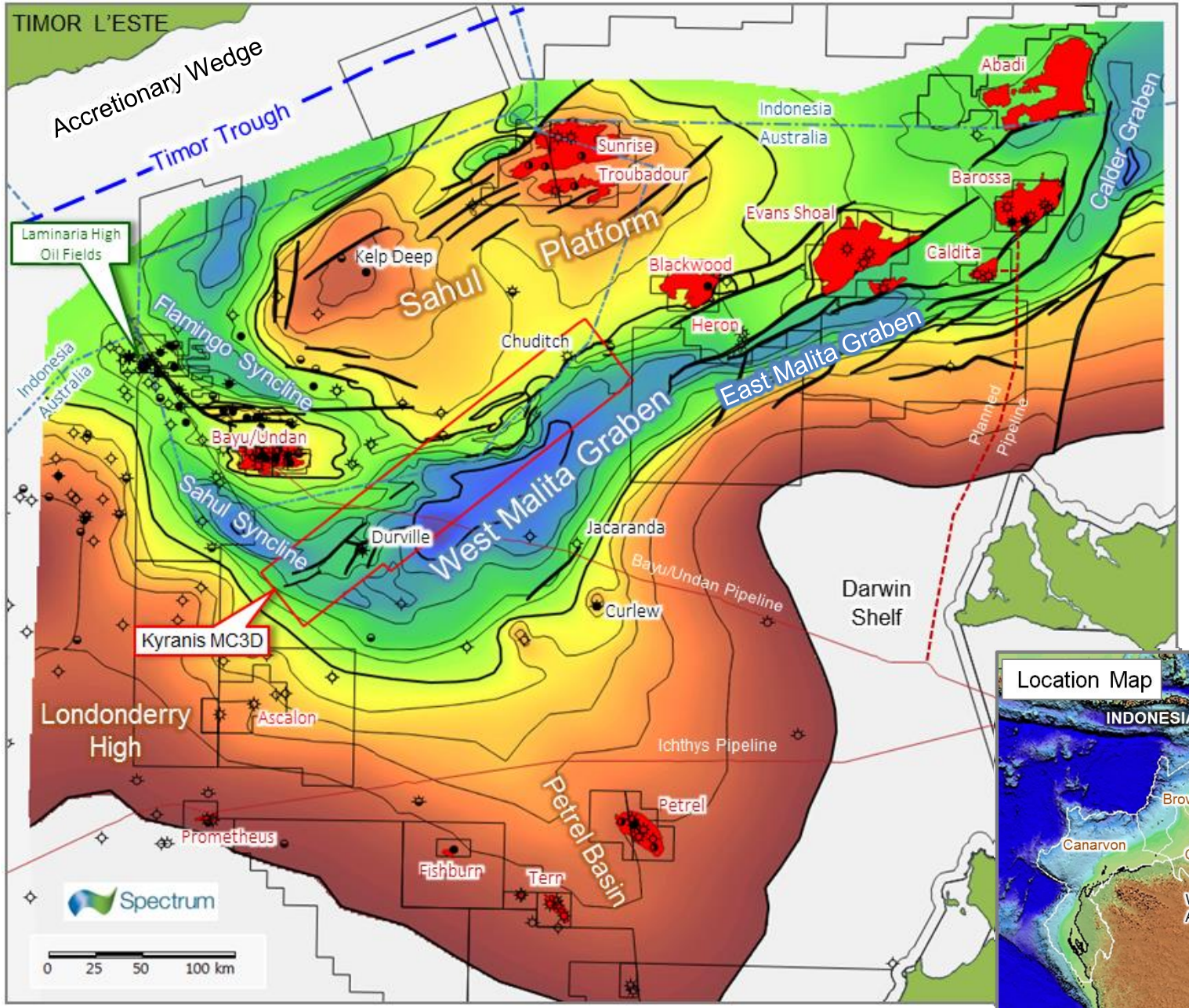
- Location & Setting
- Why the Ugly Duckling
- Appearances can be deceiving
- Spectrum Database - Kyranis MC3D
  - Data Quality uplift & Challenges
  - Chuditch-1
  - Durville-1
- Prospectivity Overview
- Conclusion

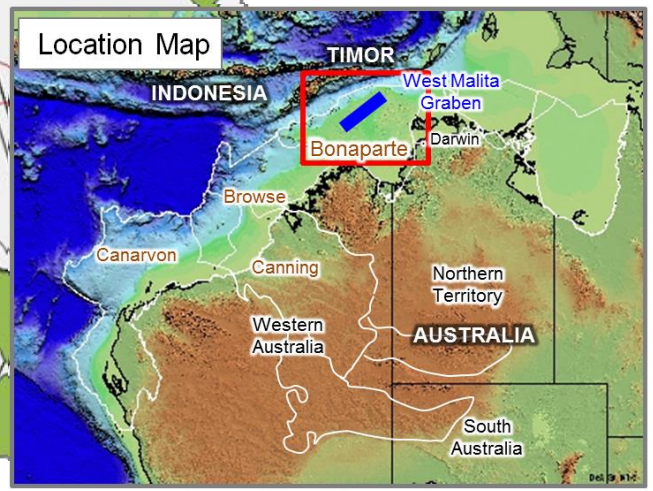


Note: This is a high level overview due to the time allowed.
For a more detailed presentation please do not hesitate to contact the SpectrumGeo Team in Perth.

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





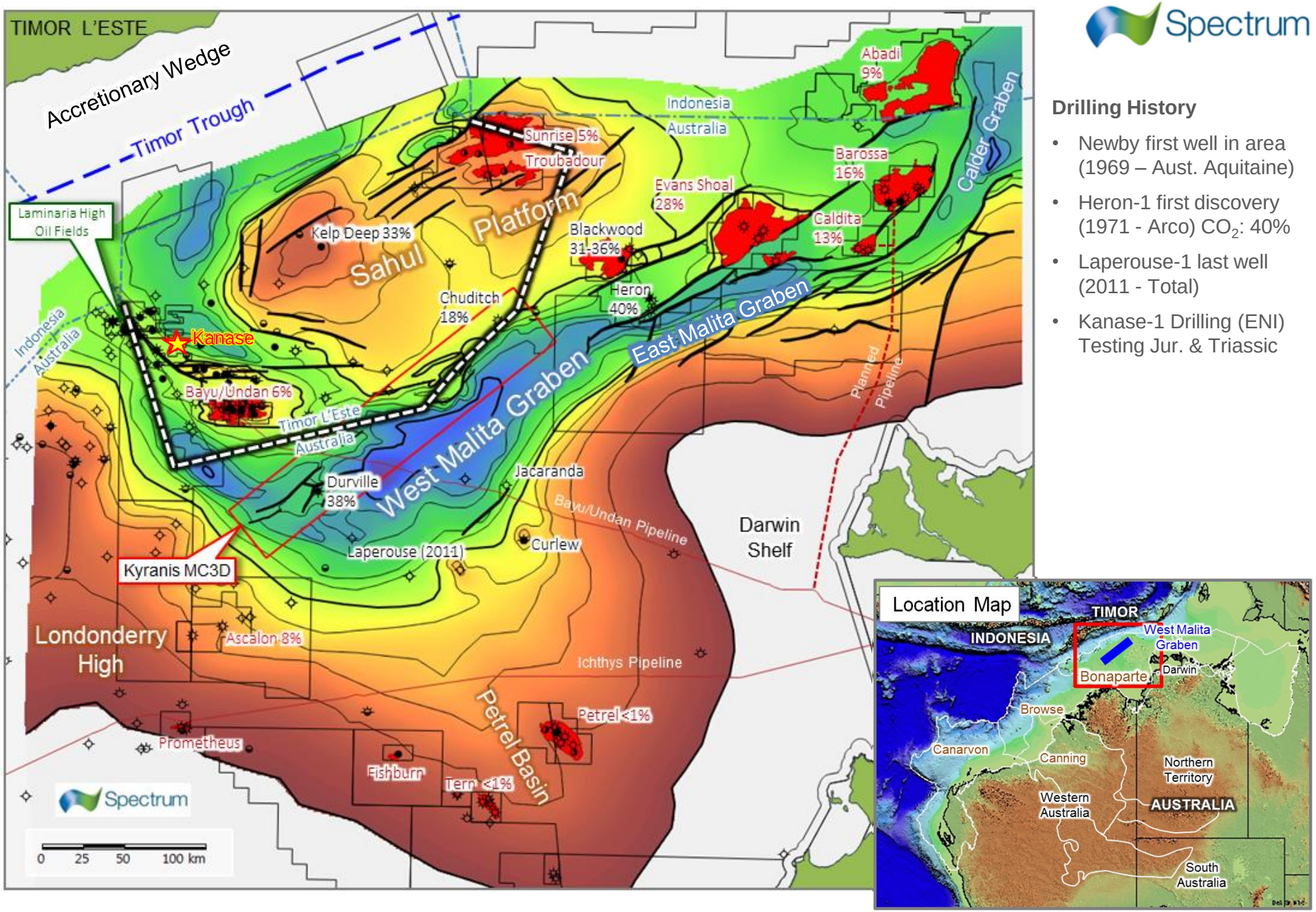
Top Elang/Plover Fm Sand Play (Oxfordian Unc., JO) TWT map , showing the regional setting of Malita Graben and location of the Kyranis Multi-client 3D

Spectrum

- The Malita Graben is SW-NE trending Late Carboniferous – Early Permian rift that over printed 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

West Malita Graben: The Ugly Duckling

1. Early wells targeted big structures
2. A lot of CO_2
3. Boundary with Timor L' Este in dispute

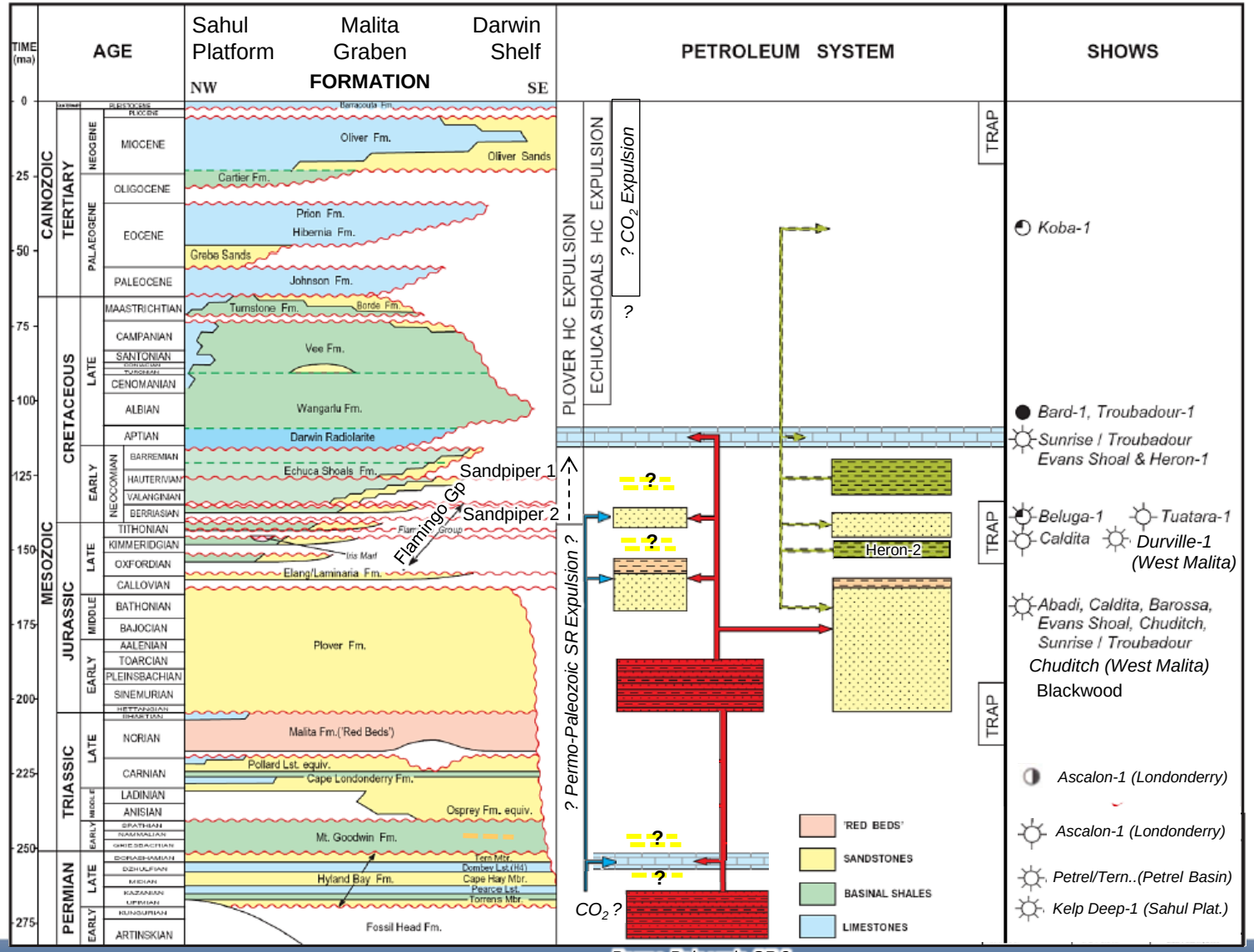


Top Elang/Plover Fm Sand Play (Oxfordian Unc., JO) TWT map , showing the regional setting of Malita Graben and location of the Kyranis Multi-client 3D

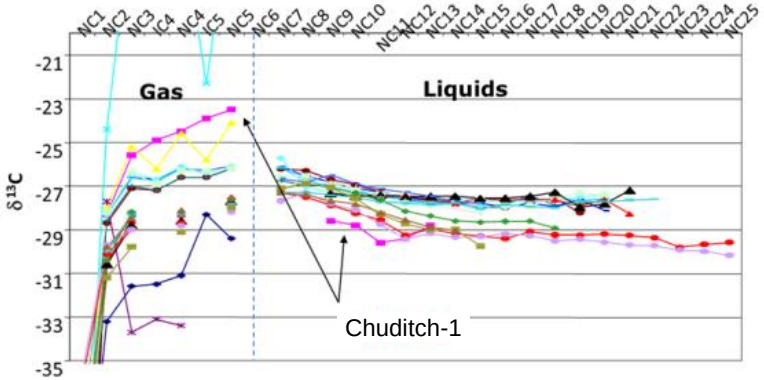
Drilling History

- Newby first well in area (1969 – Aust. Aquitaine)
- Heron-1 first discovery (1971 - Arco) CO_2: 40%
- Laperouse-1 last well (2011 - Total)
- Kanase-1 Drilling (ENI) Testing Jur. & Triassic

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.

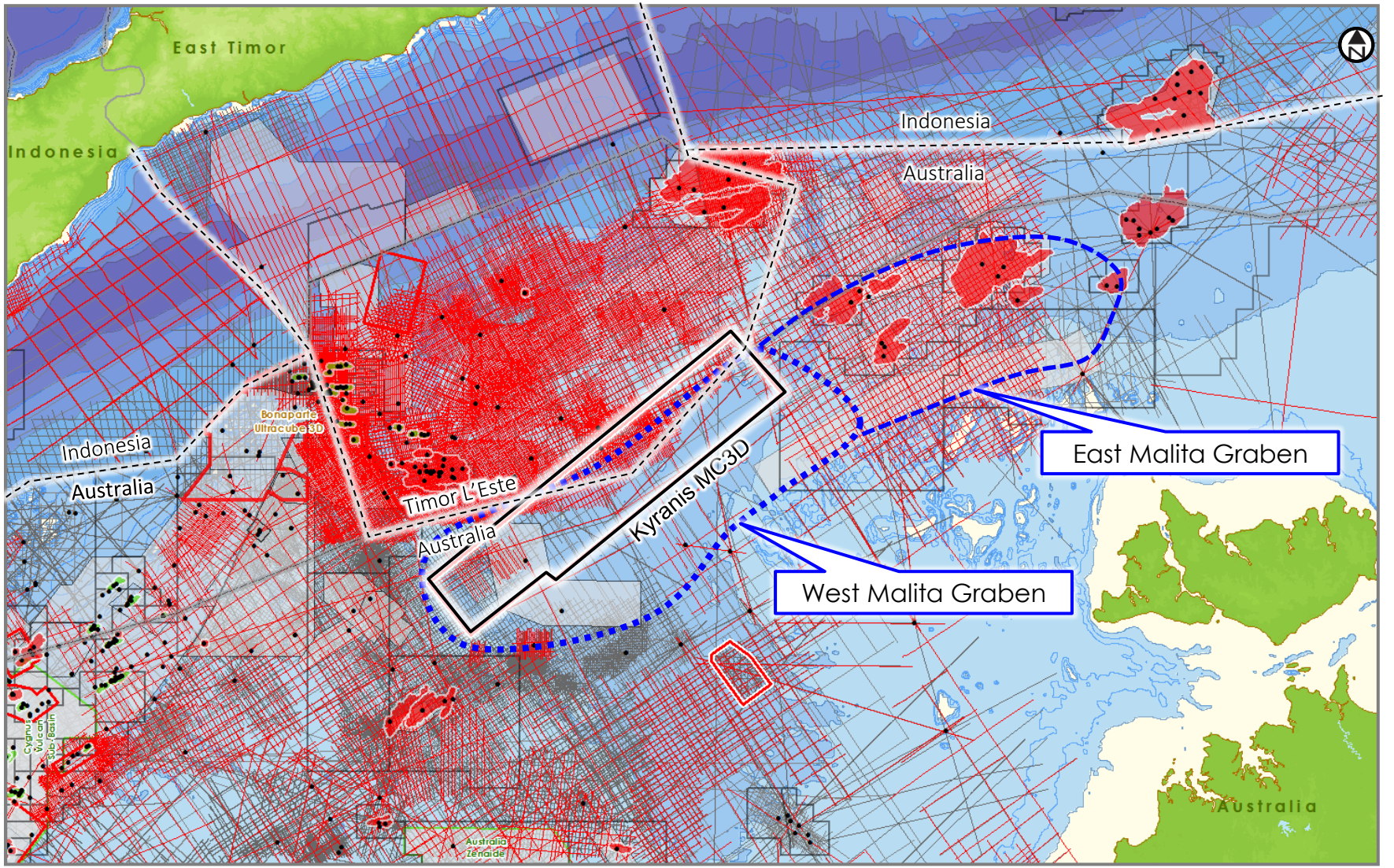
Adapted from COP Caldita 3D Interp Report

Regional Seismic Database

Kyranis MC3D (2012-2013)

Total PreSTM area: 9,023km^2

- 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



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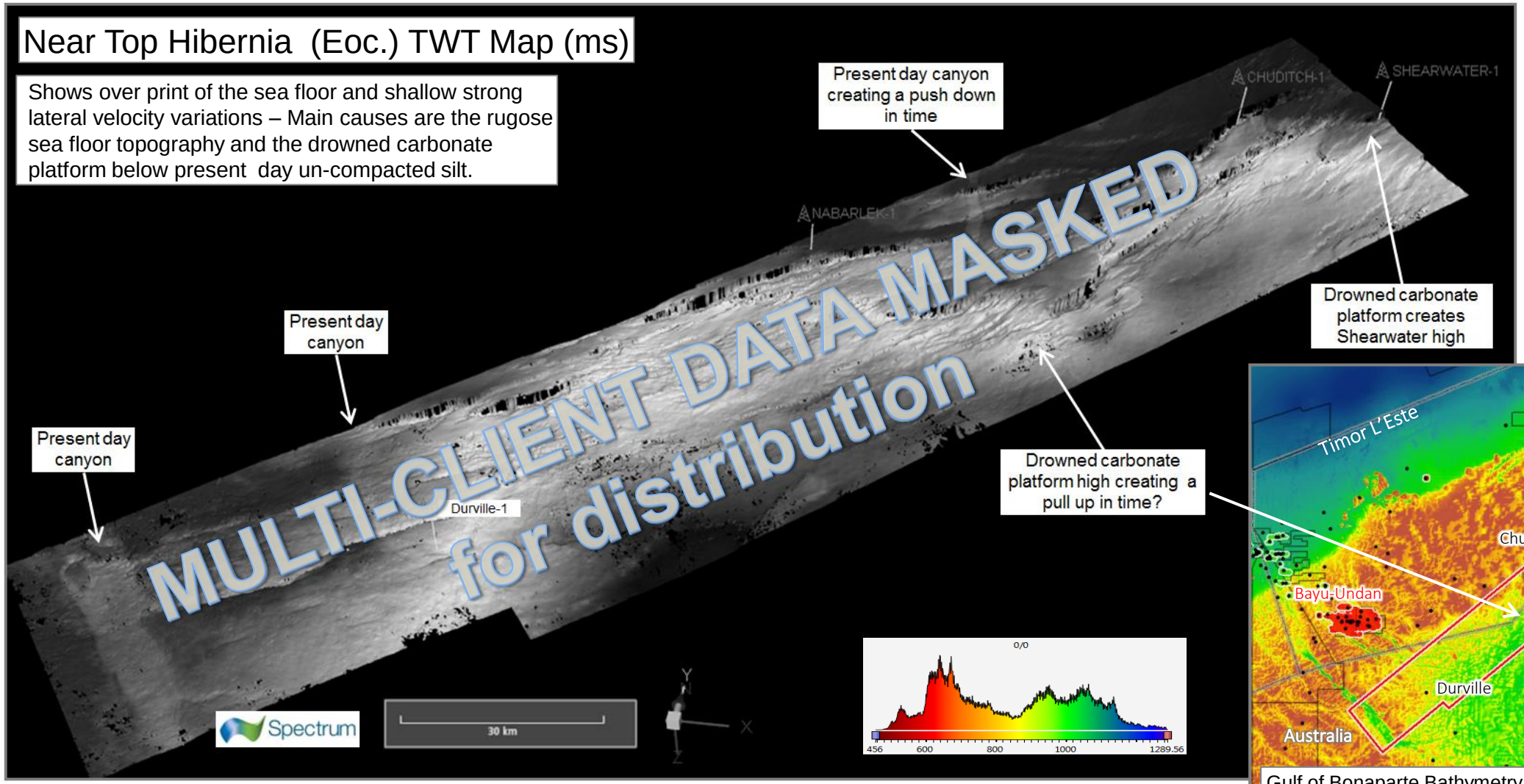
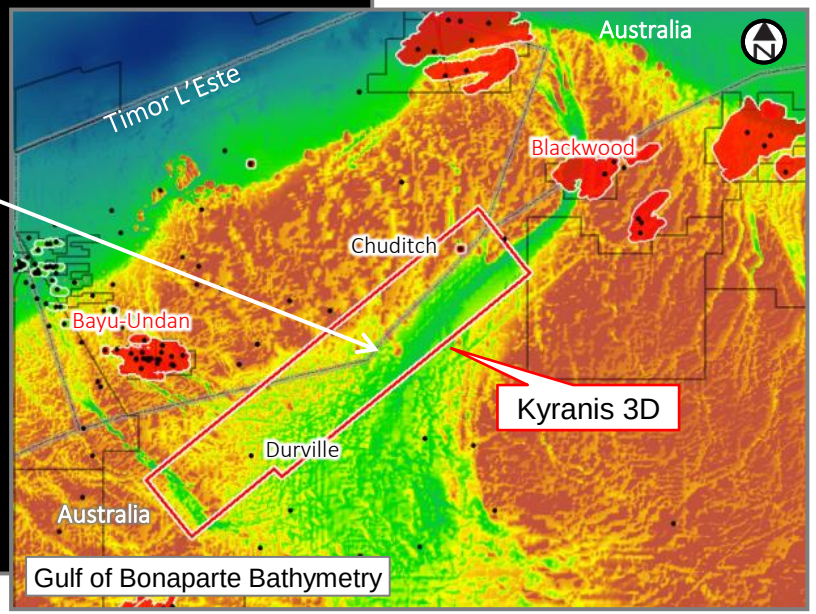
Seismic Data

- Spectrum's recent MC3D's
- Spectrum's MC3D Repro
- Spectrum's MC2D
- Other 3D data sets
- Other 2D data sets

Kyranis MC3D: Sea floor velocity artefacts

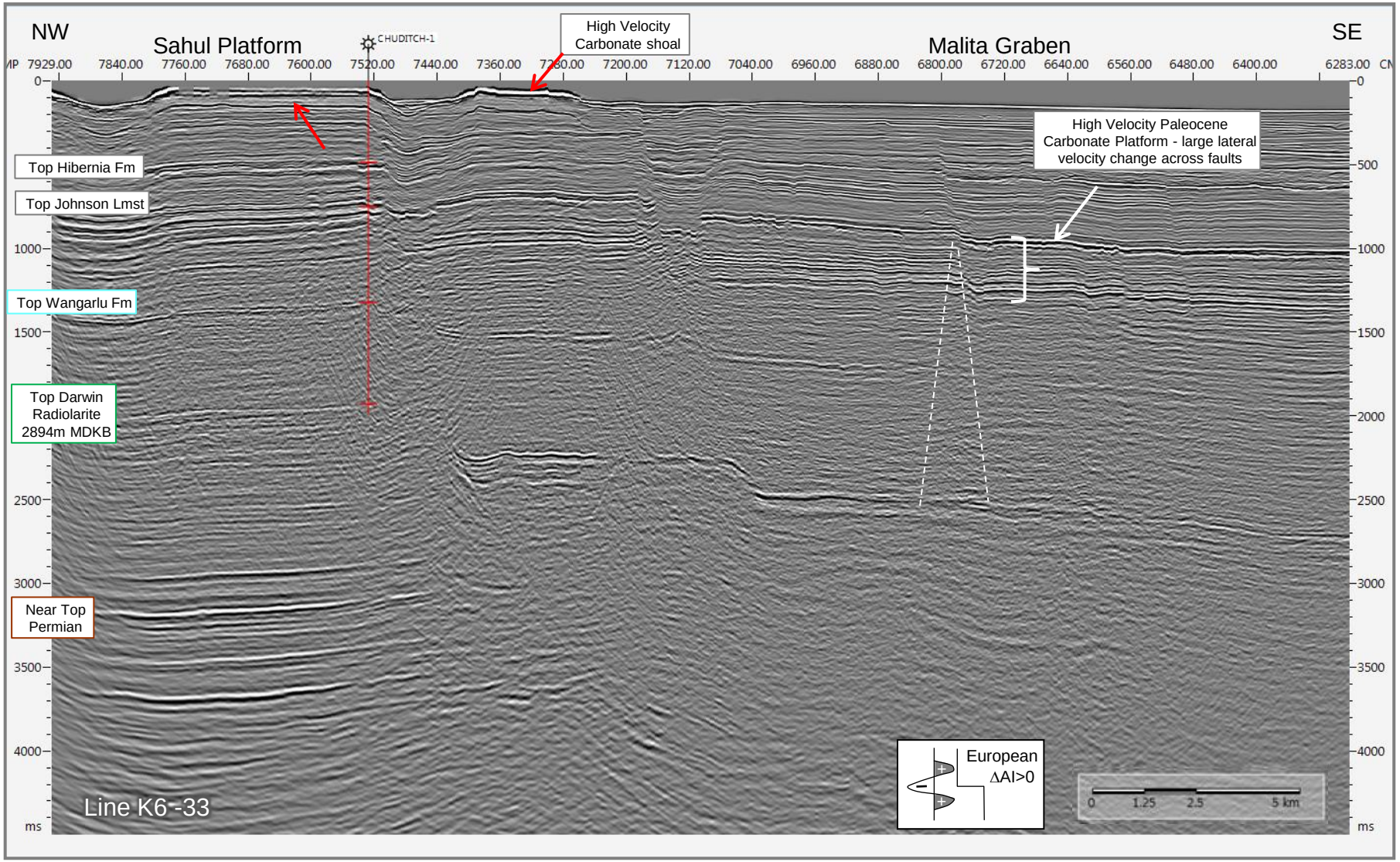


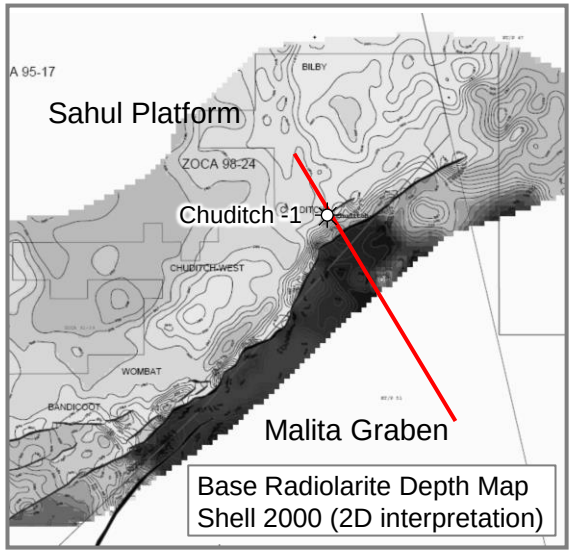


Subsurface imaging

- Very challenging, particularly for 2D time data
- Structures have a large uncertainty in depth

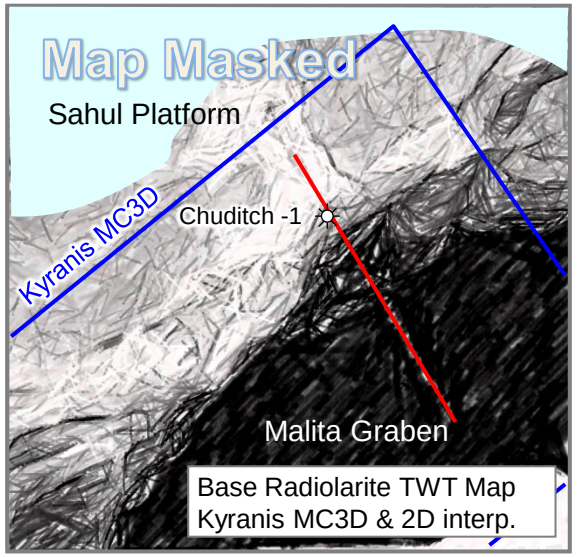
Data Quality: Chuditch-1 with Legacy 2D





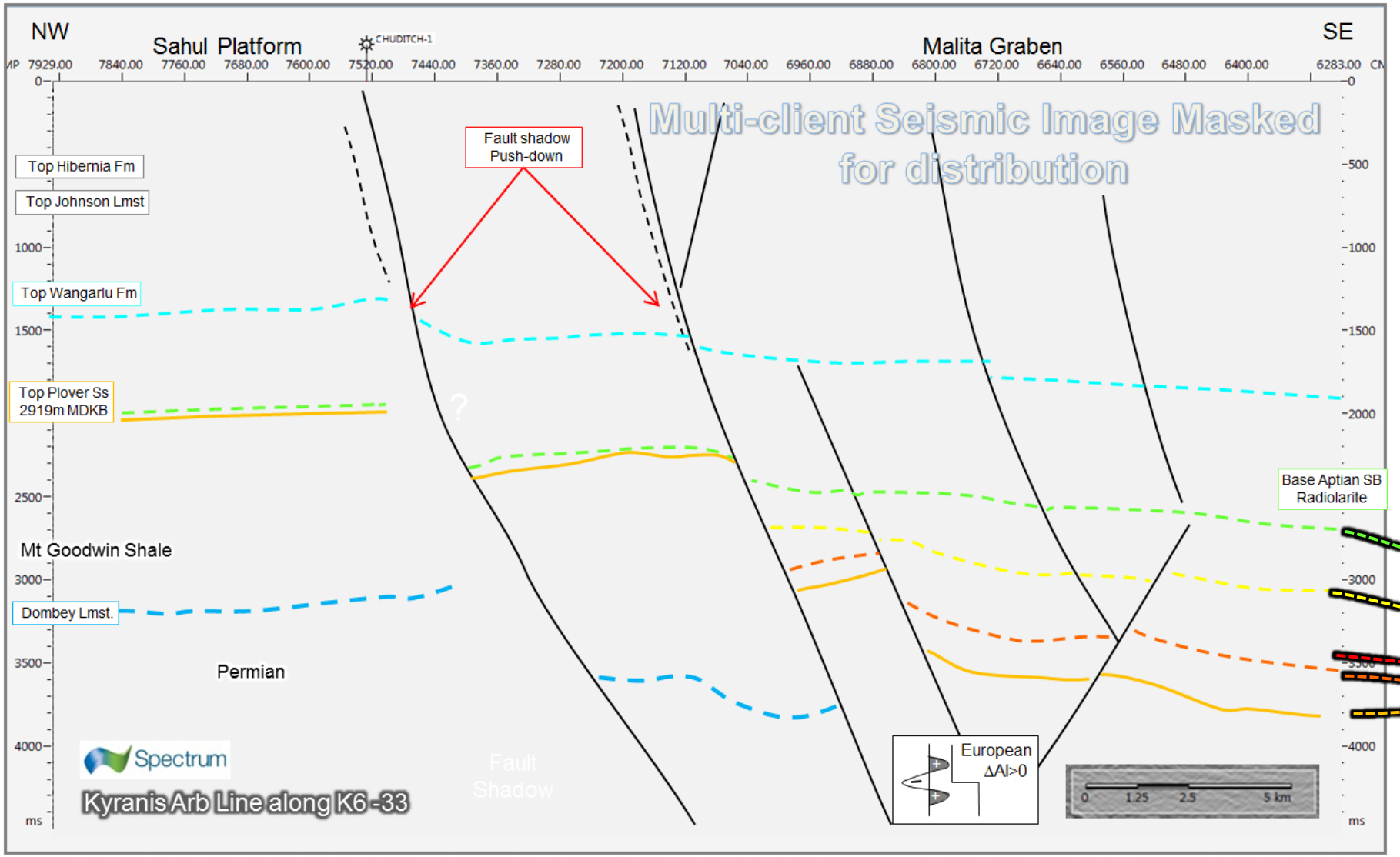
- Major distortion due to shallow high velocity layers
- Low signal to noise
- Main reservoir objective levels (Sandpiper/Elang/Plover) hard to map and see any character
- Permo-Triassic hard to map below graben bounding fault
- **Note** Shell 2D depth map with bumpy relief

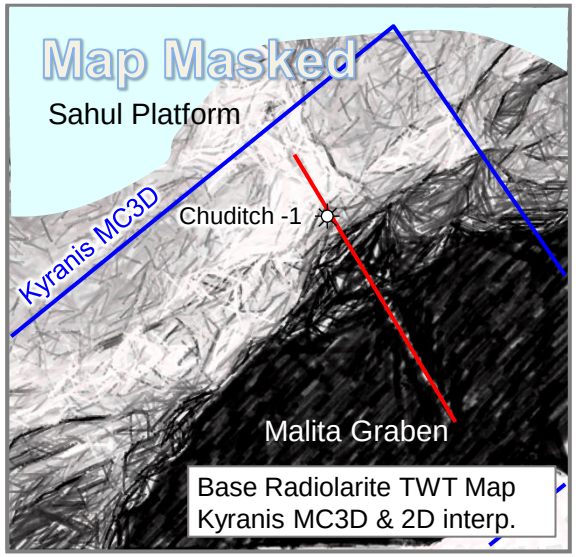
Data Quality: Chuditch-1 with Kyranis PreSTM



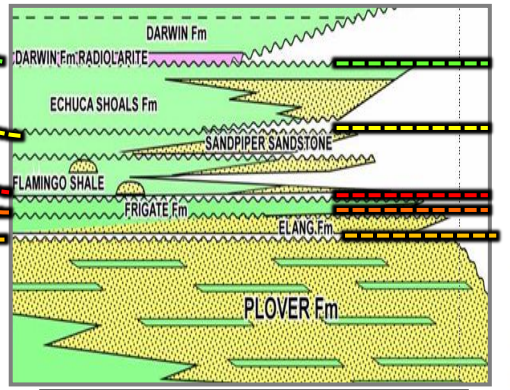
- Improved water bottom statics (Replacement & residual statics)
- Improvement in signal to noise
- Marked improvement at main reservoir objective levels (Sandpiper/Flamingo/Elang/Plover)
- Can now map and see character in the deeper sediments (Permo-Triassic)
- Note Kyranis 3D TWT map - much smoother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

Data Quality: Chuditch-1 with Interpretation



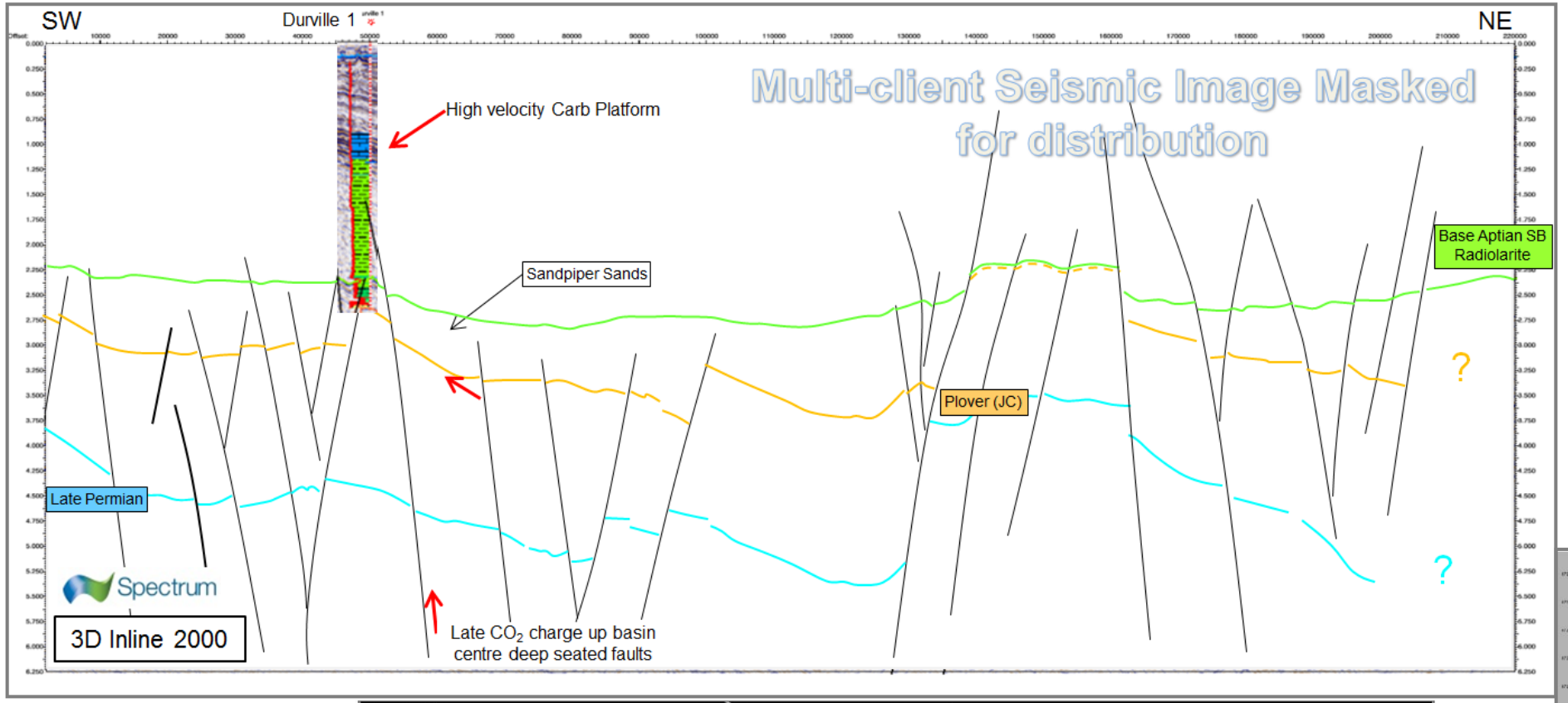


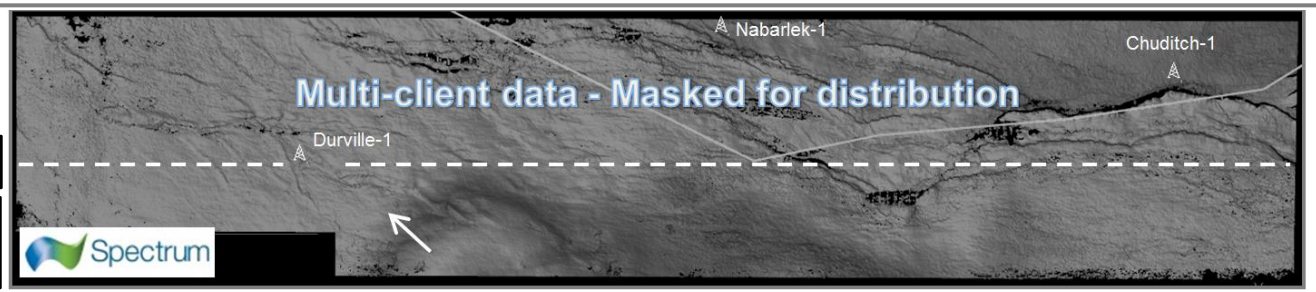
Note: No direct calibration of events within the Malita Graben



Main Plays & Picks on Seismic

Durville-1: Seismic Interpretation





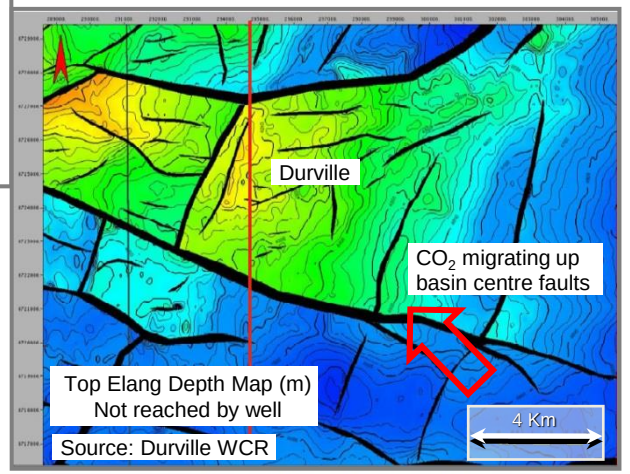
Inline 2000

Base Aptian (Radiolarite) TWT Map (Kyranis MC3D)

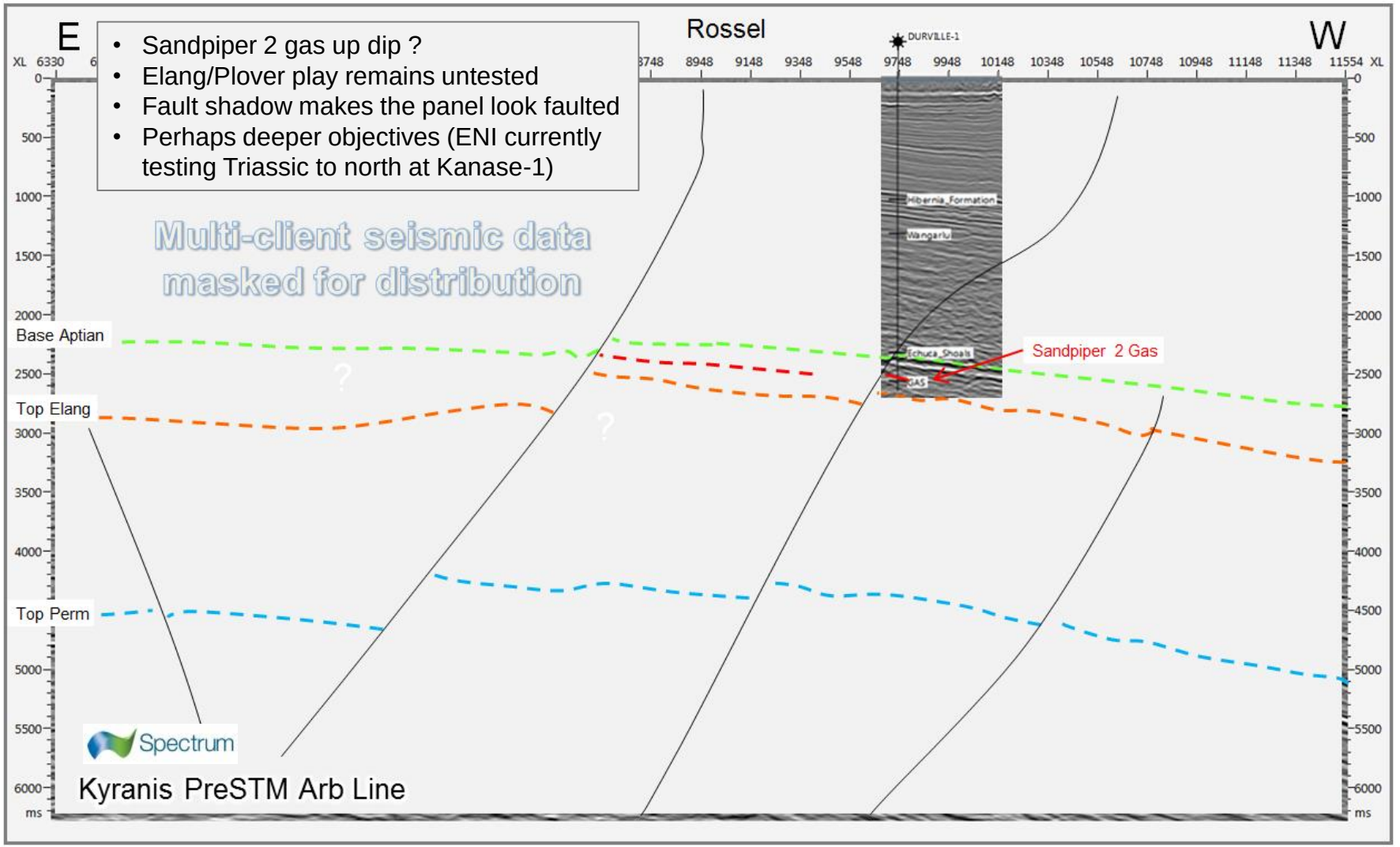
Objectives
Structural fault closure at top Elang/Plover but **Not Reached**

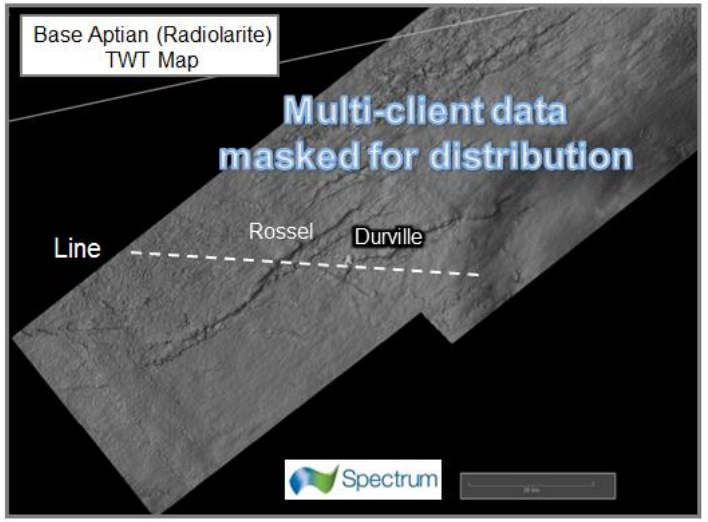
Results
Discovered 36m Gas column (CGR not known, 38% CO_2)
Possible residual oil column > 40m in Sandpiper Fm

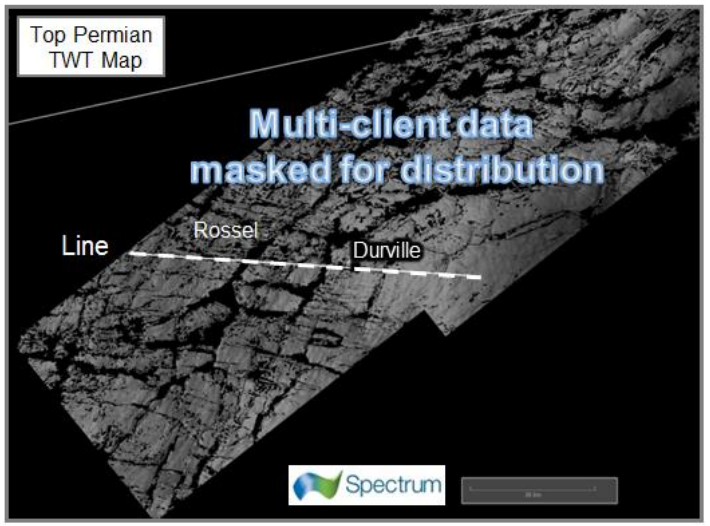
- Oil shows noted on core sample & fluorescence present on core photographs with slightly elevated resistivity profile. Possibly due to invasion during coring?
- Tests:. No DSTs – MDT samples recovered



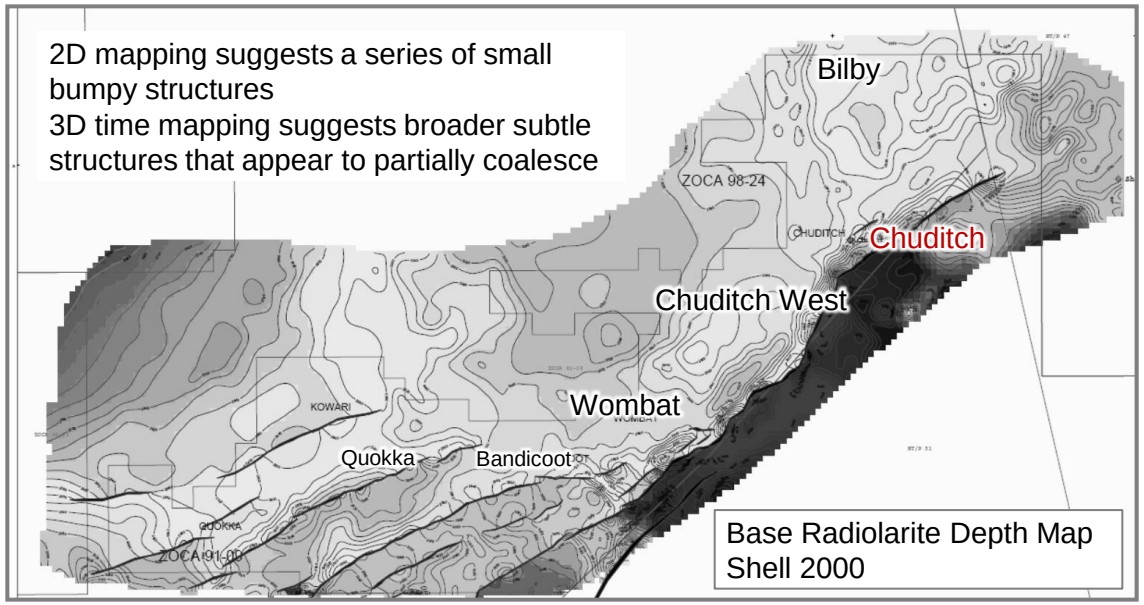
Durville-1: Untested Play & Up-dip Gas







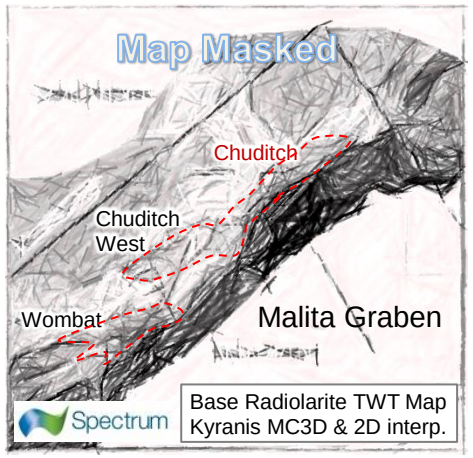
Chuditch Area: Shell Vols & Deeper Objectives



Shell Gas Volume Summary, 2000
(unrisked in place volumes bcf)

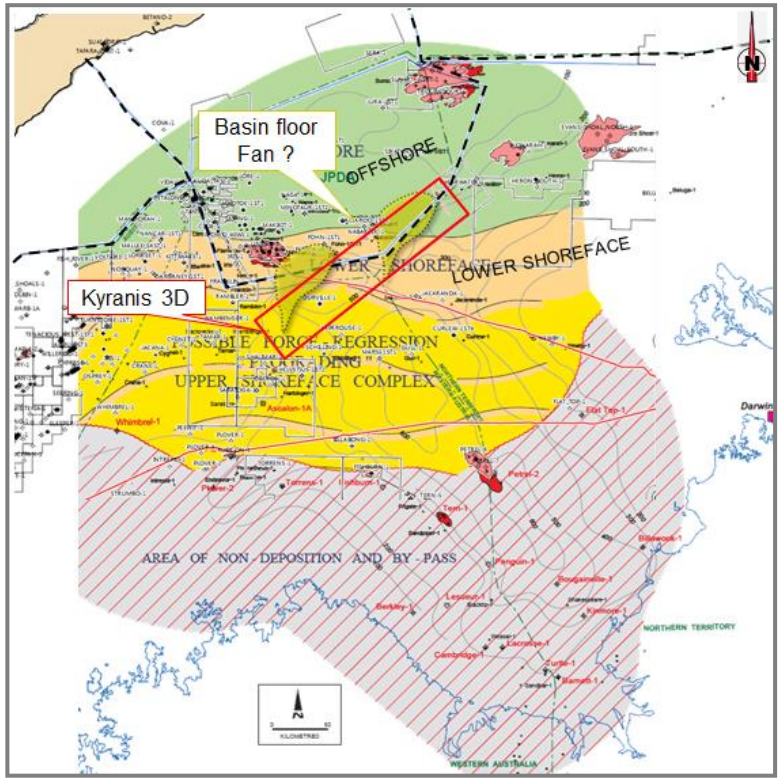
Elang/Plover Sands

	cutoff	POS	MSV	P85	P15
Chuditch	0	100	1170	670	1490
Chuditch-West	0	90	530	396	668
Bilby	0	100	190	138	247
Wombat	0	100	775	401	1106
Total			2674		



Possibility of stacked objectives

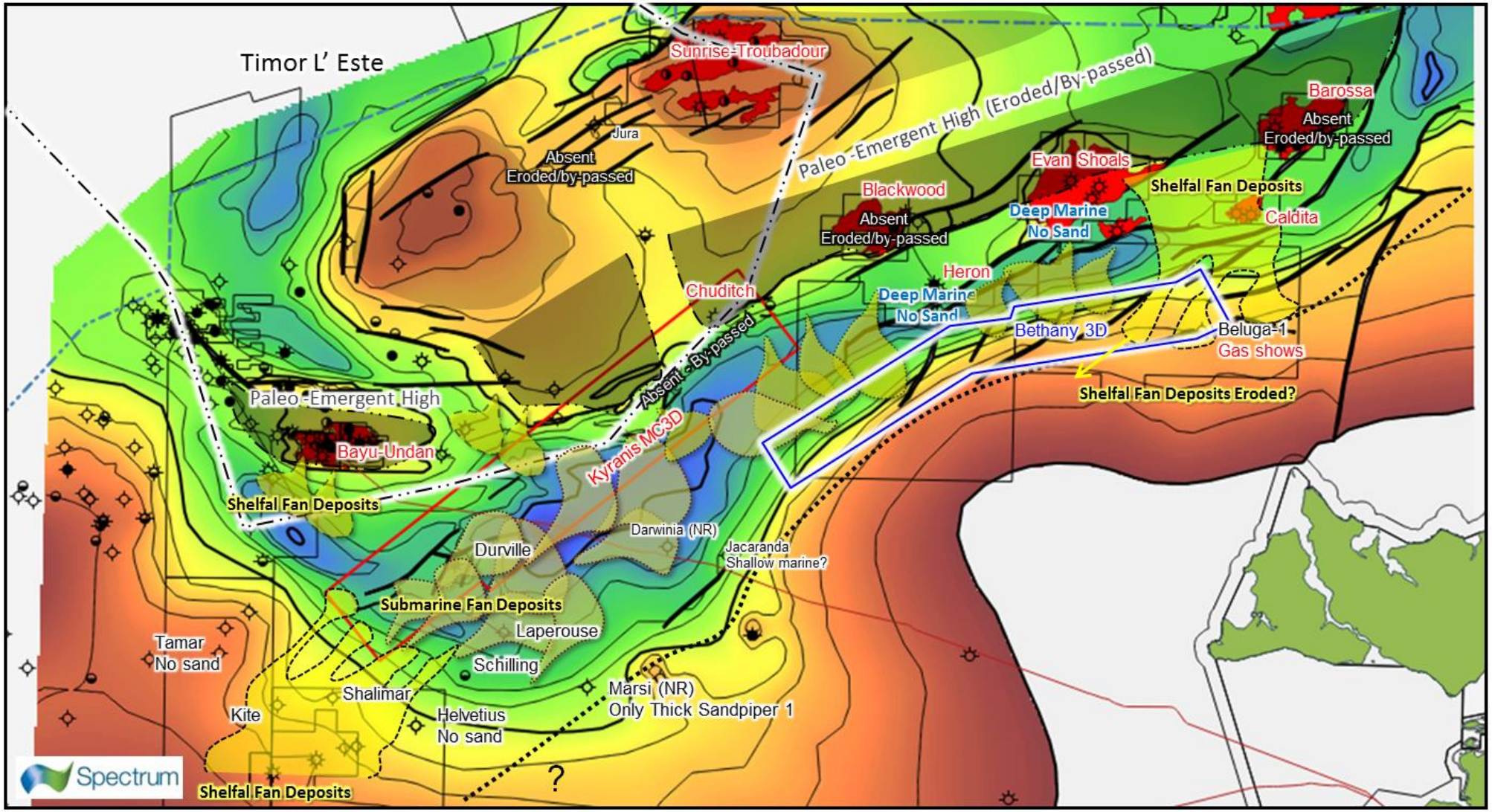
- Elang/Plover Sands
- Triassic Sands? (Ascalon Sst. Early Triassic)
  - Lower shoreface could extend further or
  - Basin floor turbdite fans could be present
- Permian Sands (Upper most Cape Hay)
- Fractured Carbonates (Darwin, Pearce. . . ?)



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? Echuca & Flamingo Shales

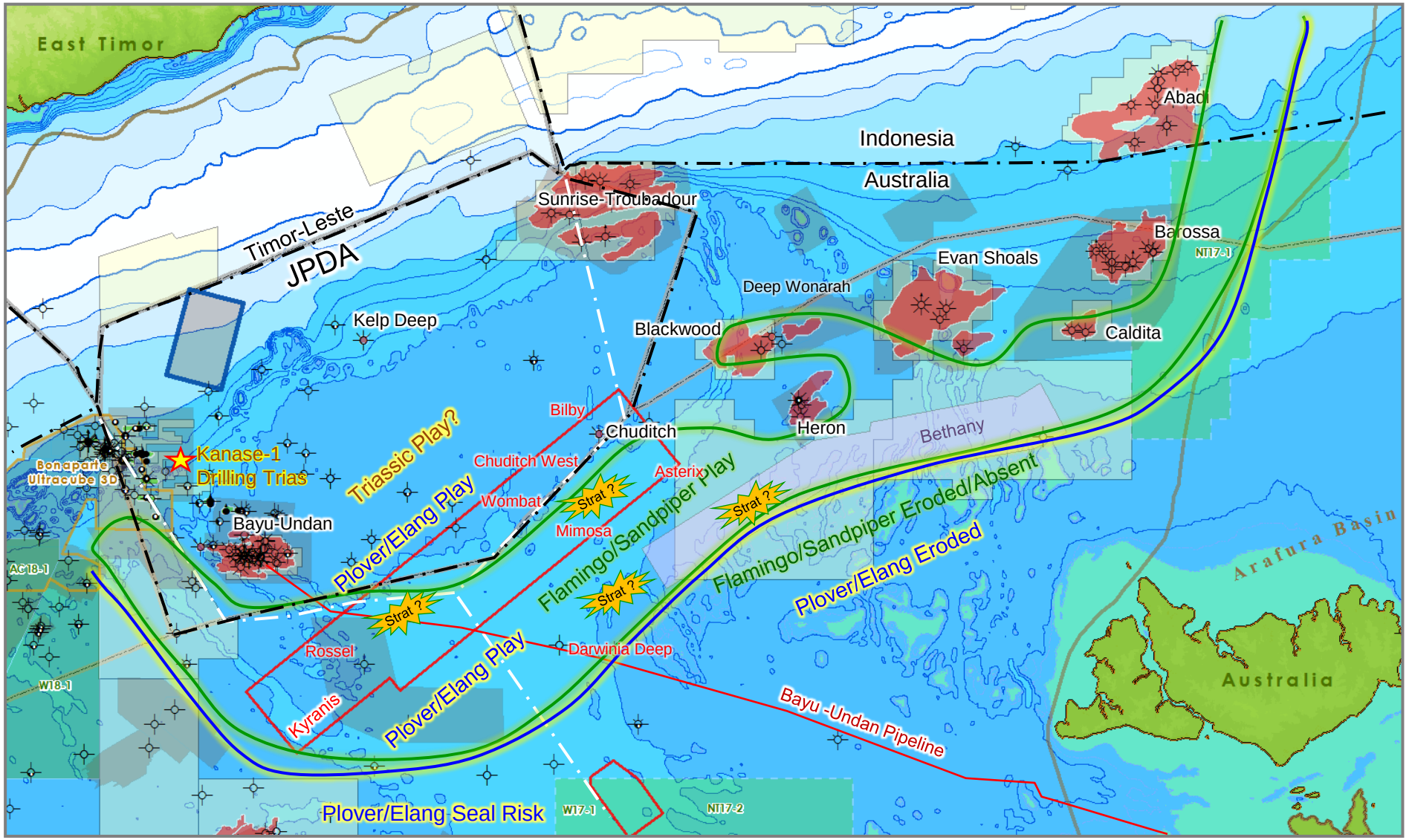
Beluga-1

- **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

Overlying Sandpiper 1 Sands more wide spread in south

West Malita Graben: Prospects / Concepts



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)

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Opportunities

Bilby Prospects

Concepts

Seismic Data

Spectrum's recent MC3D's

Other 3D data sets

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