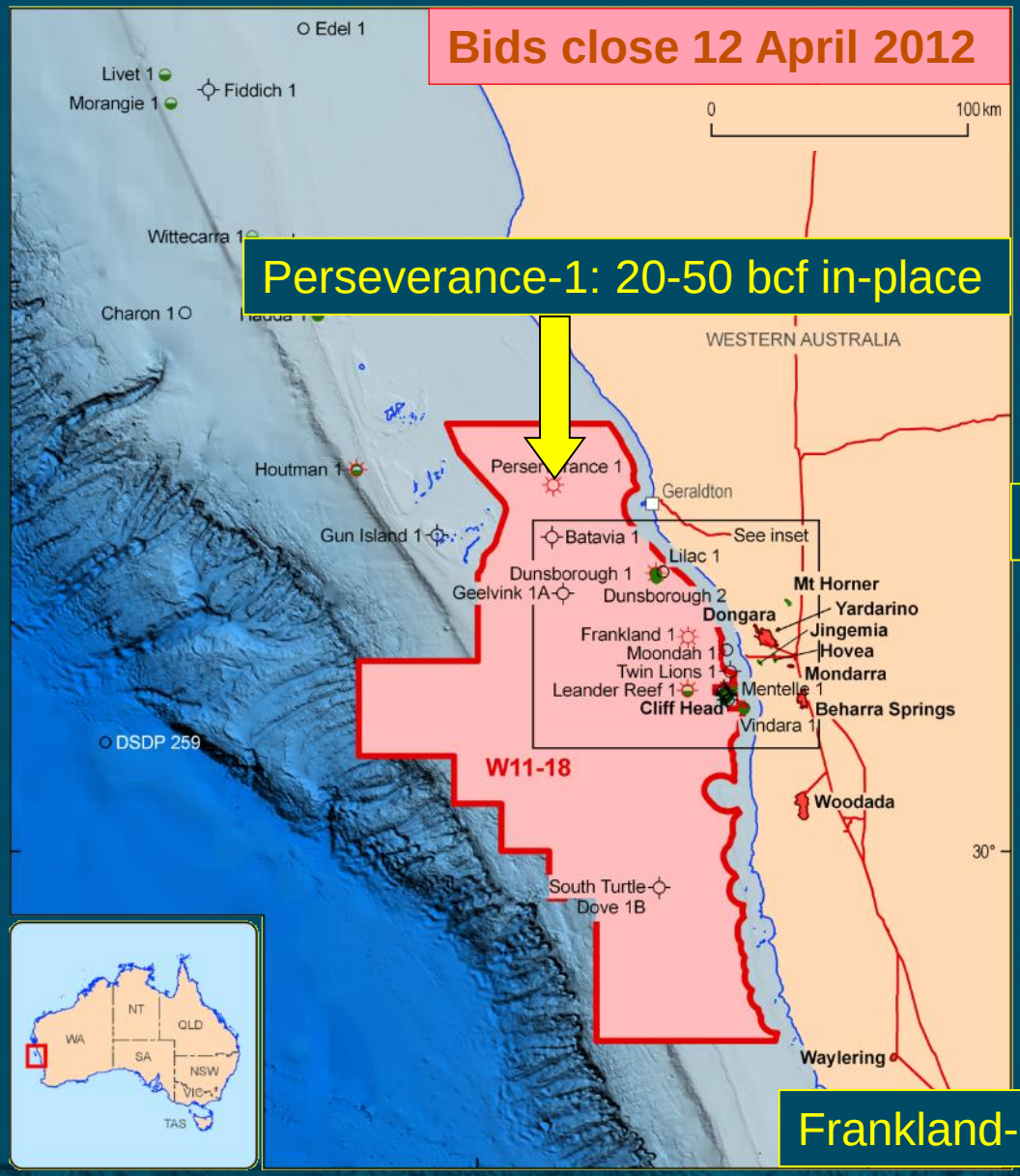
Australian Government
Geoscience Australia

New exploration opportunities in the offshore northern Perth Basin

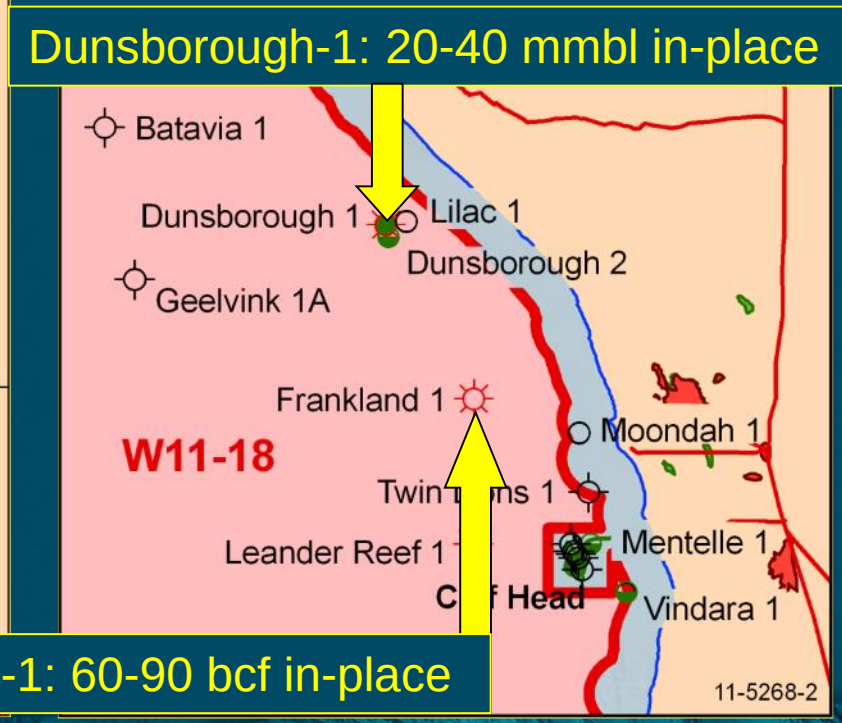
Andrew Jones
on behalf of the Perth Petroleum Section
Geoscience Australia

ExxonMobil Meeting, 13 February 2012

Offshore Northern Perth Basin Release Area W11-18



- Very large area (259 blocks; 17,475 km^2)
- Mostly in <500 m water
- Adjacent to producing Cliff Head oil field (produced 9 mmbl; 2P reserves 8.3 mmbl; Roc Oil)
- Includes 3 recent discoveries



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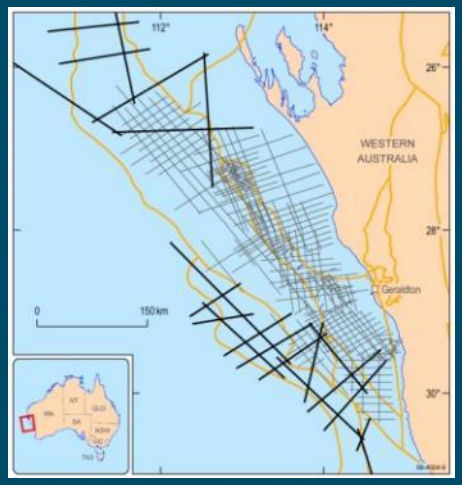
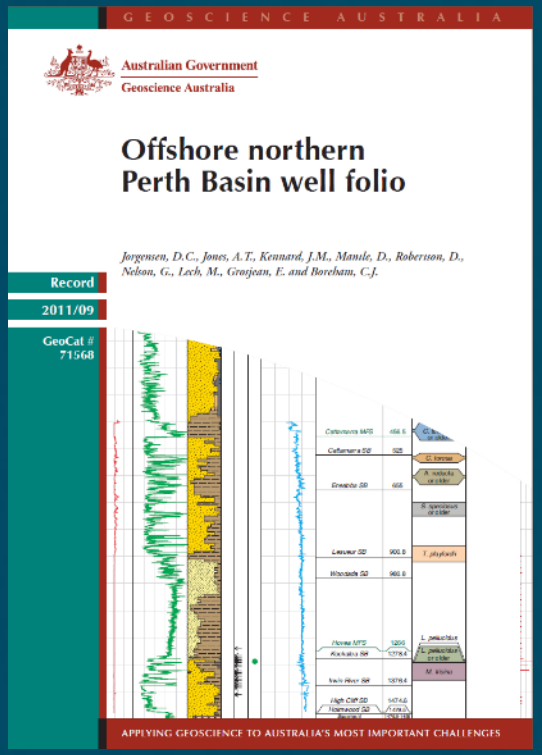
Preliminary estimates: Roc Oil Stock Exchange Releases

Southwest Margin Datasets and Products

New Data

- Seismic (Survey 310, Reprocessed industry data)
- Potential Field (magnetic, gravity)
- Marine (multibeam bathymetry, sub-bottom profiler, rock dredges, sediment cores)
- Open-file wells (palynology, source rock, fluid inclusions)





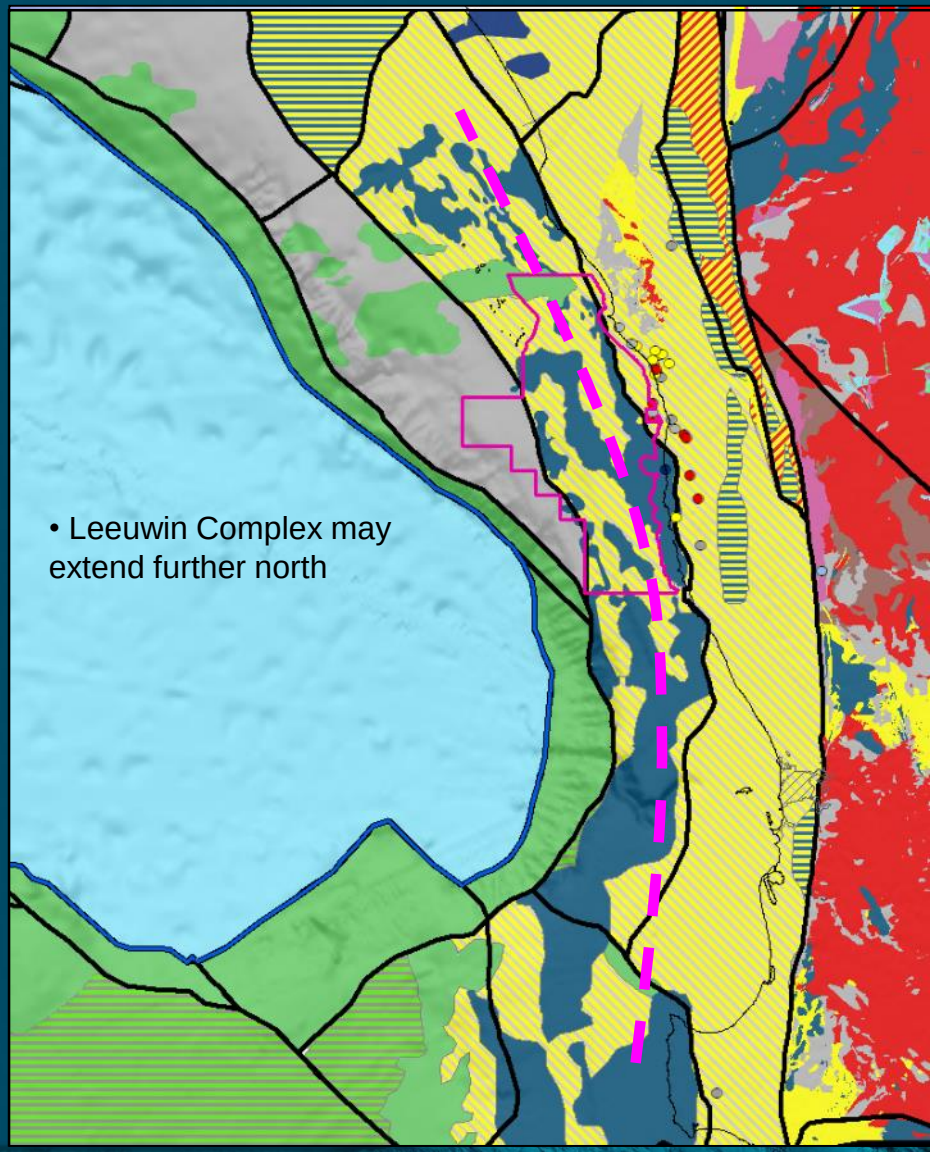
Geoscience Australia Records

- Marine reconnaissance post-survey report (2009/38)
- Offshore North Perth Well Folio (2011/09)
- Velocity analysis & depth conversion (in press)
- Magnetic modelling of depth to basement (in prep)
- SW margin basement terranes (in prep)
- SW margin potential field data (in prep)
- MNF seepage survey post-survey report (in prep)

APPEA paper, AR documentation, PESA & AusGeo News

Basement Composition

- **Basement composition from outcrop and wells**
- **Interpolated on the basis of potential field data (including automated magnetic source body attribute extraction)**
- **Constrained with geochronogical data**



COB

Basement terrane boundary

Oceanic crust

Igneous

Metaigneous gneiss

Metasedimentary gneiss

Undifferentiated gneiss

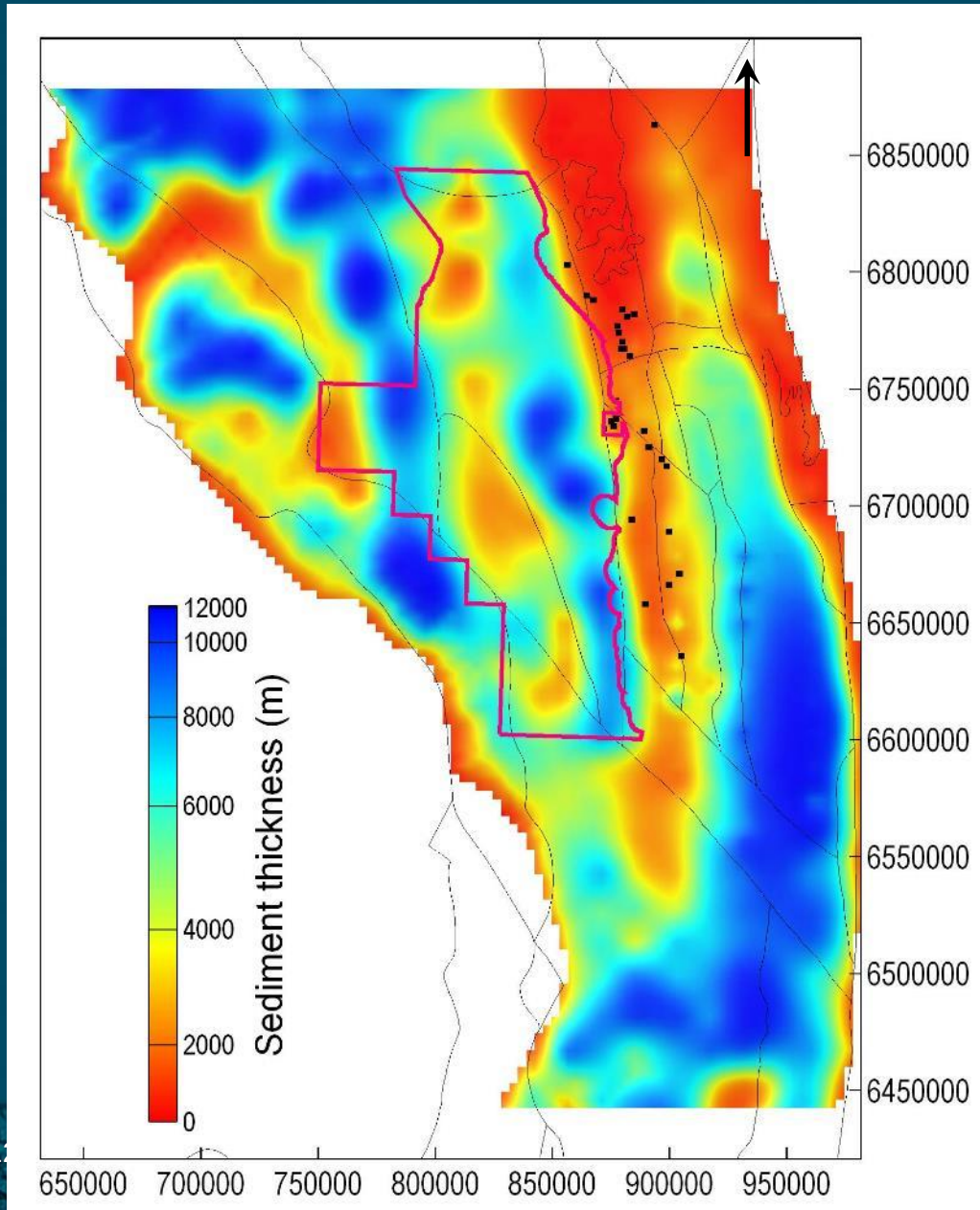
Granite

Depth to basement modelling

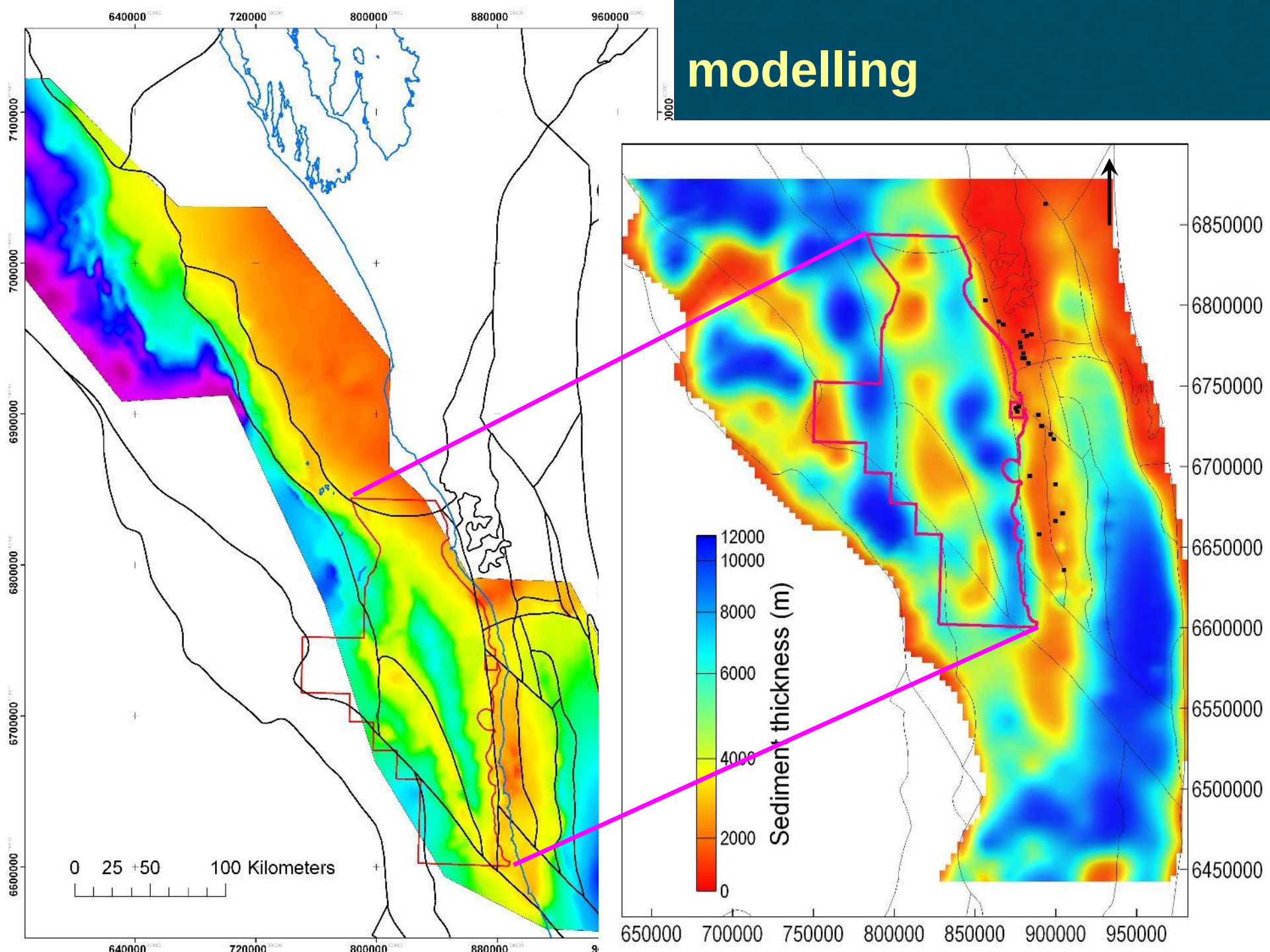
- Produced from magnetic power spectrum depths (Spector and Grant, 1970)
- Depth to magnetic susceptibility contrasts

(e.g. sediment-basement/magnetic bodies)

- Integrates known geological constraints
- Depth to Precambrian from wells and onshore seismic
- Interpretation aided by Bouguer gravity
- Methodology detailed in Johnston and Petkovic, in prep and refs therein



modelling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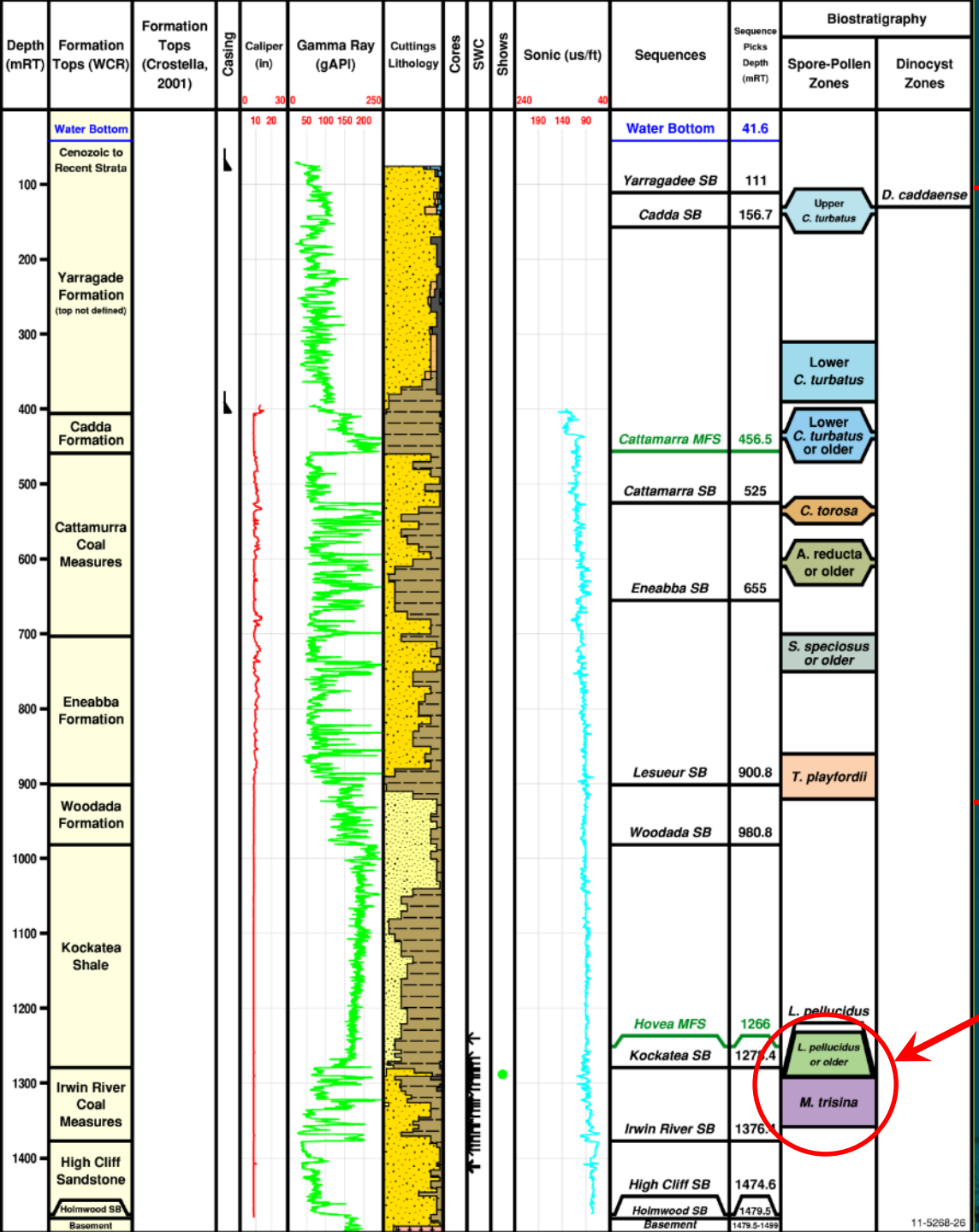

Cliff Head-1 Well Composite

Palynological data provide constraints for age correlative sequences

New Palynology

- *T. playfordii to D. caddaense*
- Early Triassic to Mid-Jurassic

Previous Palynology

- *M. trisina to L. pellucidus*
- Late Permian – Earliest Triassic

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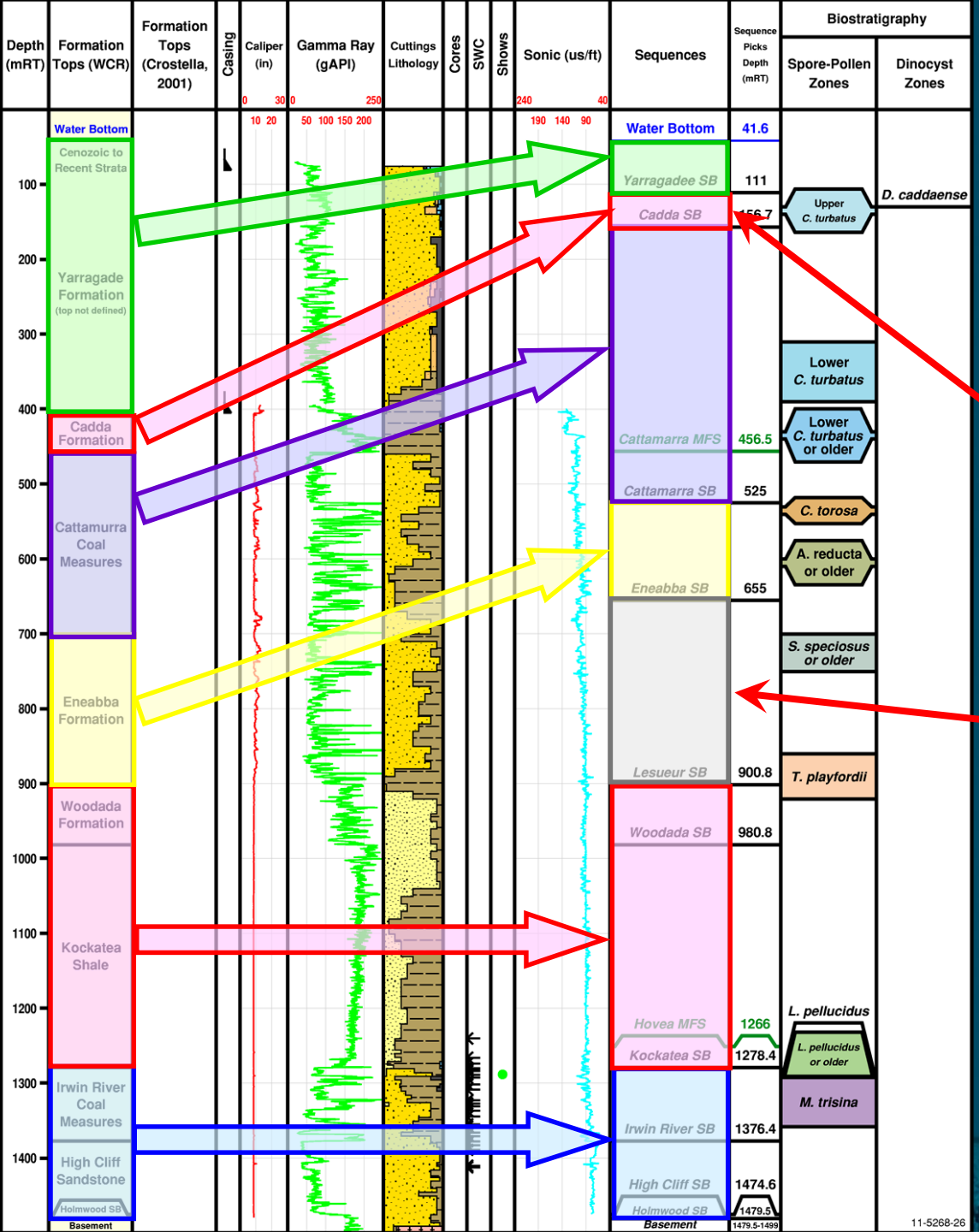
Cliff Head-1 Well Composite

Revised interpretation based on new palynological data and sequence stratigraphy

Mid-Jurassic MFS (Cadda) identified 300 m higher in well

Thick Triassic sand package (Lesueur) present



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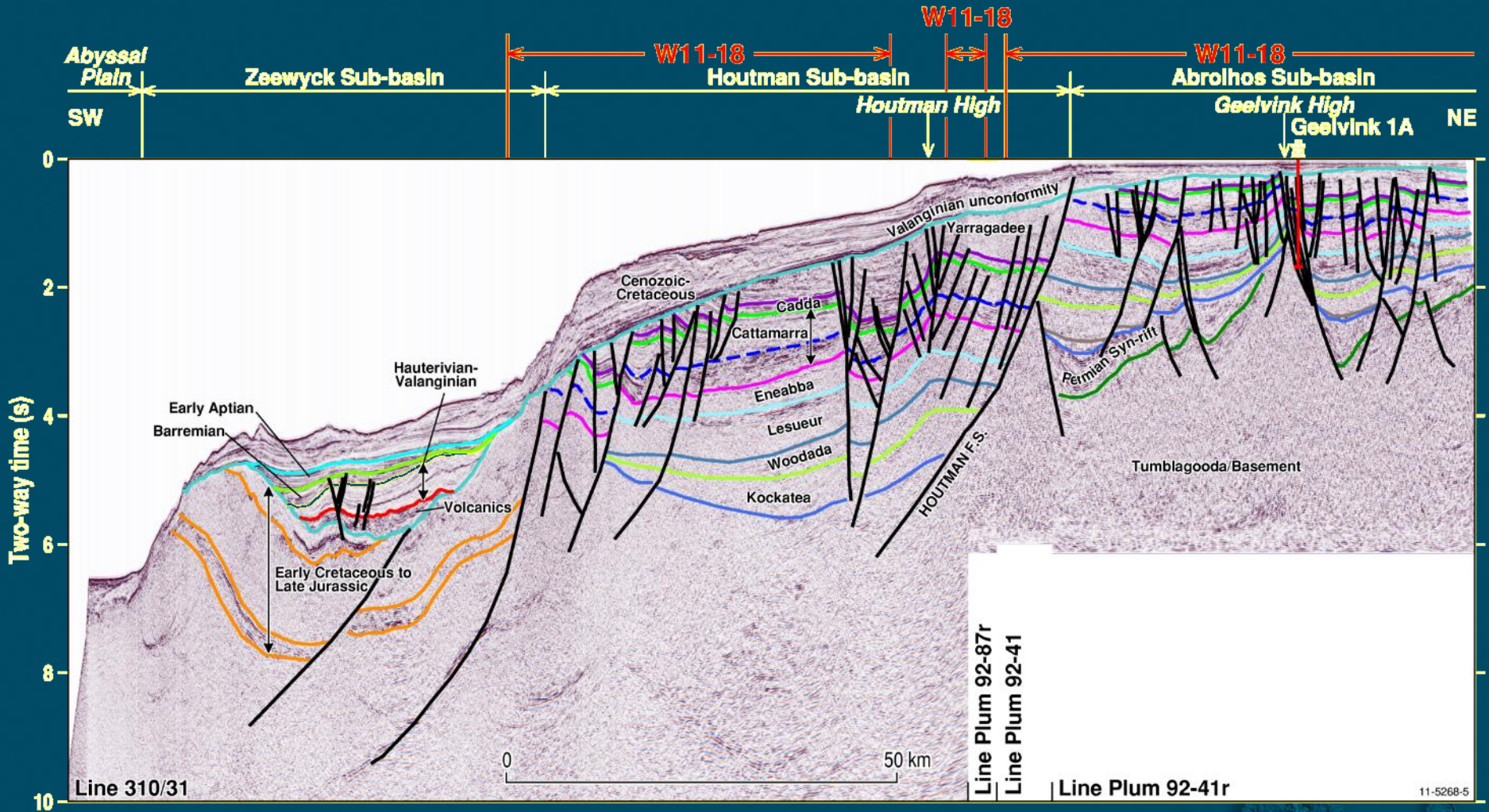
Key sequences tied to regional seismic transects



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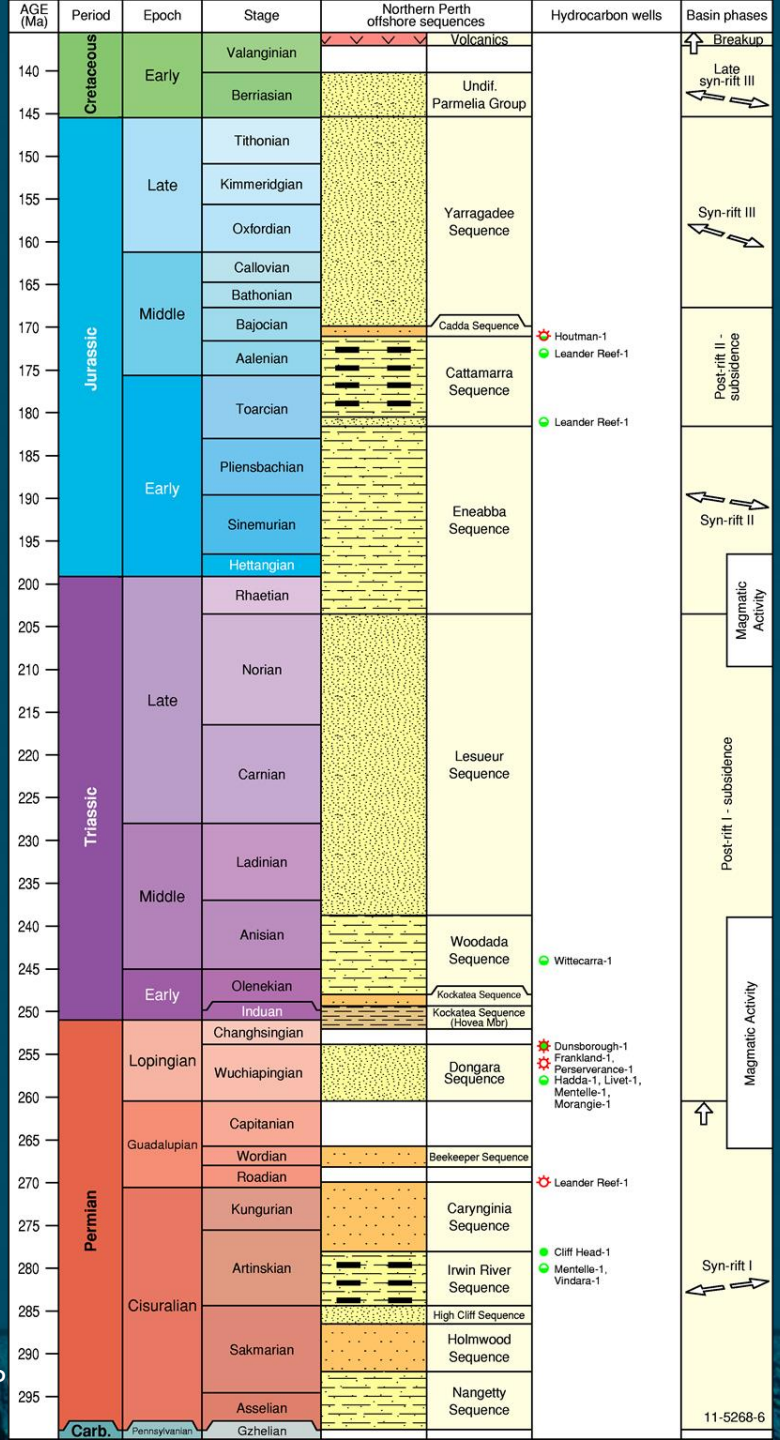


Offshore Northern Perth Basin Tectonostratigraphy

Three phases of rifting:

Late Jurassic/Early Cretaceous

Early Jurassic

Permian

Two major uplift events:

Early Cretaceous

Mid/Late Permian

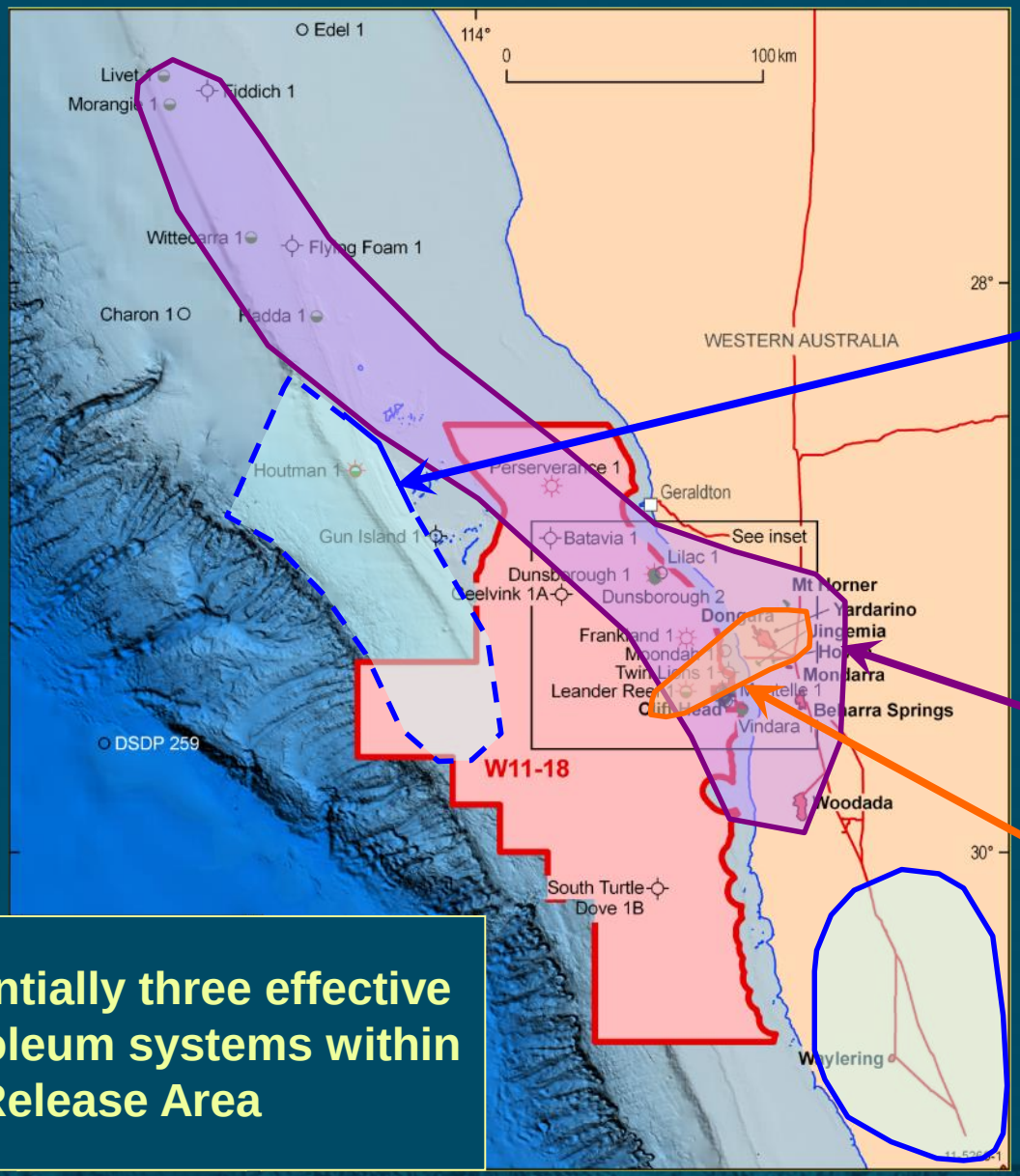
Three periods of magmatism:

Early Cretaceous

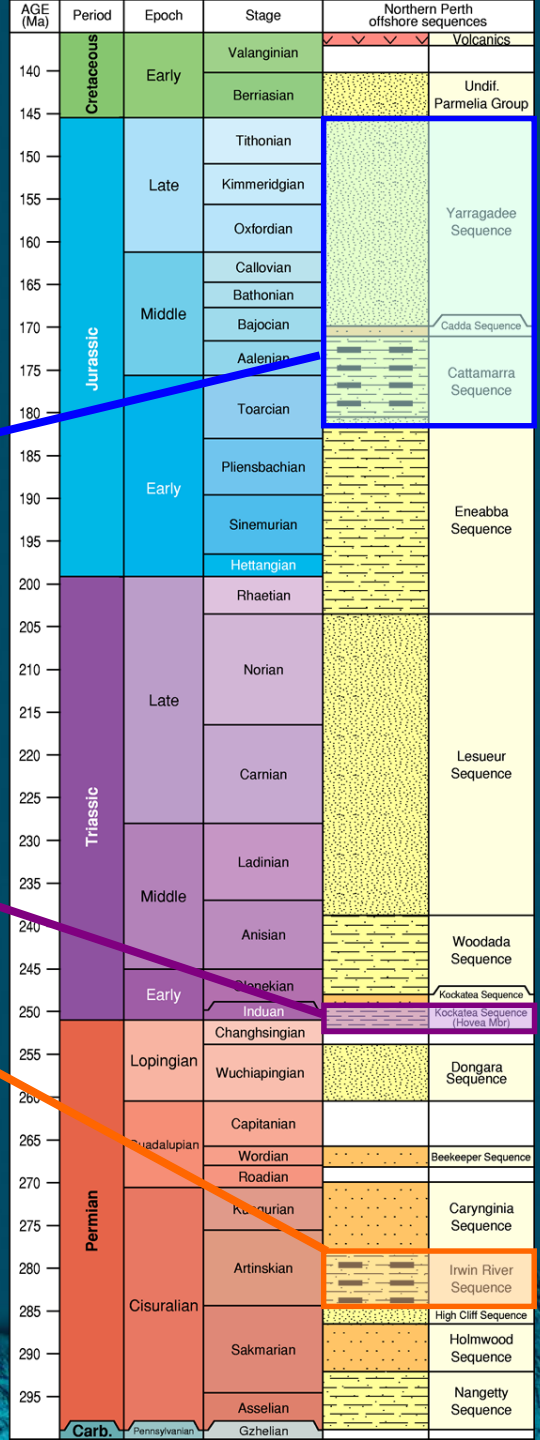
Late Triassic/Early Jurassic

Late Permian/Early Triassic

Northern Perth Basin Petroleum Systems



Potentially three effective petroleum systems within the Release Area



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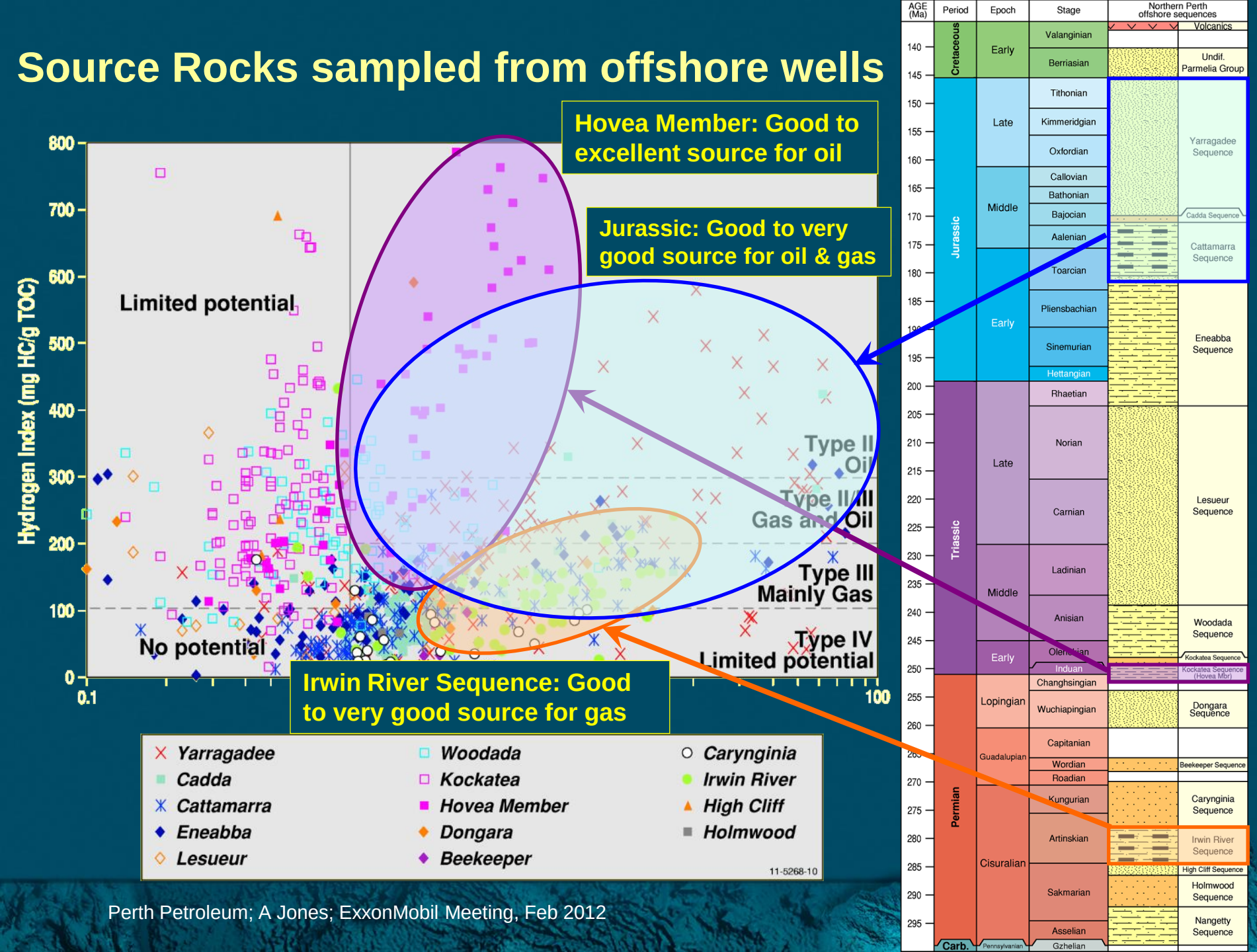
Source Rocks sampled from offshore wells



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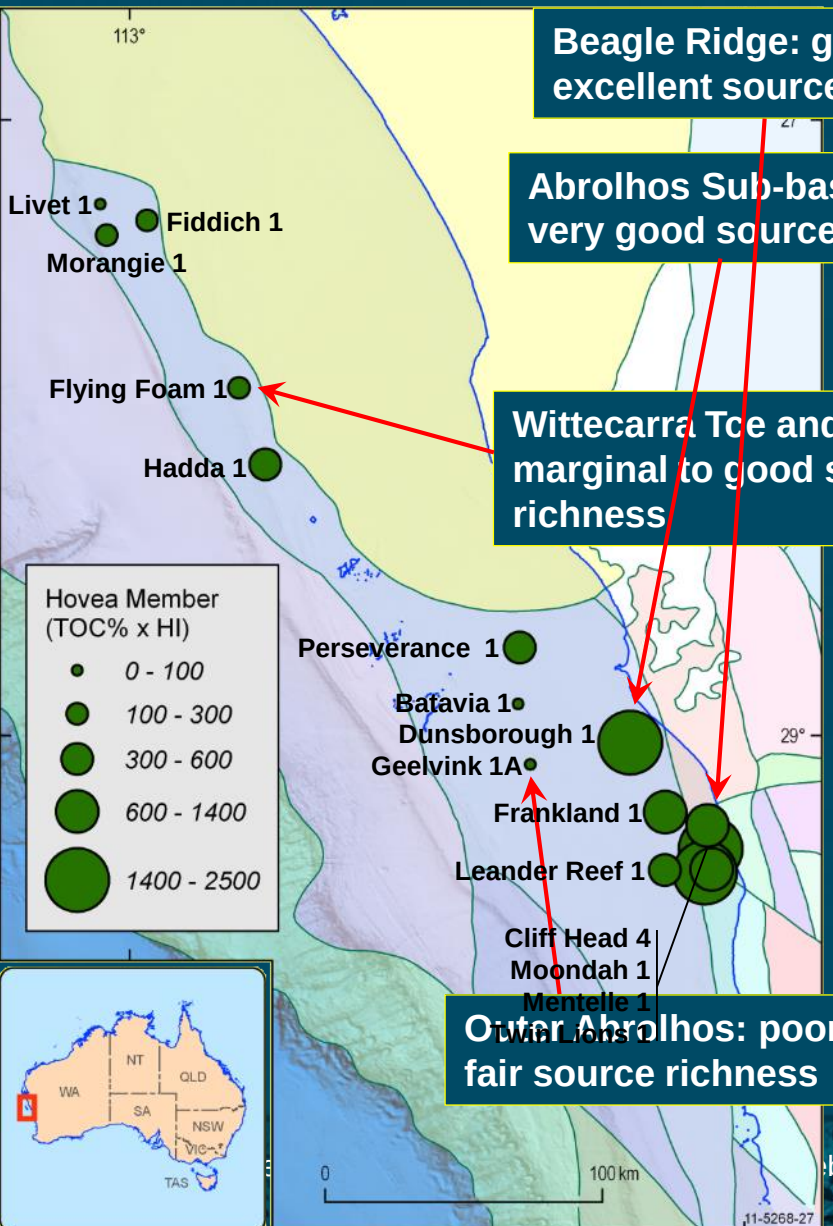
Source potential of Hovea Member in offshore wells

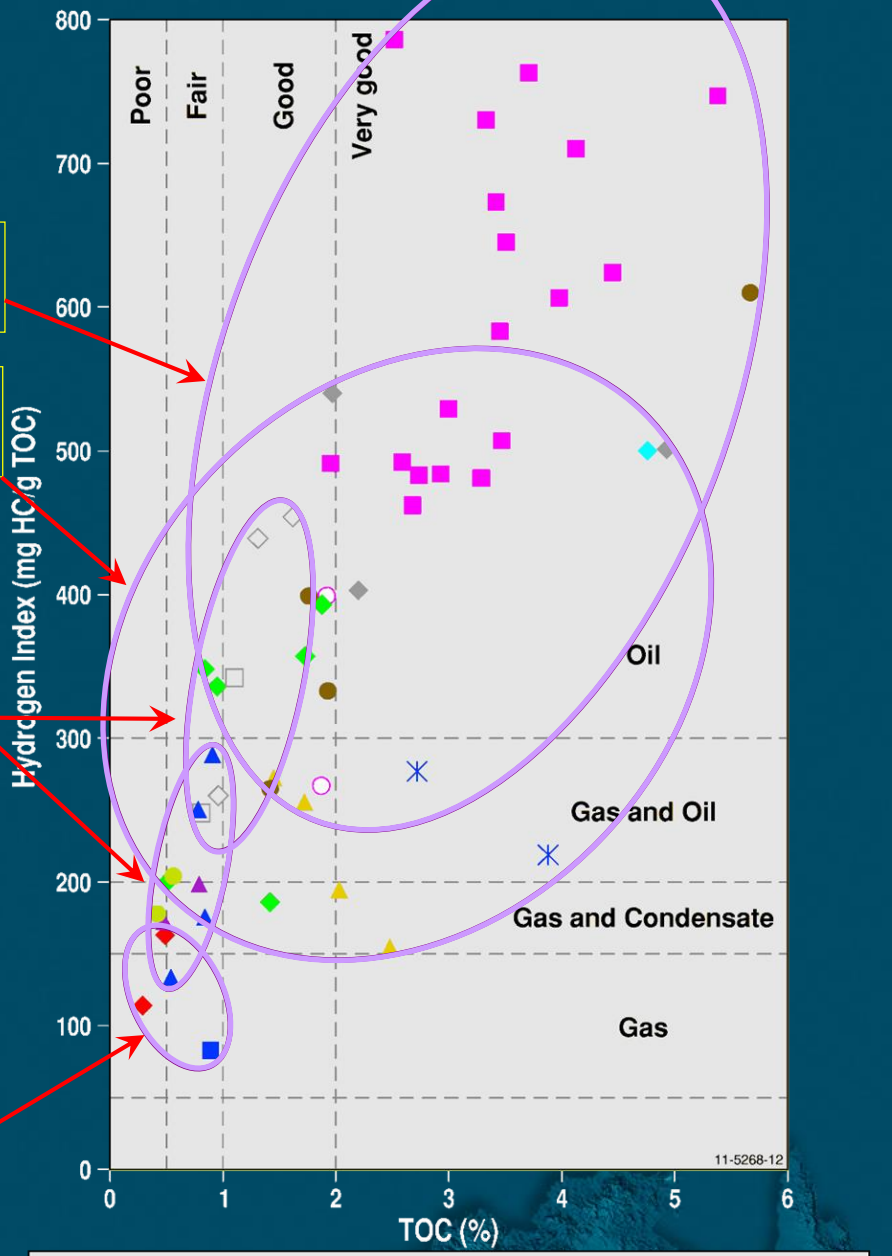


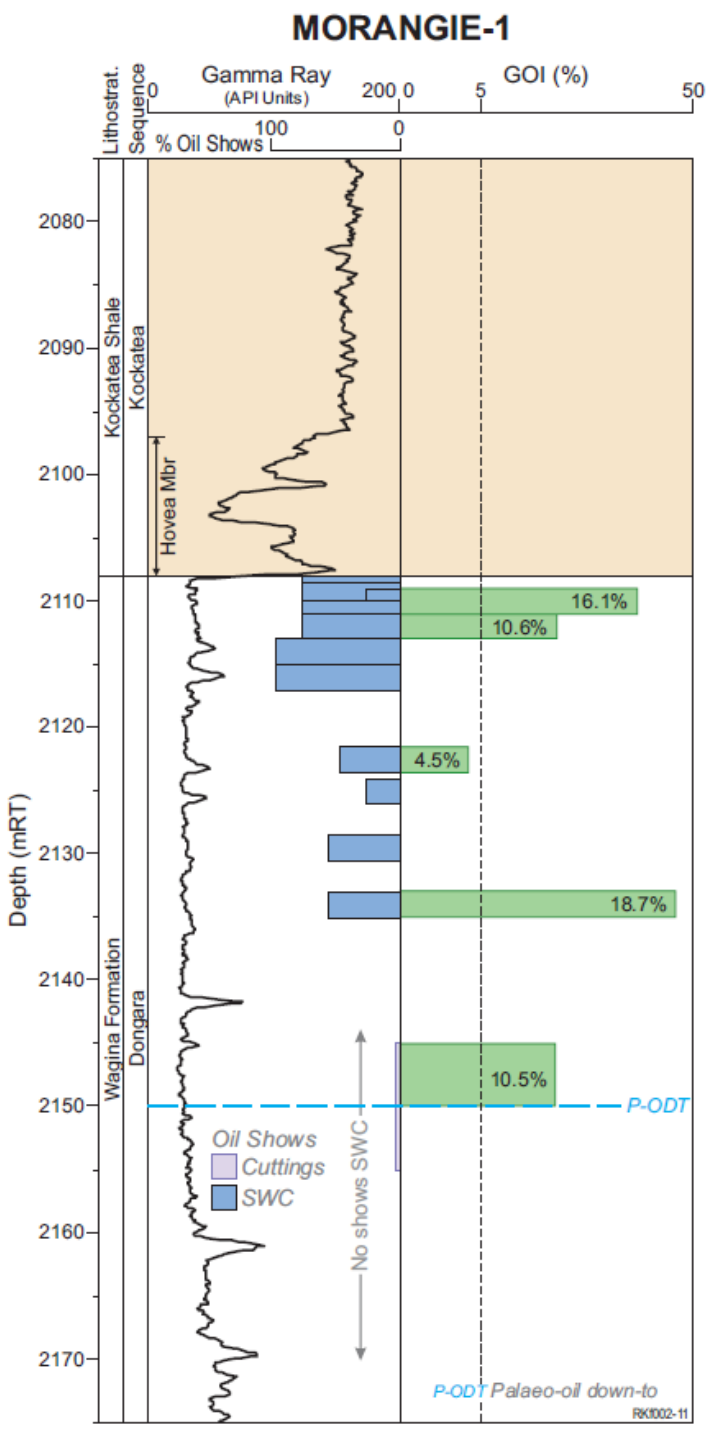
Beagle Ridge: good to excellent source richness

Abrolhos Sub-basin: fair to very good source richness

Wittecarra Tce and North: marginal to good source richness

Outer Abrolhos: poor to fair source richness





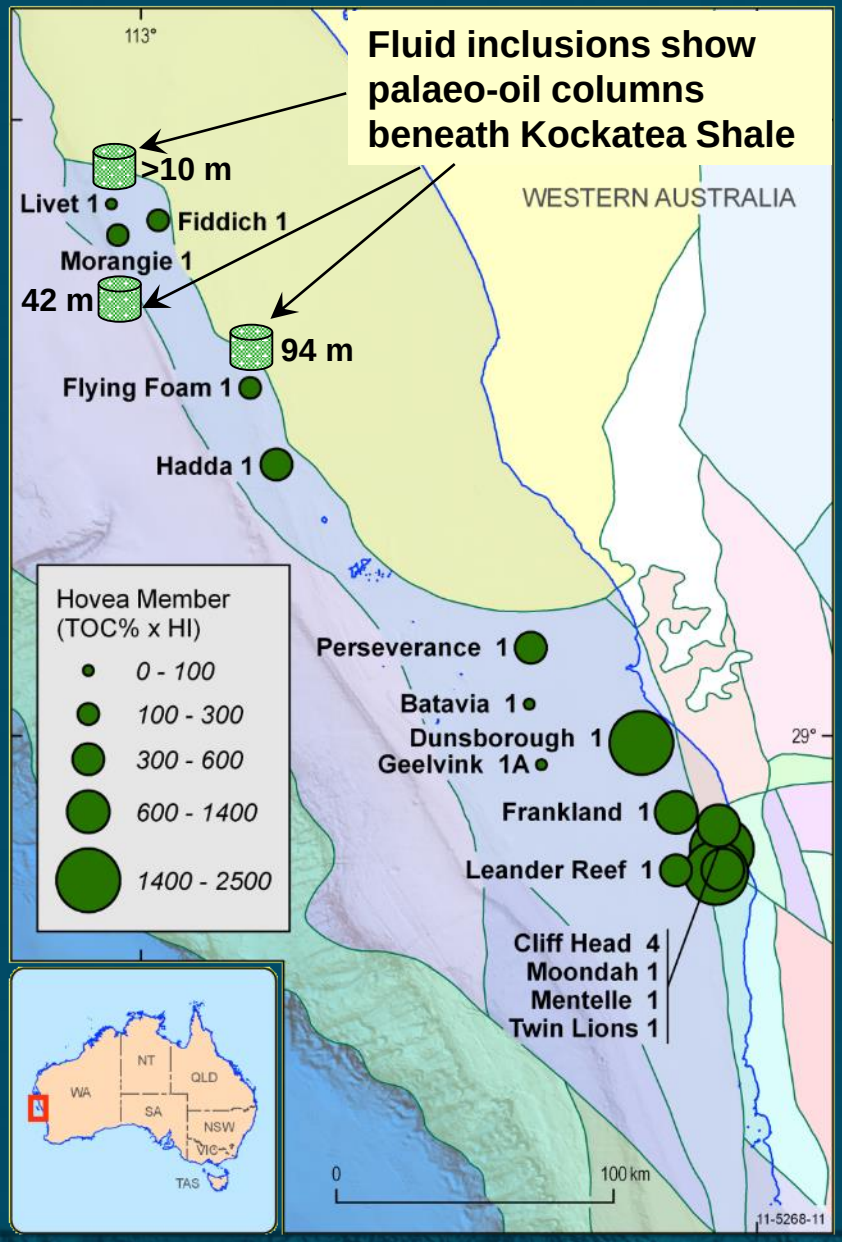
New Fluid Inclusion Data – GOI

Palaeo-oil columns have been detected in 14 exploration wells.

Cliff Head, Dunsborough, Frankland and Perseverance fields

Flying Foam–1
Hadda–1
Houtman–1
Leander Reef–1
Lilac–1
Livet–1
Mentelle–1
Morangie–1

Trap breach is a key risk for the offshore northern Perth Basin



Implications of Geochemical Data

Source rock studies suggest potential of Hovea on the northern Wittecarra Terrace is only poor to fair

Palaeo-oil columns provide direct evidence of un-penetrated Hovea source kitchens

Perth Petroleum; A Jones; ExxonMobil Meeting, Feb 2012

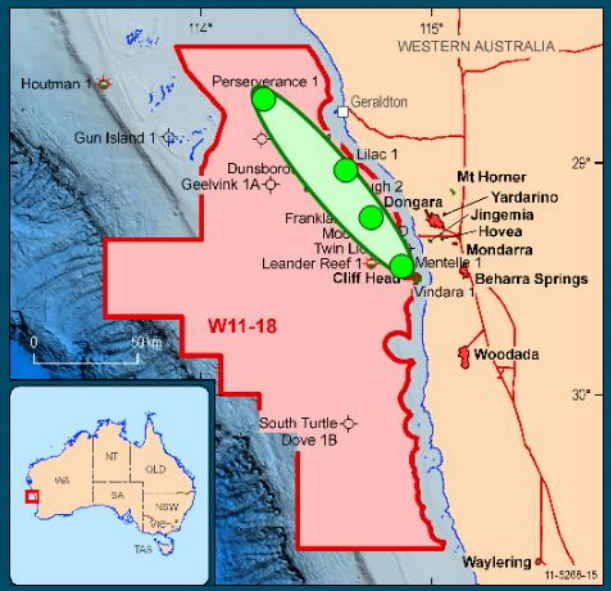
Offshore Northern Perth Basin Discoveries

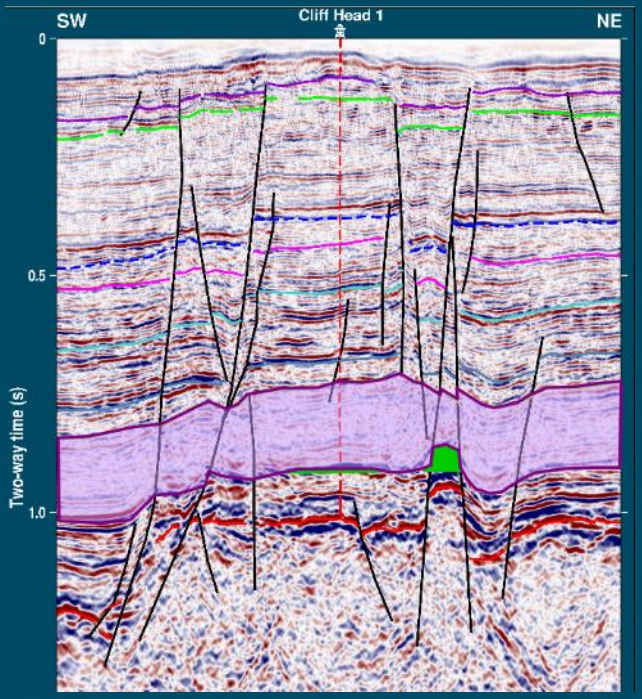
Source: Hovea Member

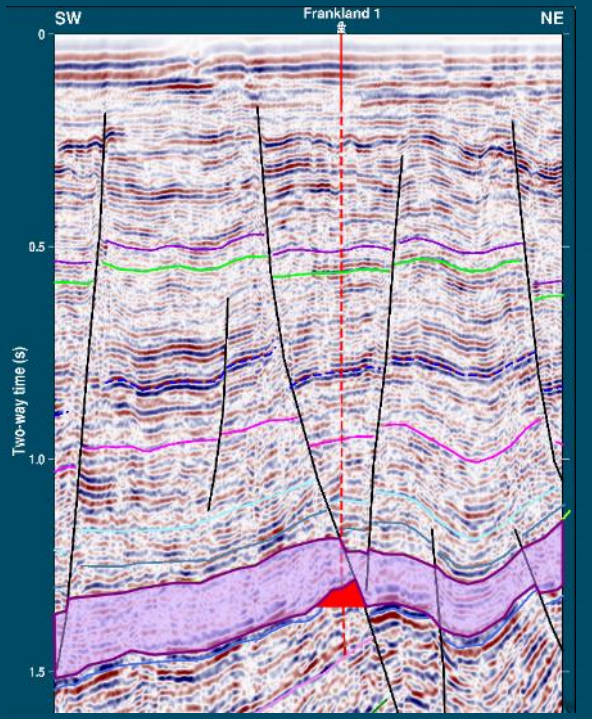
Reservoir: Dongara SS, IRCM

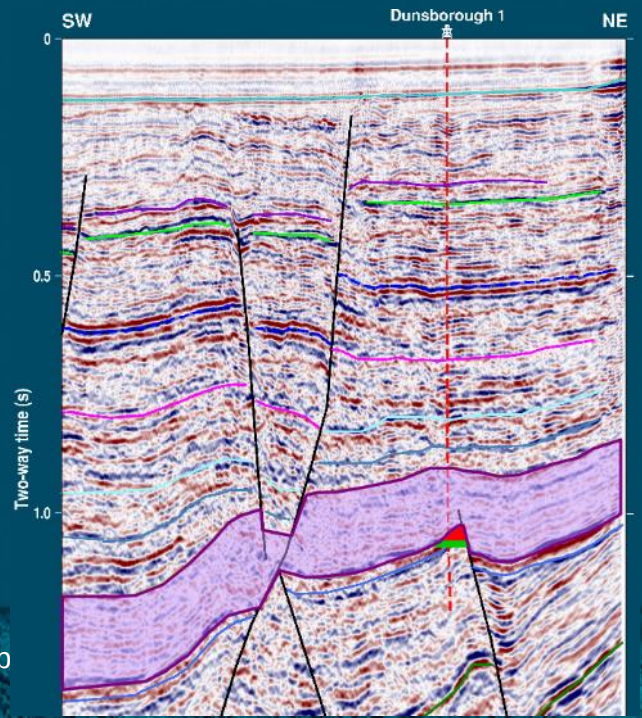
Seal: Kockatea Shale

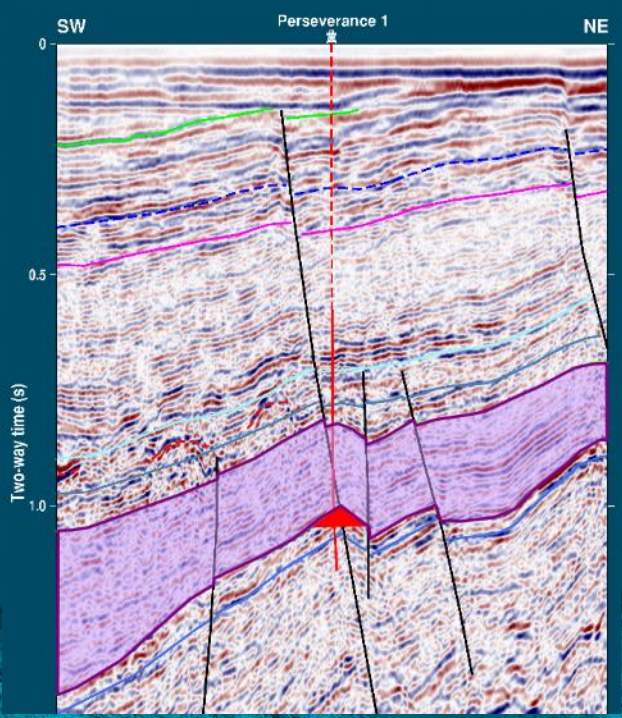
Trap: Fault Block











Perth Petroleum; A Jones; ExxonMob

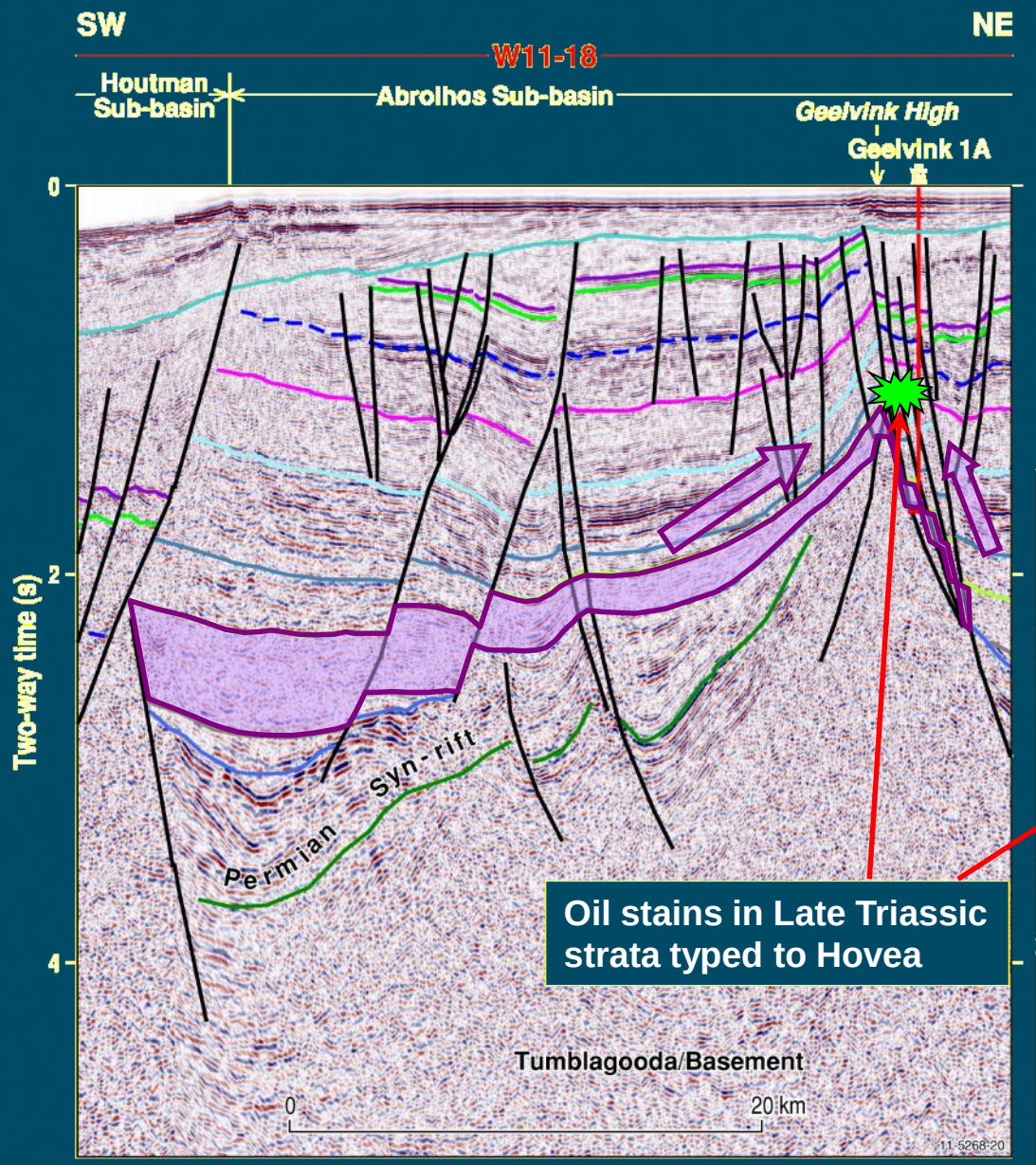
Offshore Northern Perth Basin Potential Plays

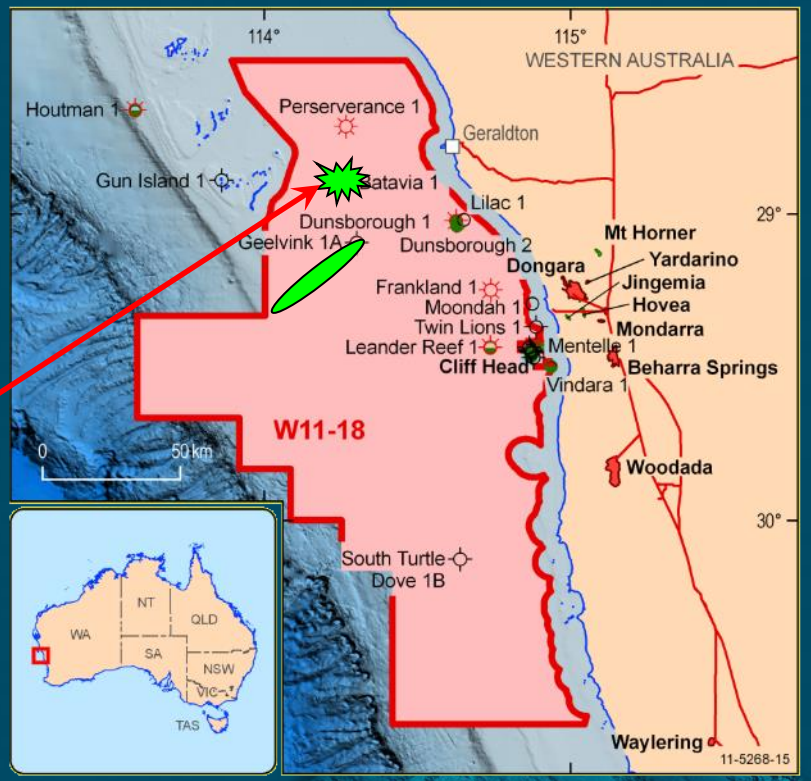
Source: Hovea Member, Permian

Reservoir: Dongara SS, IRCM

Seal: Kockatea Shale

Trap: Fault Block





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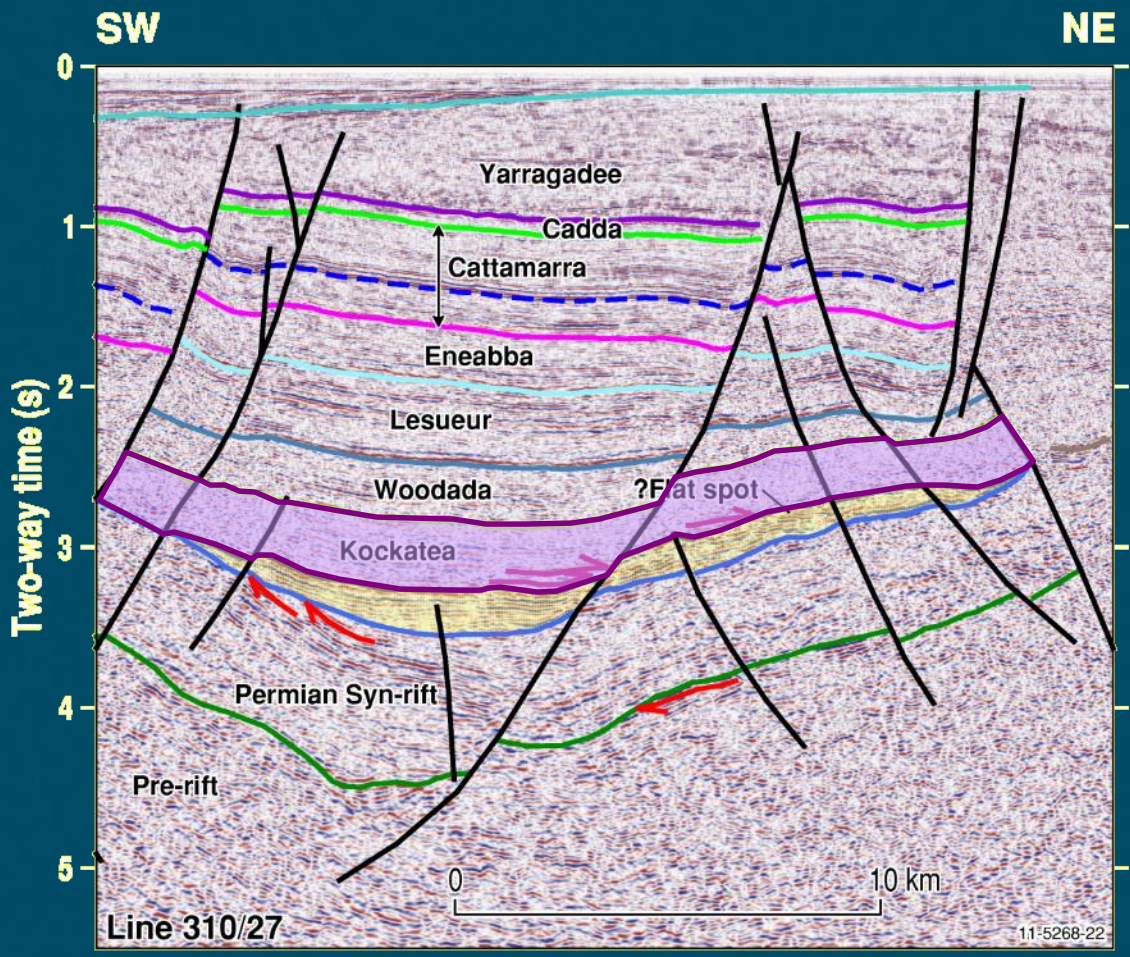
Offshore Northern Perth Basin Potential Plays
Dongara Lowstand Fan Complex

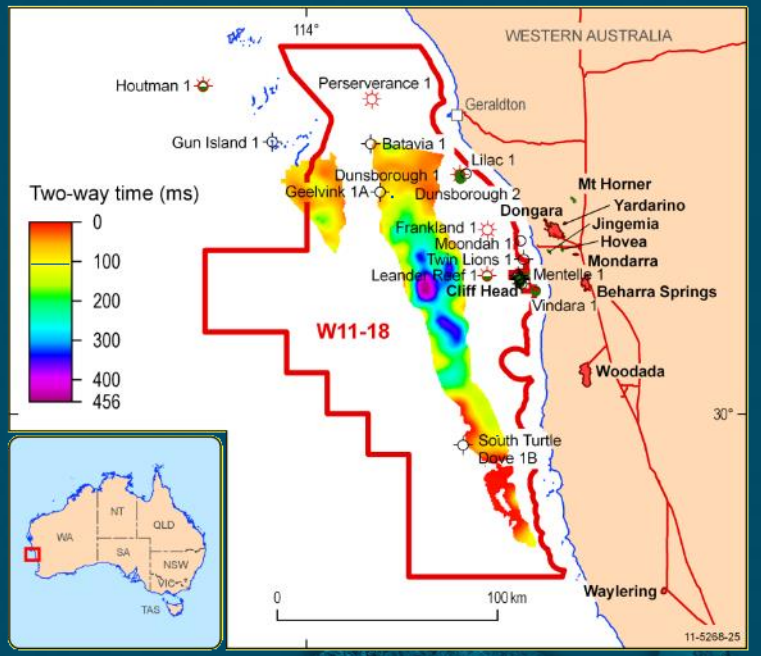


Source: Hovea Member, Permian

Reservoir: Dongara Lowstand Fan

Seal: Kockatea Shale

Trap: Stratigraphic



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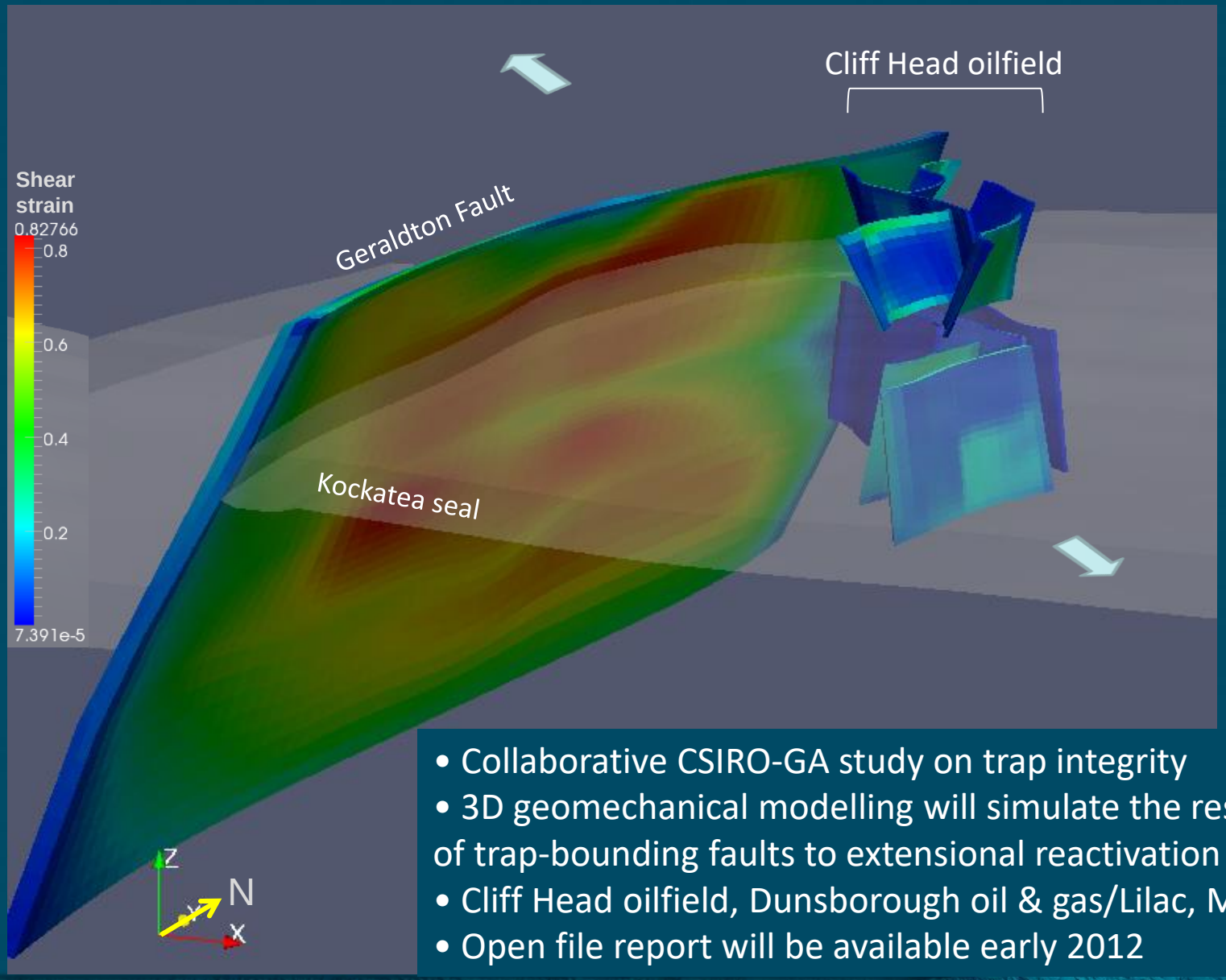
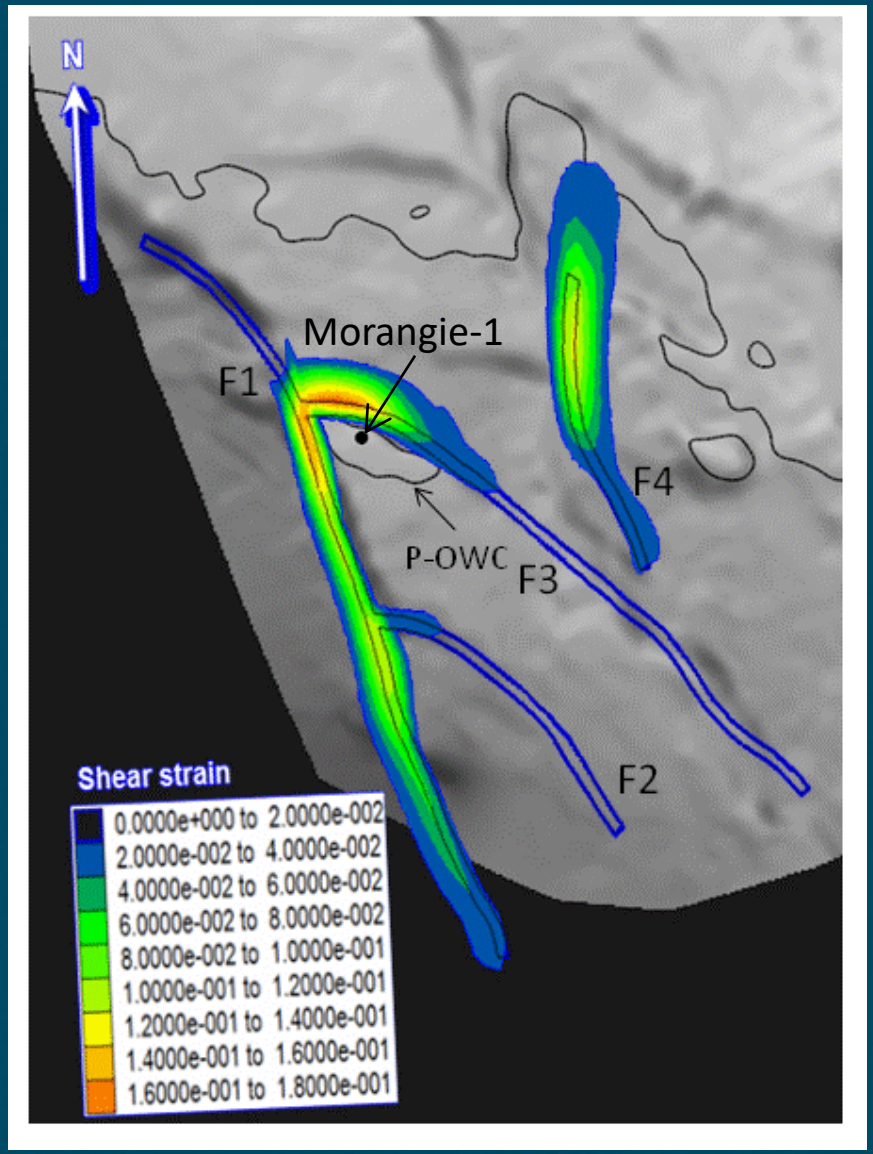
CSIRO-GA Trap integrity study



- Collaborative CSIRO-GA study on trap integrity
- 3D geomechanical modelling will simulate the response of trap-bounding faults to extensional reactivation
- Cliff Head oilfield, Dunsborough oil & gas/Lilac, Morangie
- Open file report will be available early 2012

CSIRO-GA Trap integrity study

Shear strain (plan-view)



- Morangie-1 dry well hosted a 42 m palaeo-oil column
- Loss of HC due to:
  - (i) the strain accommodated by the NNW-trending fault F1
  - (ii) (ii) the fault intersection in the vicinity of the Morangie structure resulting in a concentration of shear deformation and dilation.

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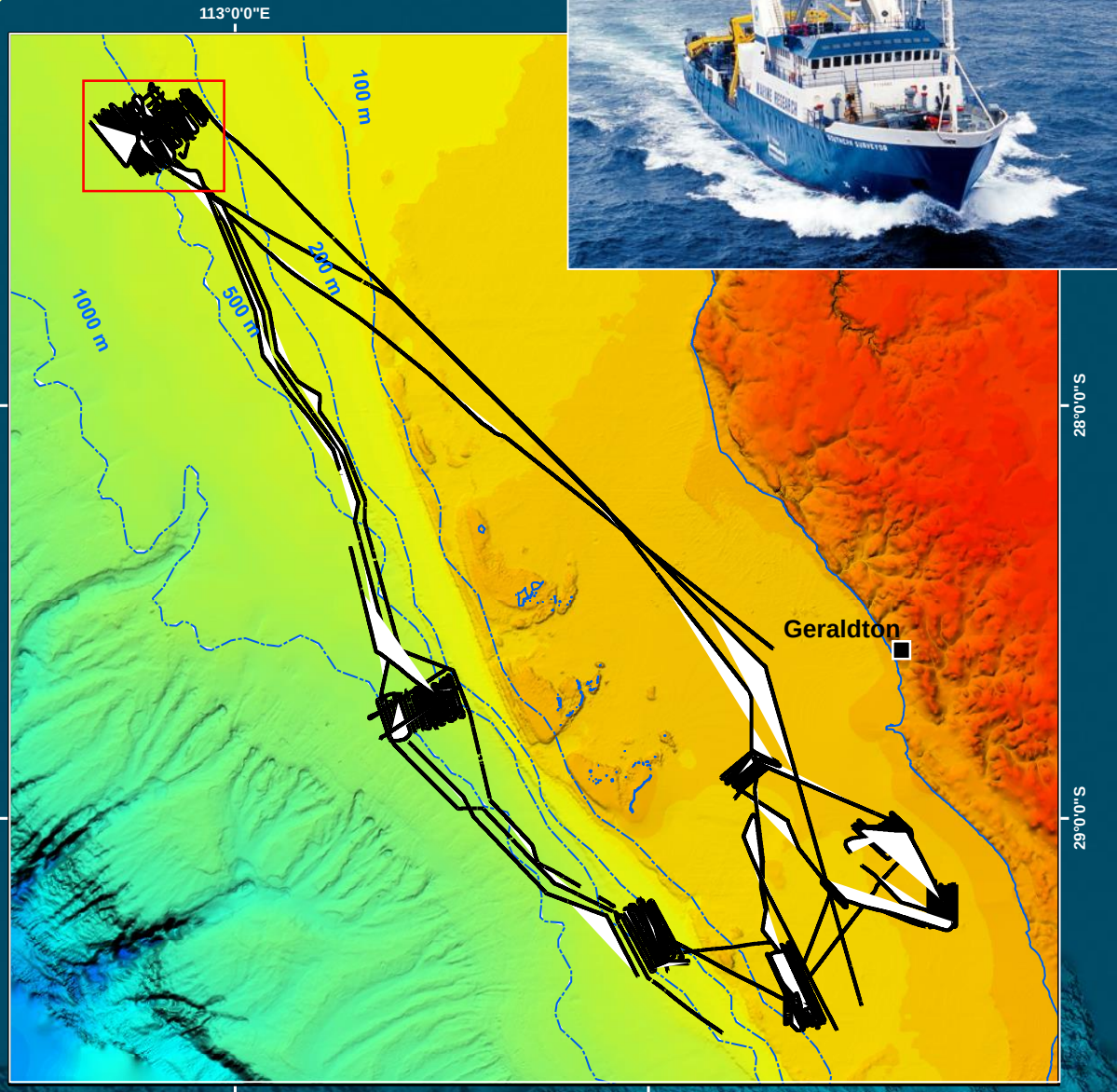
Marine National Facility Hydrocarbon Seepage Survey SS05-2011

- Proven accumulations (Dunsborough and Frankland)
- Breached structure (Livet)
- Undrilled prospects (Callisto, Updip Batavia and Zeewyck)
- Areas with seismic and remote sensing seepage indicators (Houtman Fault System).

Data type	Units	Total
Multibeam	km^2	3473
Sub-bottom profiler	line km	4038
Side-scan sonar	line km	1546
CTD	no.	11
Smith-Mac Grab	no.	71
Gravity Core	no.	28
Camera tow	no.	5
ROV	no.	9



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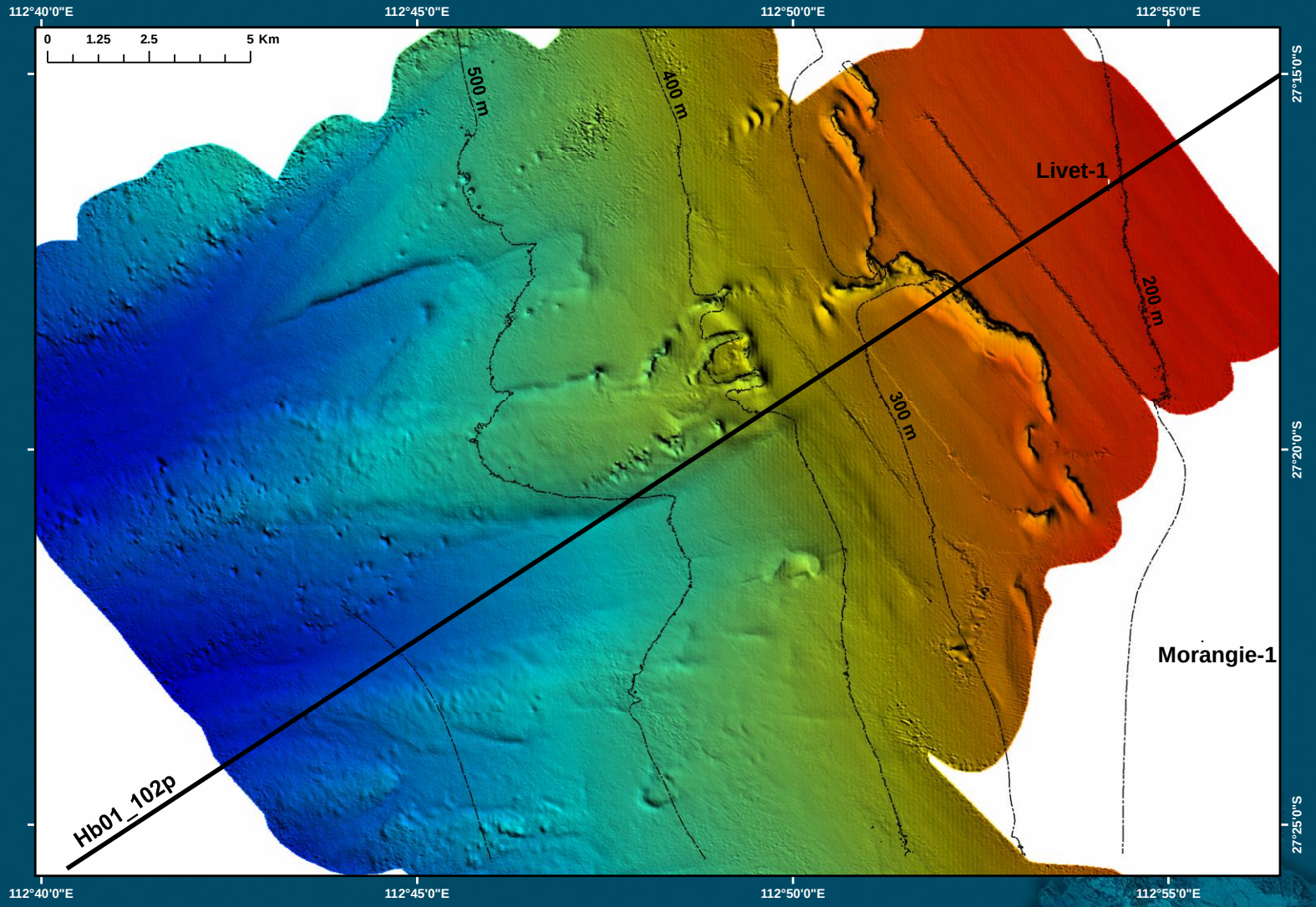
Area H – Multibeam bathymetry



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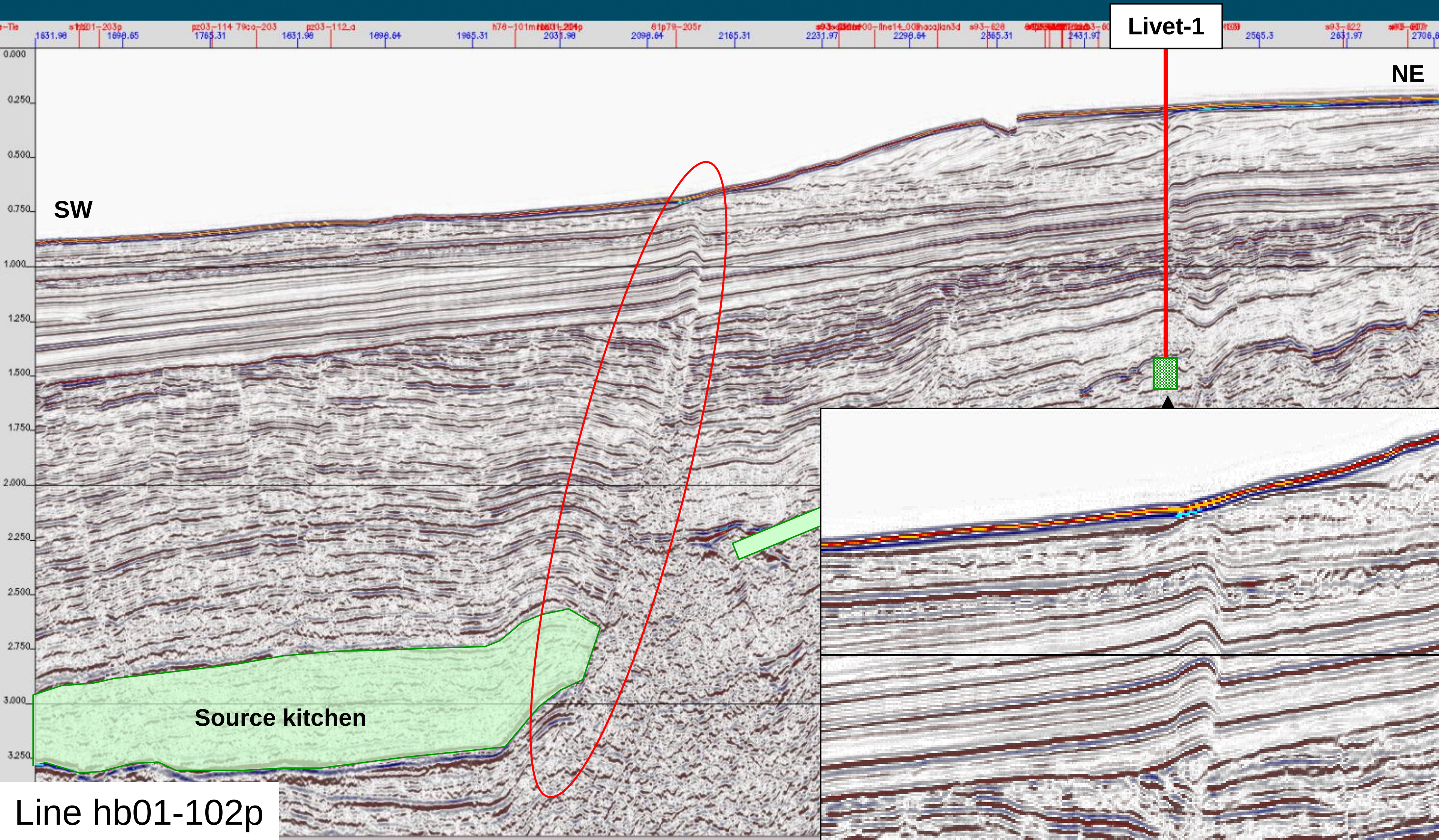
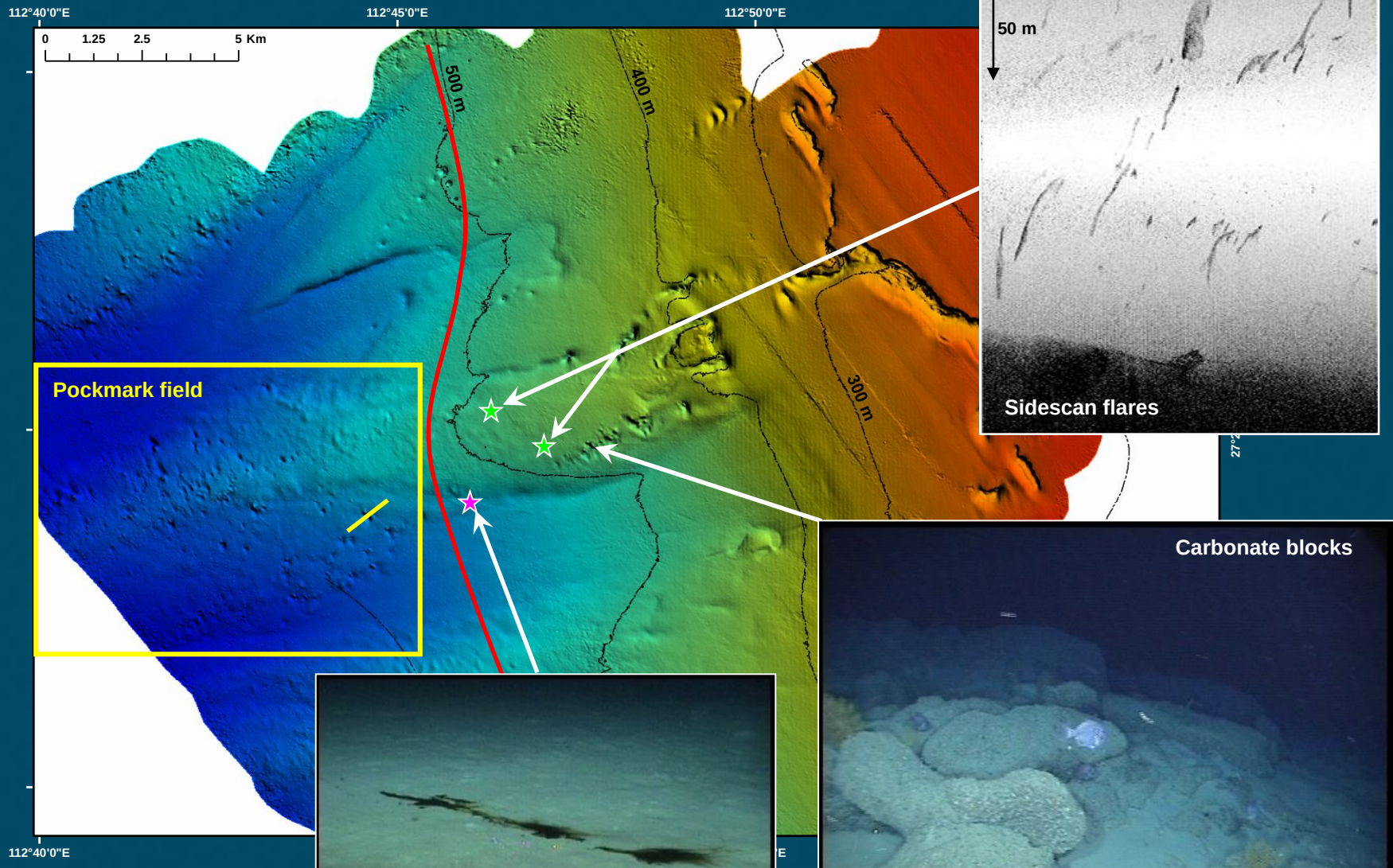
Seismic profile through Area H

Palaeo-oil column in Livet-1 indicates adjacent Hovea Mbr source kitchen

Major fault to seabed with evidence for recent movement



Area H – Multibeam bathymetry

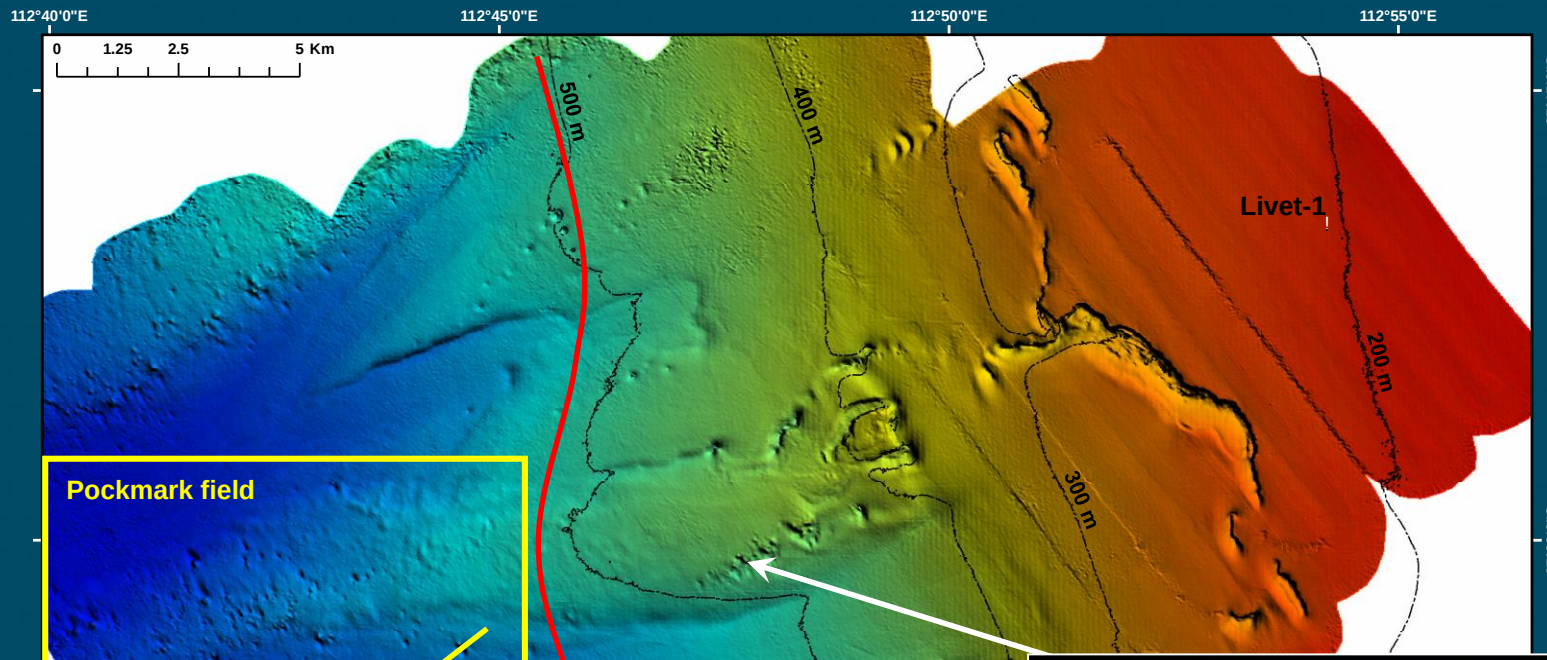


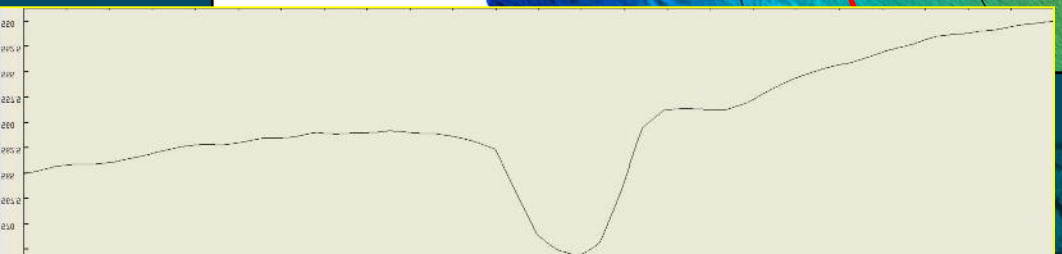
Perth Petroleum; A Jones; Exx

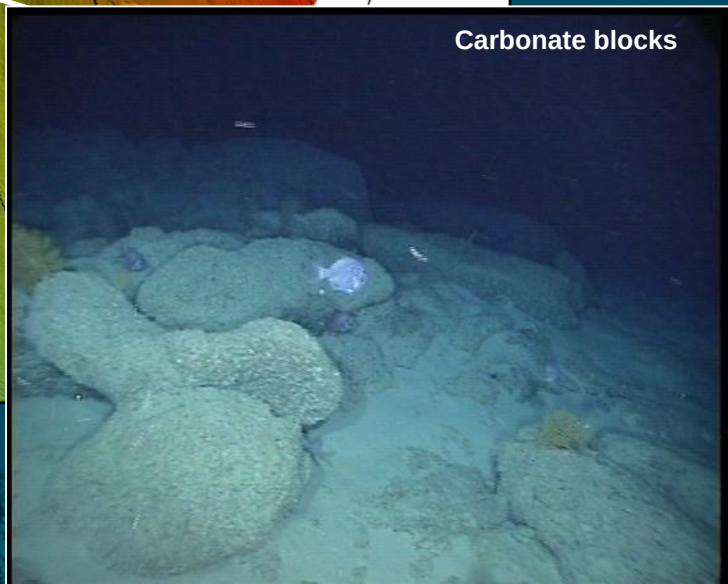
Acreage Release Area W11-18: offshore northern Perth Basin

- Highly prospective block:
  - Includes oil & gas discoveries; adjacent to producing oil field; onshore infrastructure
  - Several active petroleum systems; proven source rocks; proven plays with untested leads; new stratigraphic play
- Trap integrity modelling to understand primary exploration risk
- Evidence from marine survey consistent with natural HC (oil) seepage to the north
- Underpinned by new biostratigraphic, geochemical potential field and seismic data

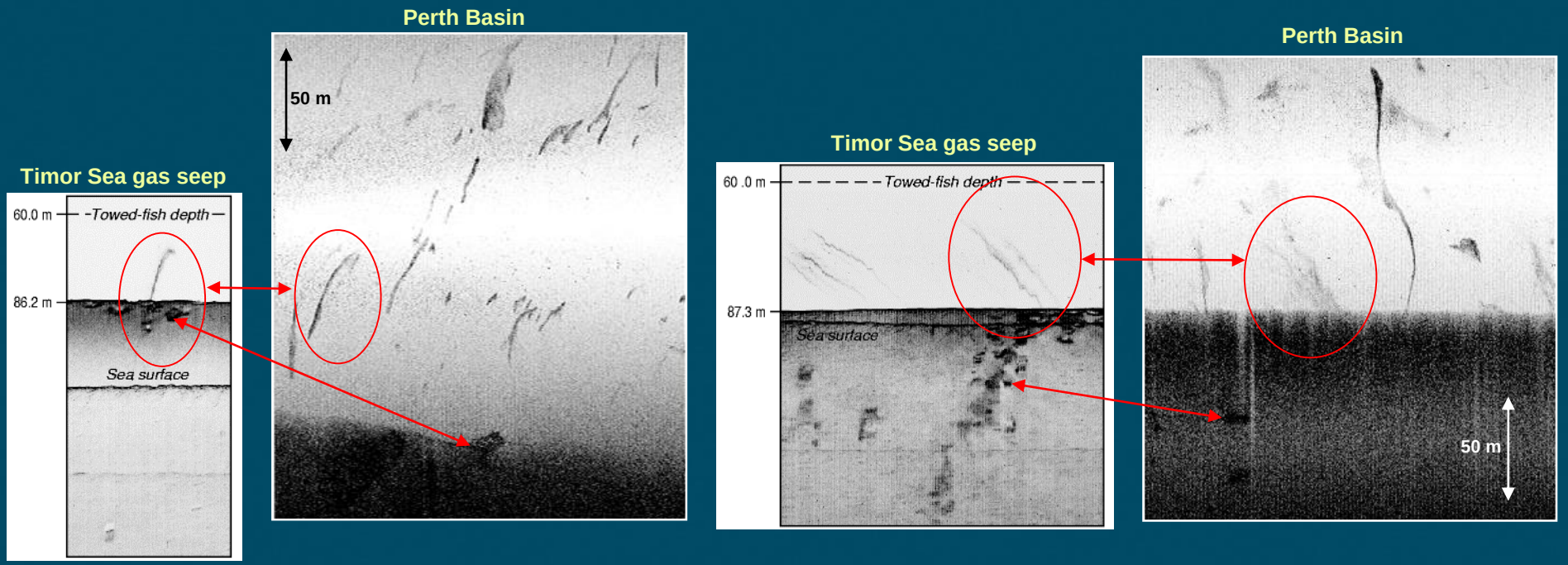
Area H – Multibeam bathymetry



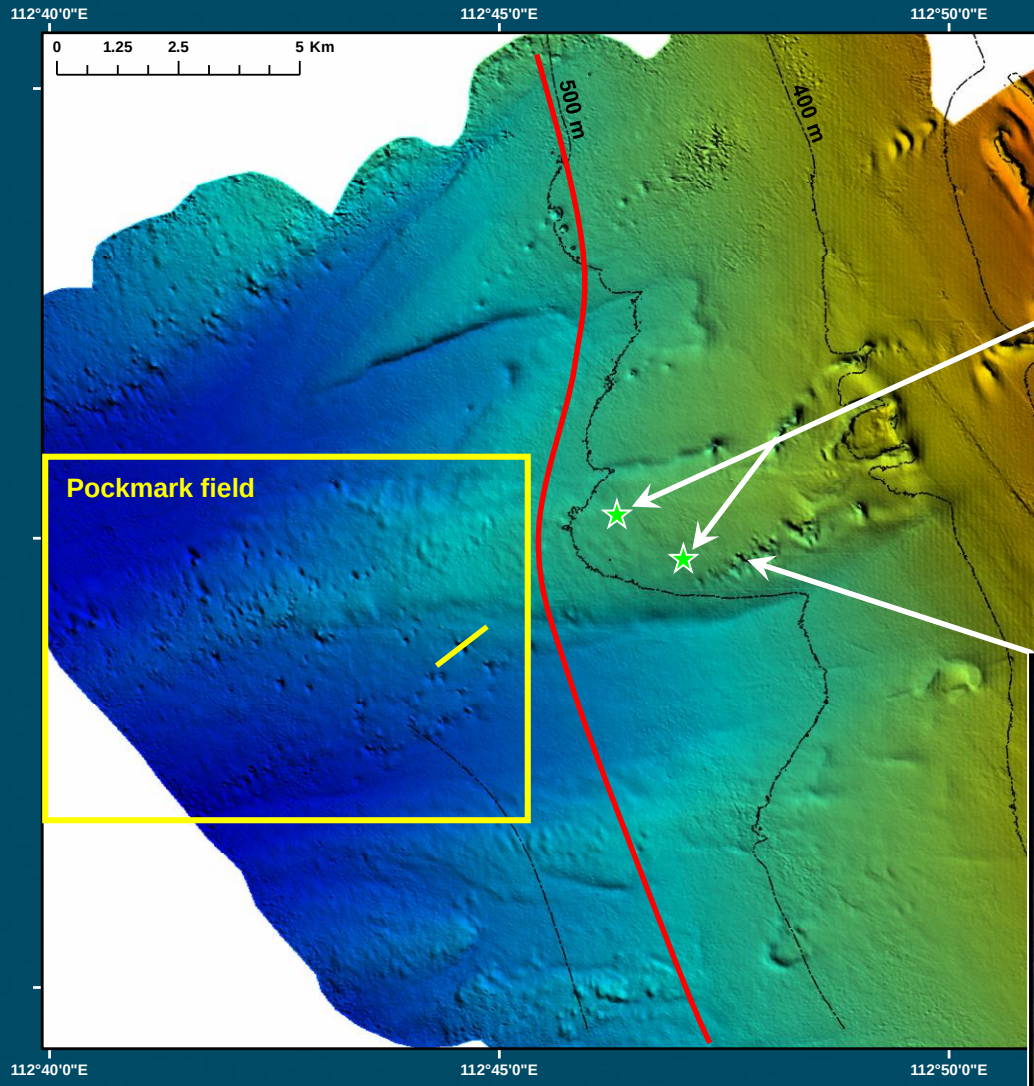


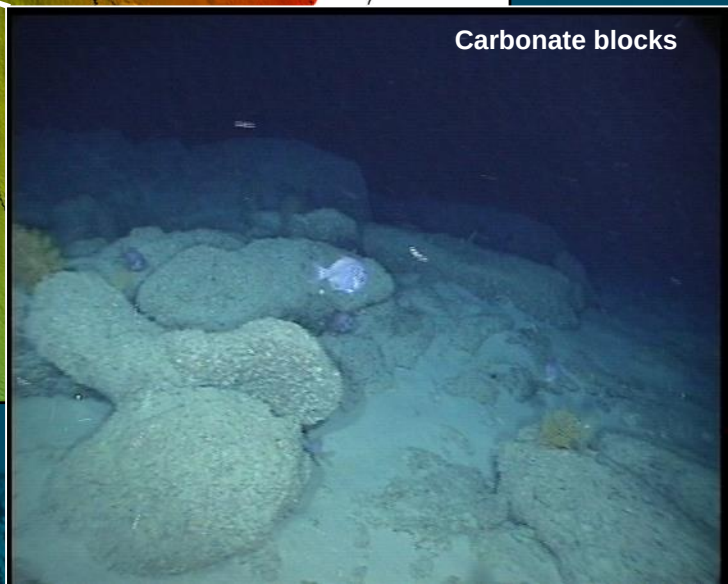


Hydroacoustic ‘flares’ detected with the sidescan sonar



Area H – Multibeam bathymetry





Perth Petroleum; A Jones; ExxonMobil Meeting, Feb 2012

ROV footage of a dark coloured fluid

Available on Perth Petroleum Project website:
(http://www.ga.gov.au/energy/projects/perth-petroleum.html)