

# **Intraformational Seals for CO<sub>2</sub> Storage\***

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Editor's note: Search and Discovery Article #80507 (2016), #80508 (2016), # 80509 (2016), and #80510 (2016) are contributions from The CarbonNet Project, Gippsland Basin, Australia.

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## **Abstract**

During its assessment of the nearshore Gippsland Basin (within 25 km of the coastline), the CarbonNet project has identified interbedded coals and shales of the Middle Eocene Lower N. asperus Zone as the key seal for upper Halibut reservoirs. This interval corresponds to the (Bartonian) T2 basal zone of the coal seams within the onshore coal-bearing Traralgon Formation which is widespread within the nearshore region of the Gippsland Basin. Previous hydrocarbon exploration shows that the T2 sequence is the intraformational topseal to several intra-Latrobe oil accumulations in the nearshore area, and that distinct pressure and salinity differences exist across this aquitard. Hence, the T2 represents a sub-regional seal, and is shown to be one of a set of backstepping subregional seals throughout the Bass Strait petroleum province. This family of seals offers additional trapping opportunities for future oil exploration in the offshore Gippsland Basin. A detailed correlation between nearshore and onshore wells has been carried out using existing well and 3D seismic data to define 3D geometry and continuity of the T2 units. The onshore Traralgon Formation ties to the offshore Burong Formation in the Barracouta gas field and small oilfields in the nearshore western Gippsland Basin. Seismic attribute extracts are presented as maps of coal quality and facies demonstrating the aspect ratio and lateral extent of coal depocentres, as well as details of the fluvial inputs, channel geometries, and clastic depocentres. Seal capacity of these intraformational seals is defined as a minimum by the observed hydrocarbon columns but also by MICP data which suggests seal potential well in excess of the proven columns. The critical constraints on trap capacity appear to be fault-related, and depend on the time scale. For petroleum, where multi-million year trapping is required in order for oil to be still present today, very efficient trapping is required with essentially no fault transmissibility. For CO<sub>2</sub> storage over many thousands of years, slow seepage through faults and offset baffles may be acceptable, especially where it leads to additional dissolution into the active aquifer which is sweeping fluids from onshore to offshore. Correlation of the T2 sequence and the definition of fairways where there is suitable seal potential is crucial to assess CO<sub>2</sub> storage potential and intraformational hydrocarbon trapping over the next 50 years of Gippsland Basin activity.

### **Reference Cited**

Norvick, M.S., M.A. Smith, and M.R. Power, 2001, The Plate Tectonic Evolution of Eastern Australasia Guided by the Stratigraphy of the Gippsland Basin: Eastern Australian Basin Symposium, *in* K.C. Hill and T. Bernecker (eds.), Eastern Australasian Basins Symposium, A Refocused Energy Perspective for the Future, Petroleum Exploration Society of Australia, Special Publication, p. 15-23.

**AAPG | SEG**

**International Conference  
& Exhibition 2015**

13-16 September • Melbourne, Australia

**PESA** Incorporating PESA's Eastern  
Australasian Basins Symposium

# Intraformational Seals for CO<sub>2</sub> Storage

Dr. Nick Hoffman, Storage Advisor

15<sup>th</sup> September 2015

# The CarbonNet Project

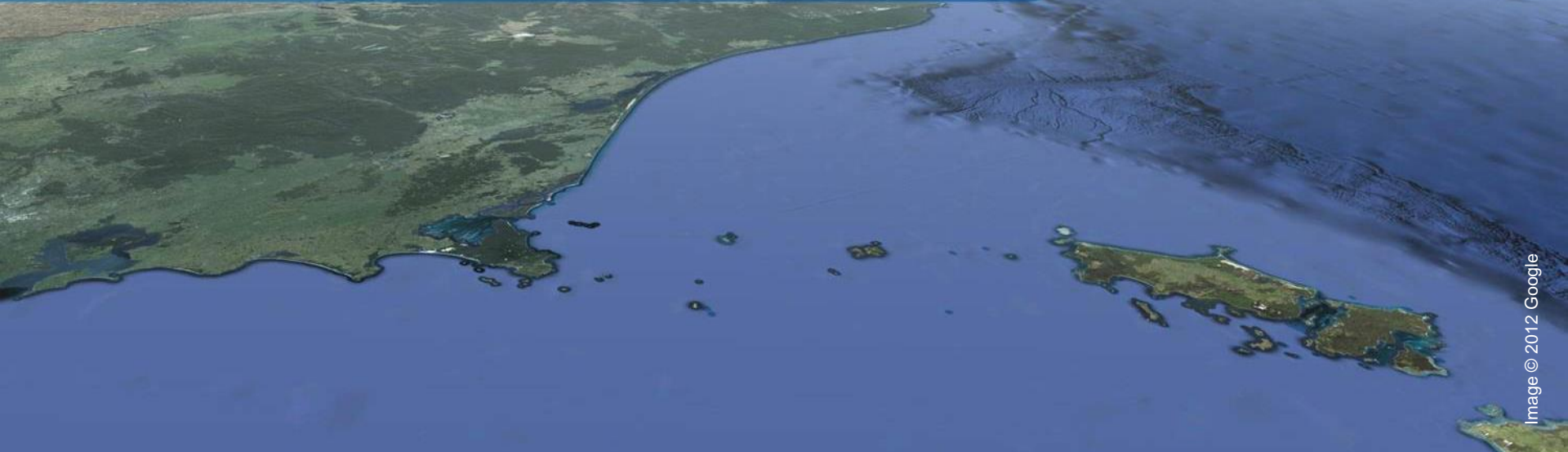


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## The CarbonNet Project

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Australian Government  
Department of Industry and Science



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CCS  
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Jobs, Transport & Resources



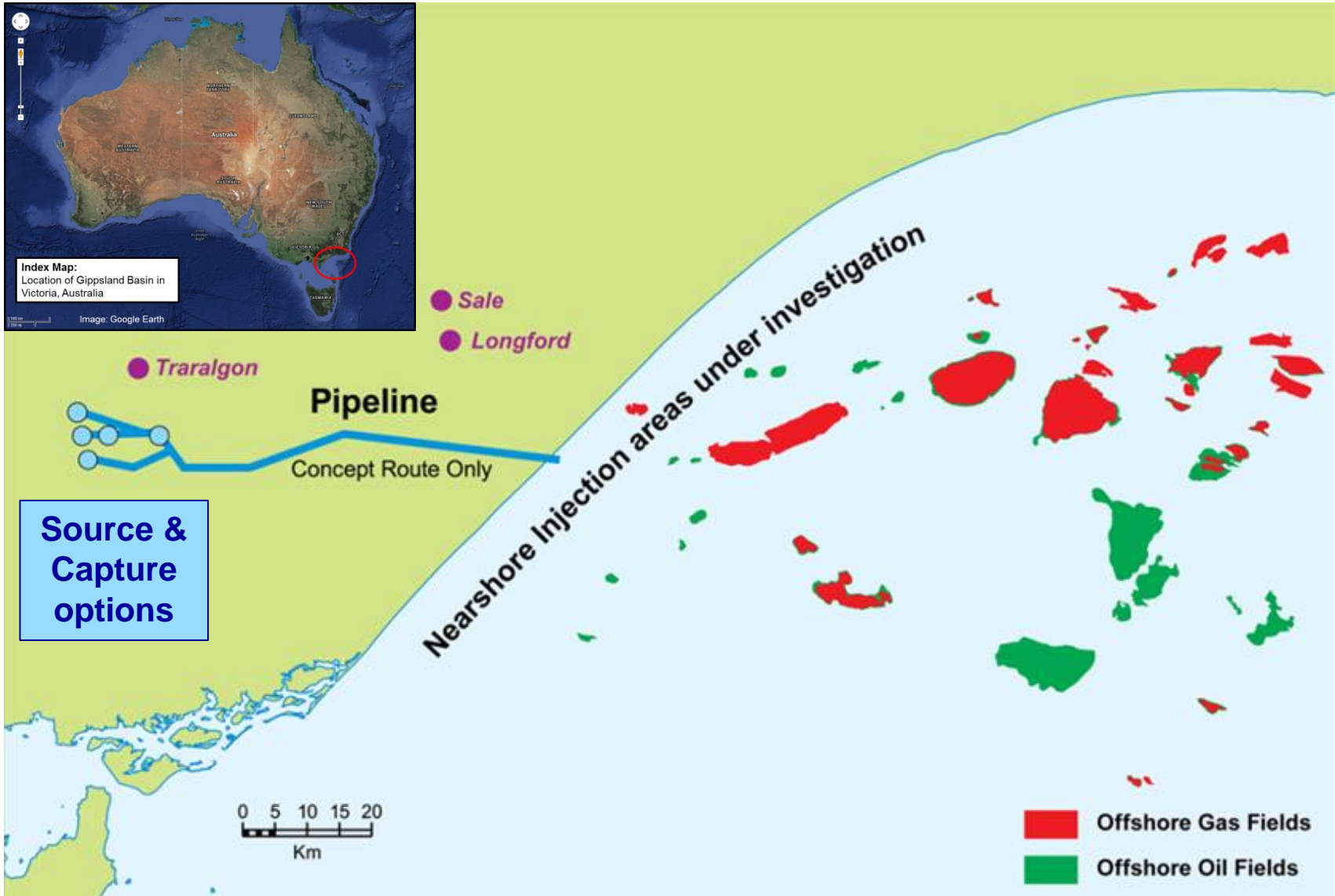
### Technical collaboration and review



## Acknowledgements

& many consultants,  
specialists and researchers

# The CarbonNet Project



# Outline

- Database and Depositional Context
- Intraformational Seals
  - Petroleum traps
  - MICP
- The T2 Seal defined
- T2 seal well observations
- T2 seal seismic observations

# Database

Working in a known and prolific petroleum basin

- + Lots of data (open access)
- Resource interaction

## WELL DATA

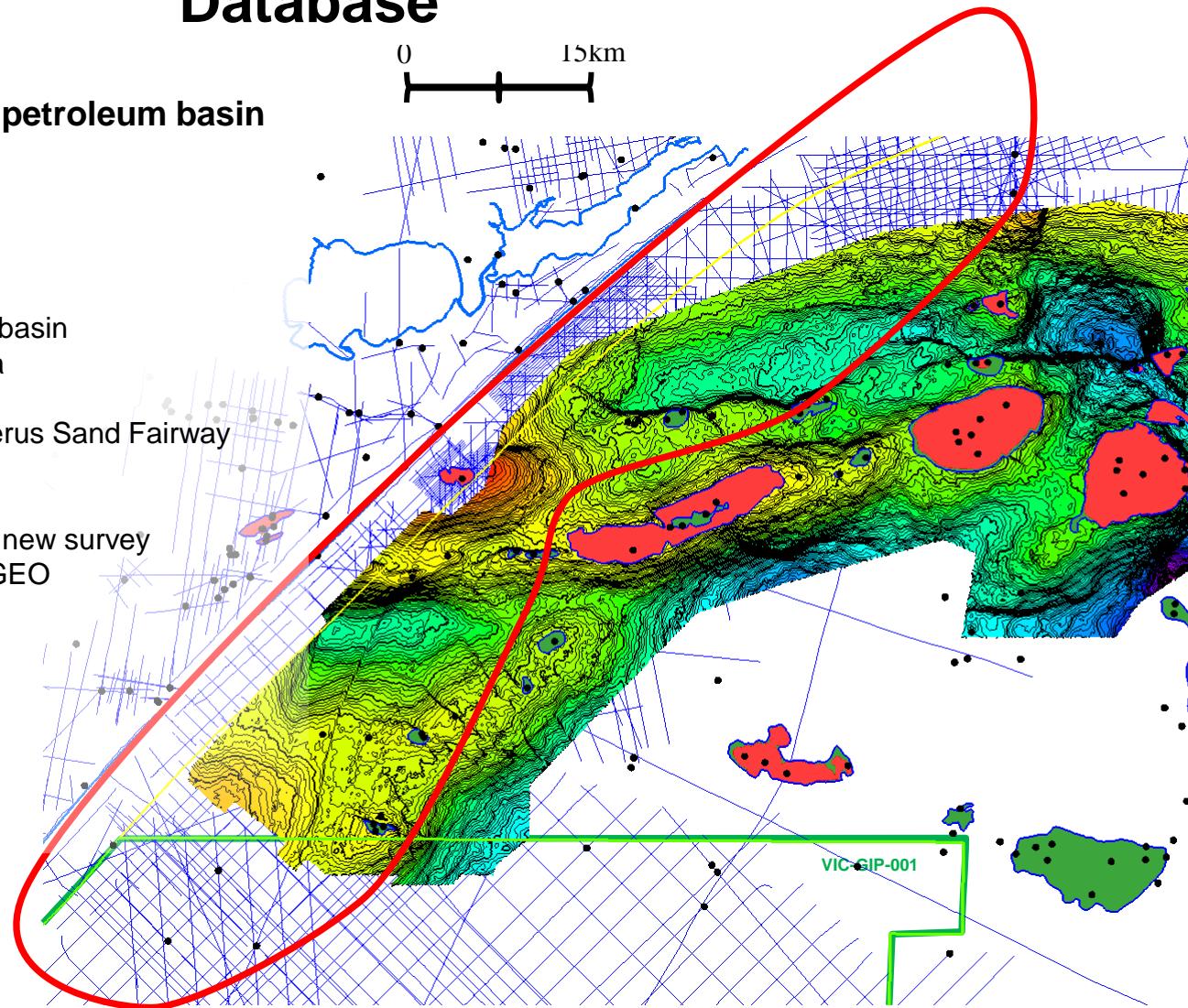
- 1562 wells and boreholes in whole basin
- 811 wells with basic geological data
- 546 wells with relevant log data
- 50 local E&P wells in Upper N.asperus Sand Fairway

## SEISMIC DATA

- 69 X 2D surveys including GDPI10 new survey
- 34 X 3D surveys – merged by 3D-GEO

## 3 CONTINGENT SITES

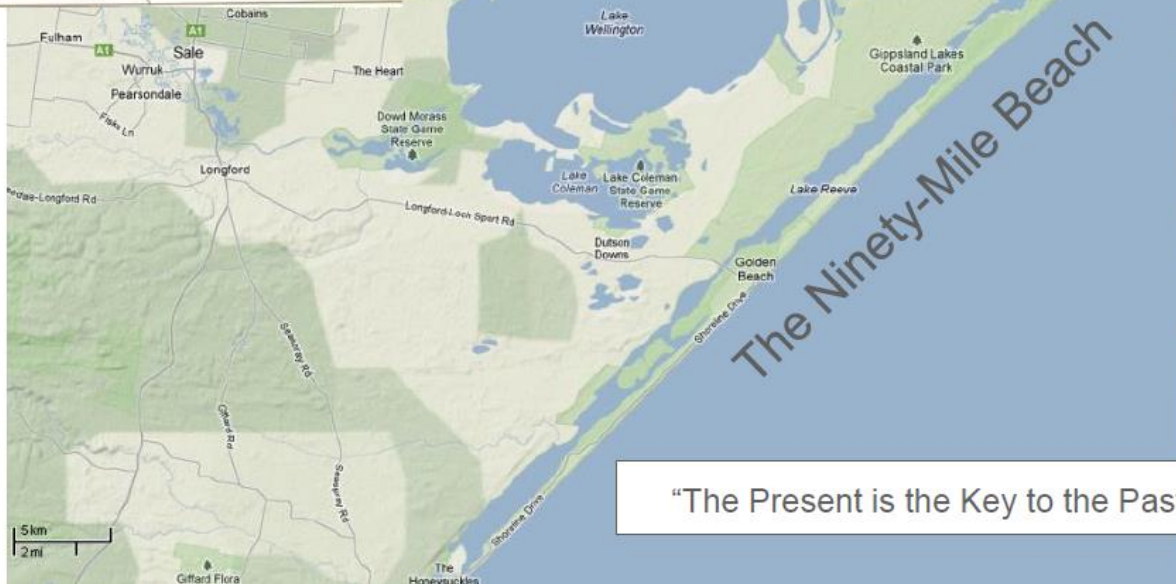
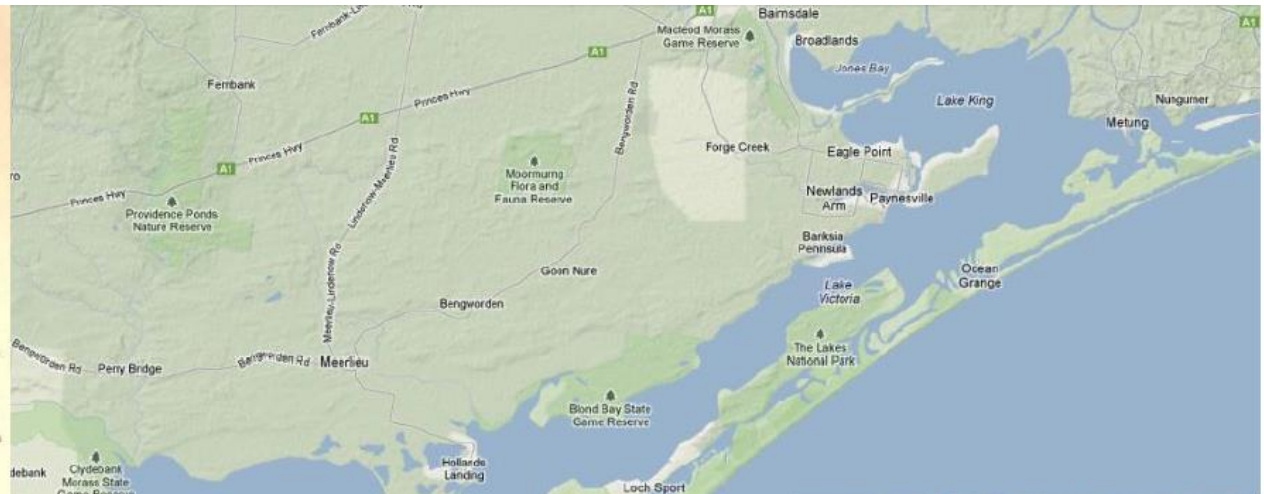
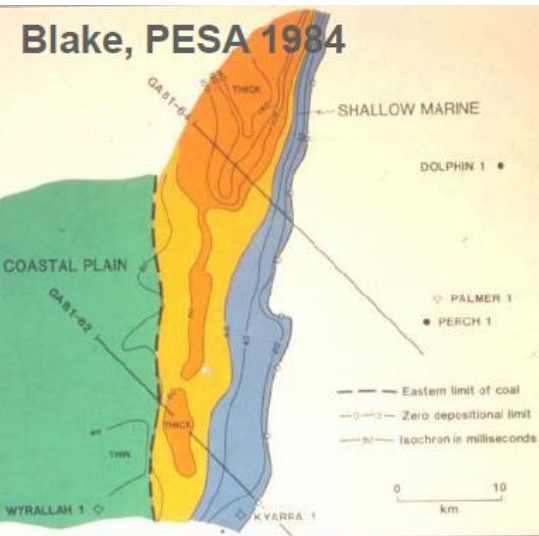
- Site A : 2 wells 2D & 3D seismic
- Site B : >2 wells 3D seismic
- Site C : 1-3 wells 2D seismic



Gippsland Basin Database  
Data spans 50+ years – quality varies!

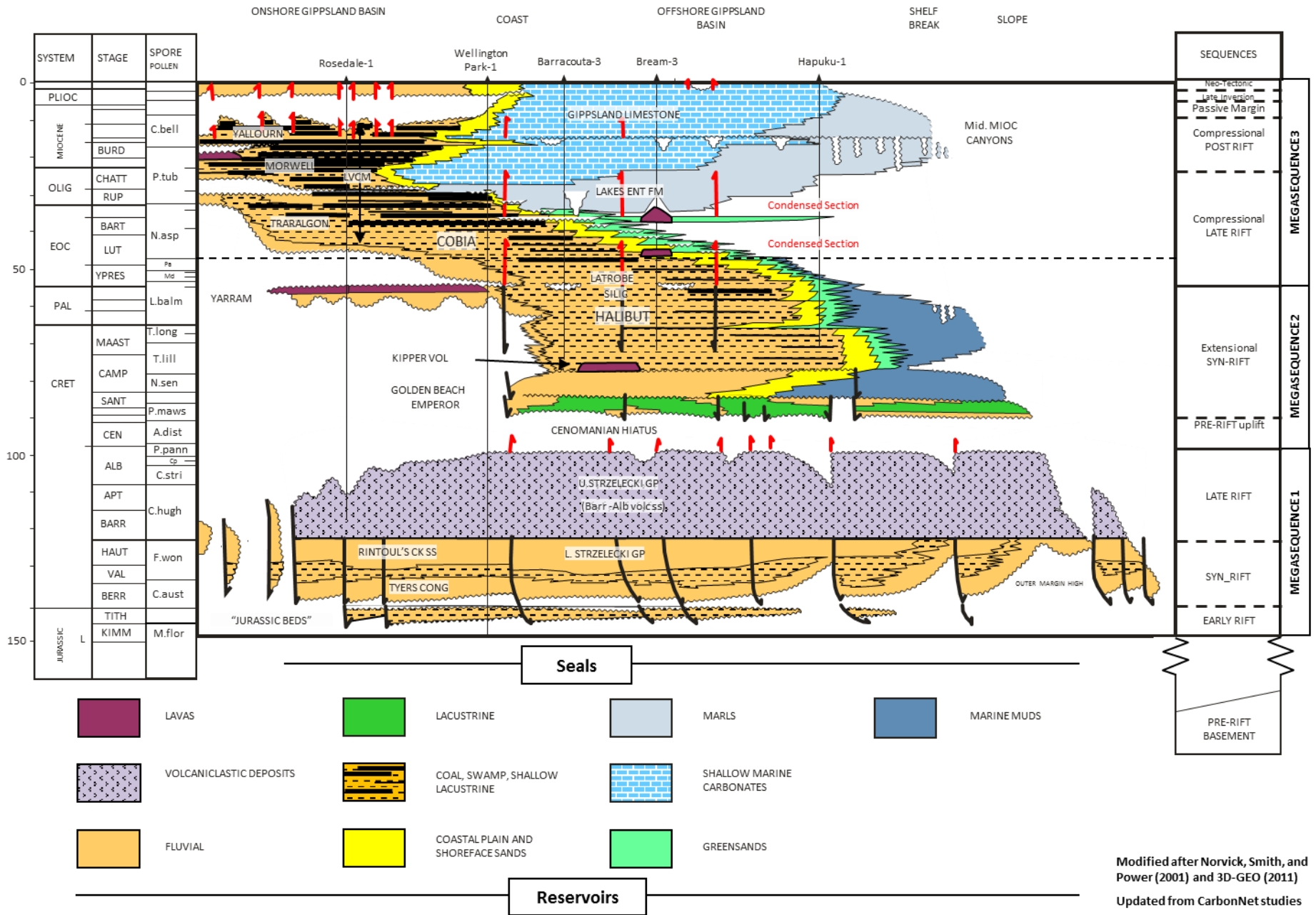
DATA BASE

# Modern Context



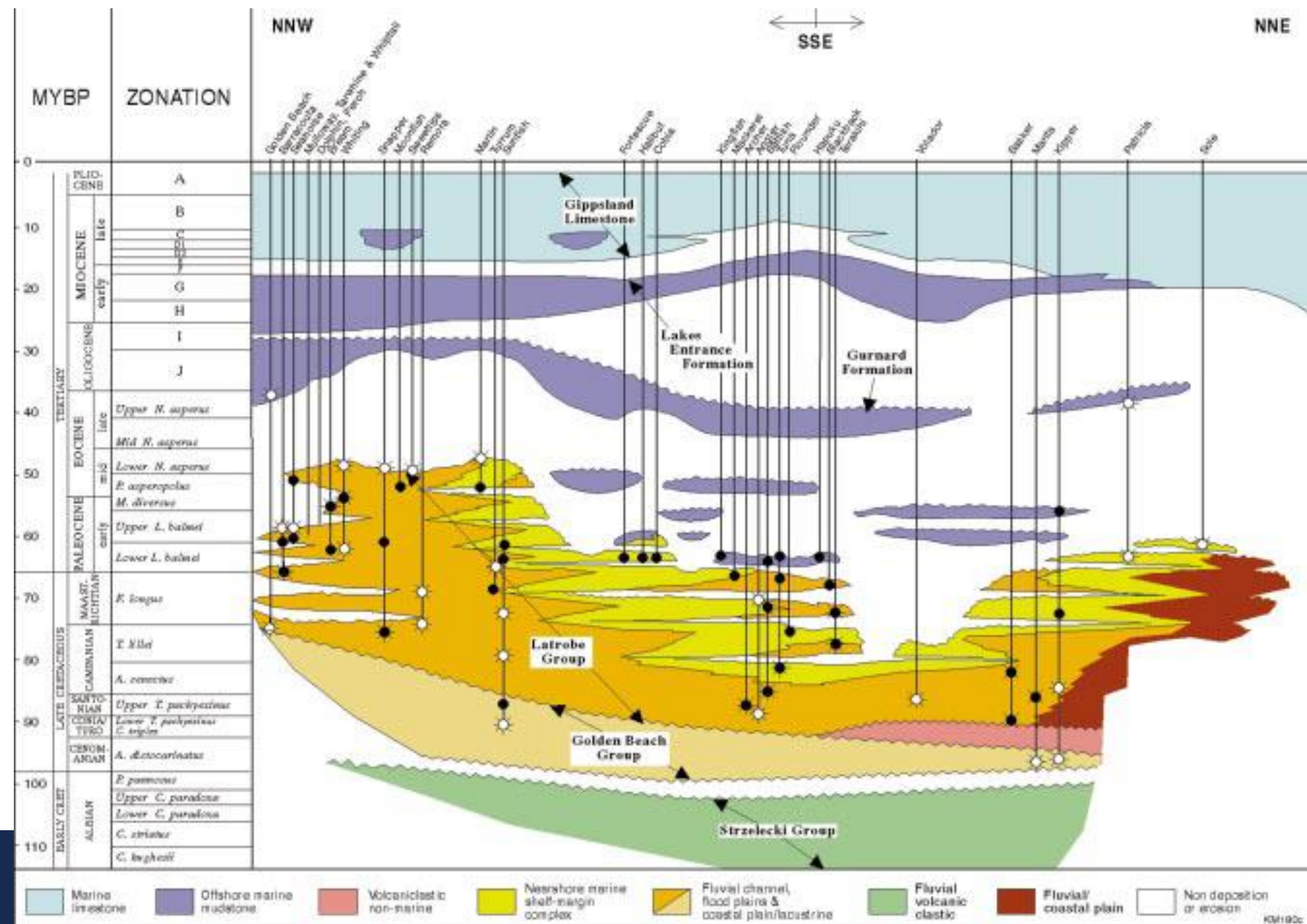
"The Present is the Key to the Past"

# Chronostratigraphy



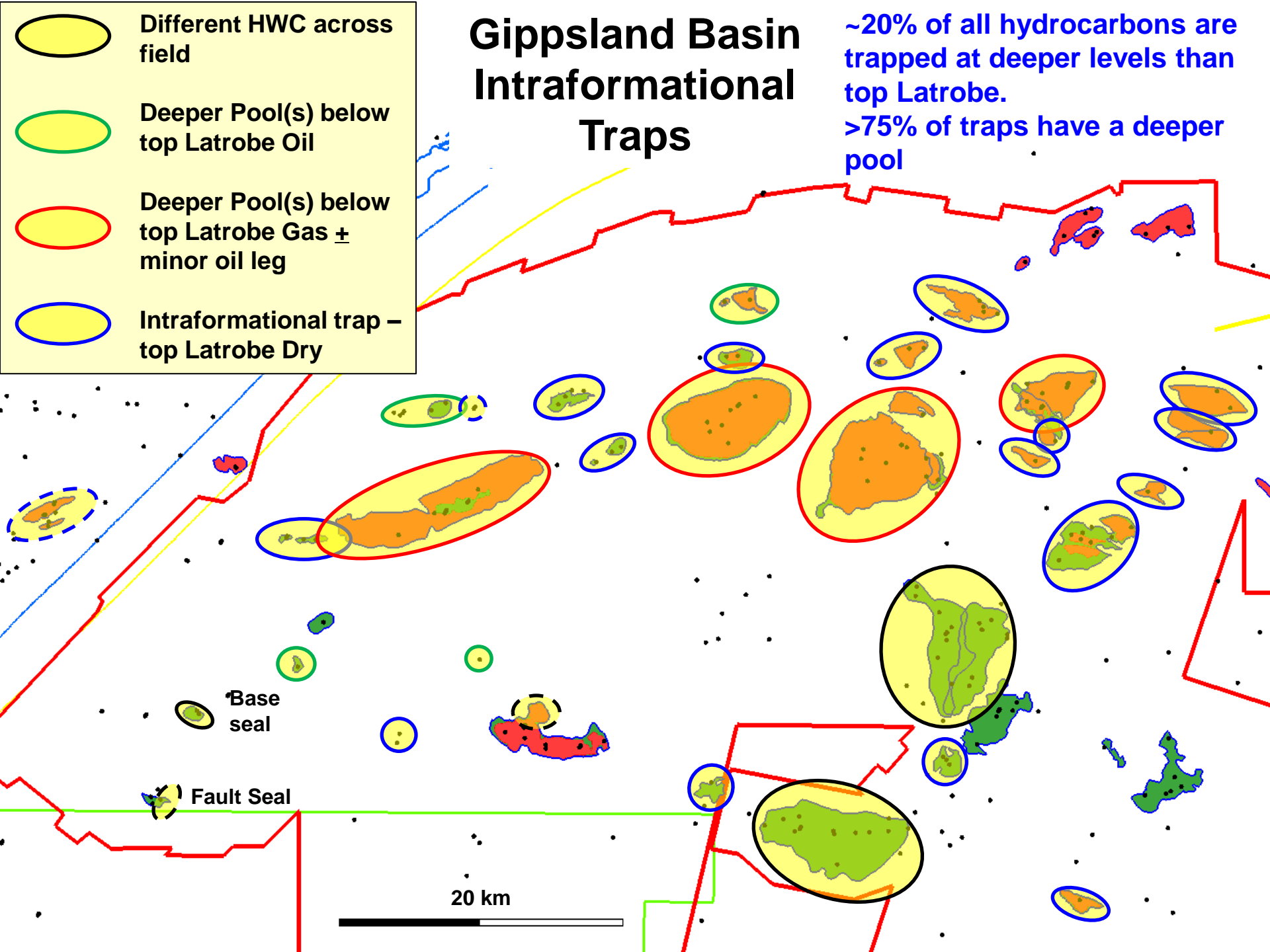
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## Basinwide Intraformational Seals

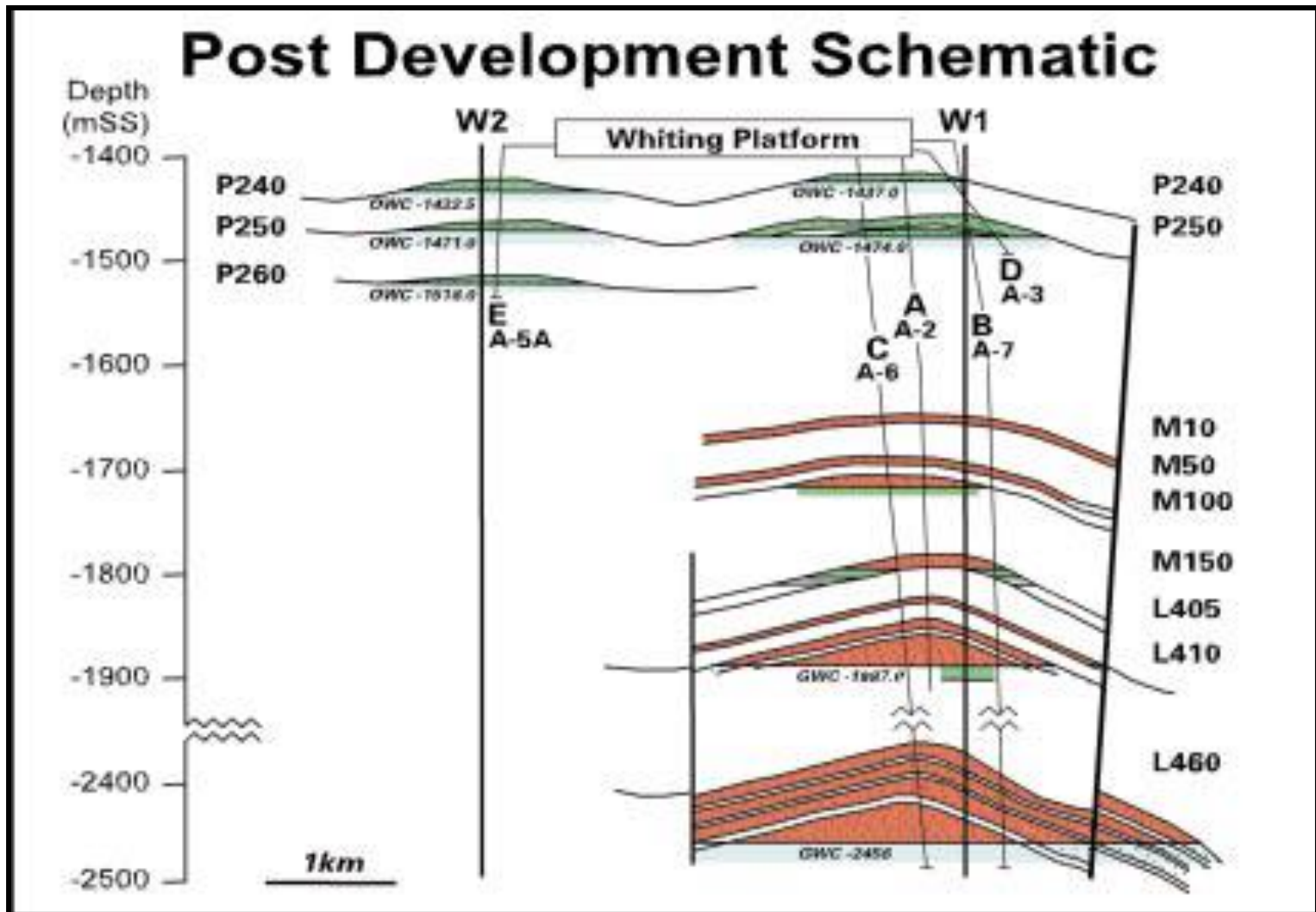


# Gippsland Basin Intraformational Traps

~20% of all hydrocarbons are  
trapped at deeper levels than  
top Latrobe.  
>75% of traps have a deeper  
pool

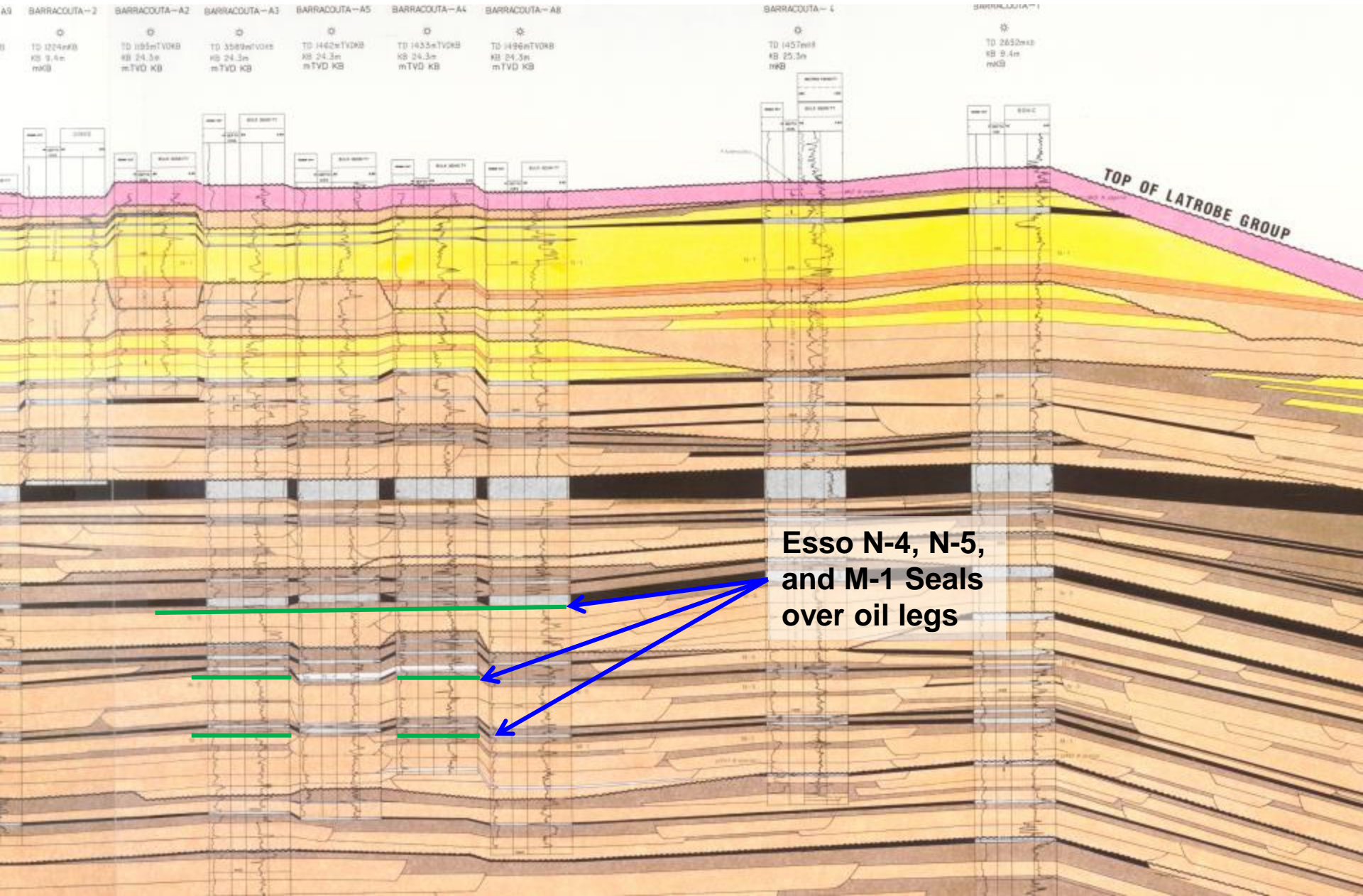


# Examples of Intraformational Seals Whiting Field



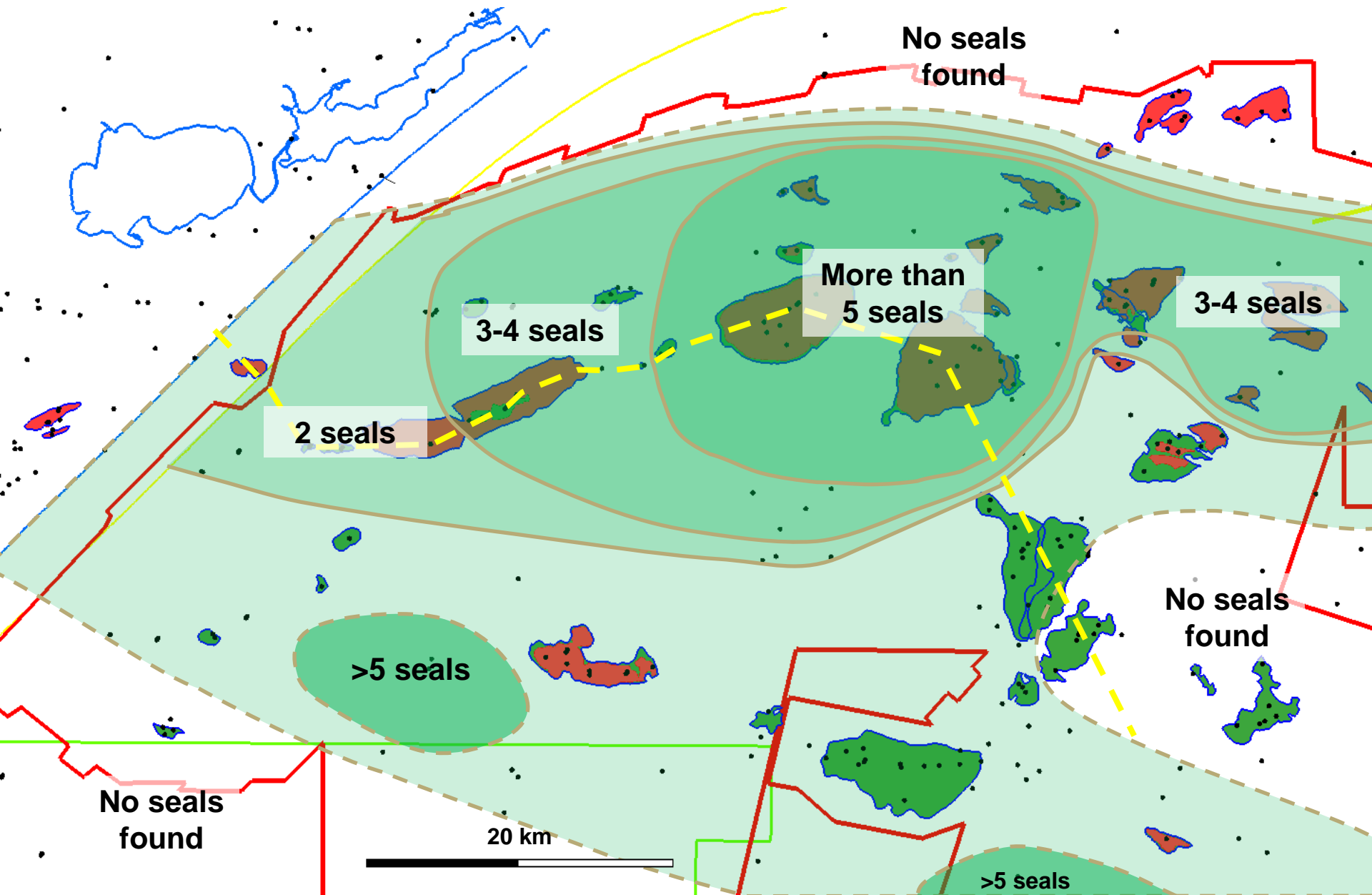
Intraformational seals can hold 100m+ gas columns

# Examples of Intraformational Seals Barracouta Field

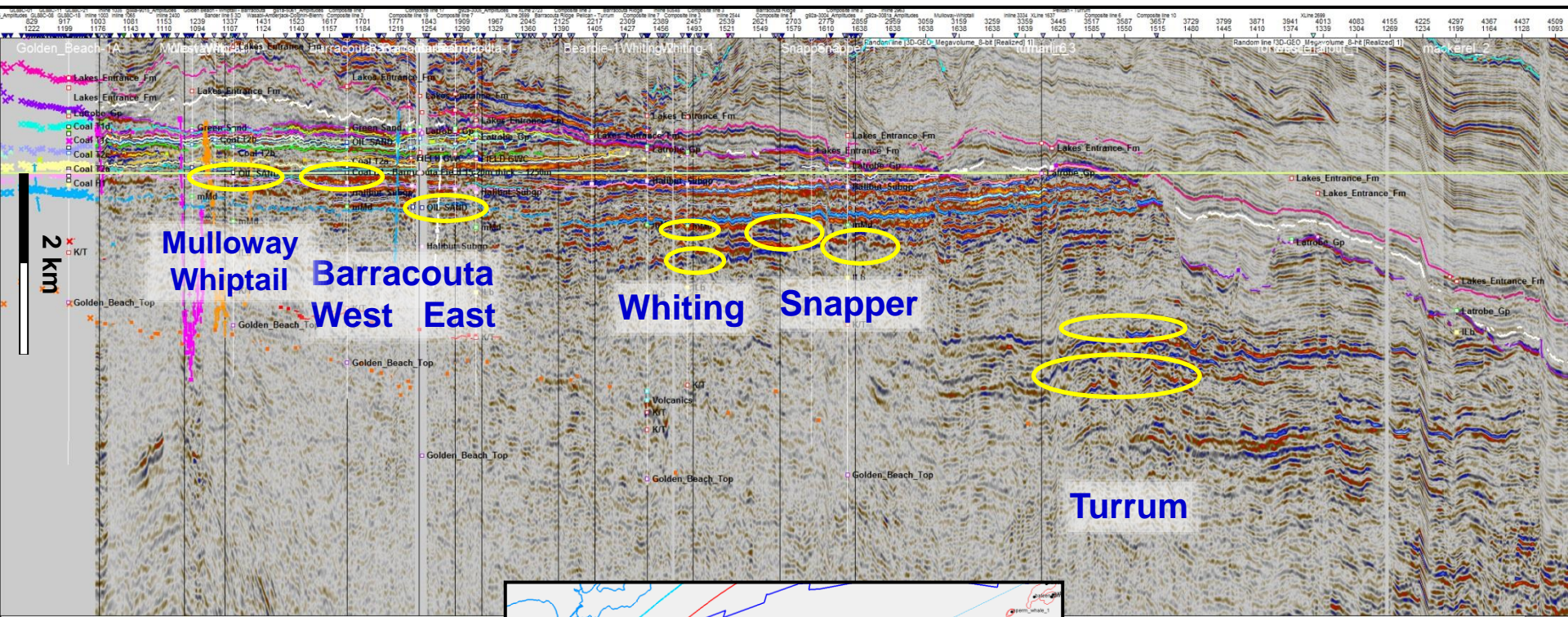


# Gippsland Basin

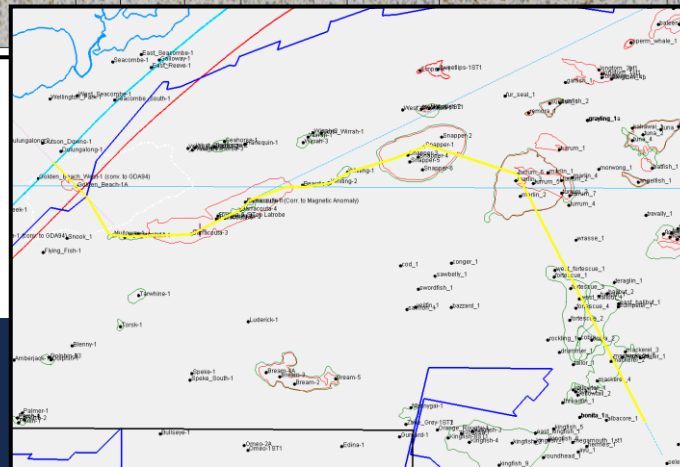
## Intraformational Seal Fairways



# Flattened section across seal fairway - with intraformational hydrocarbon finds



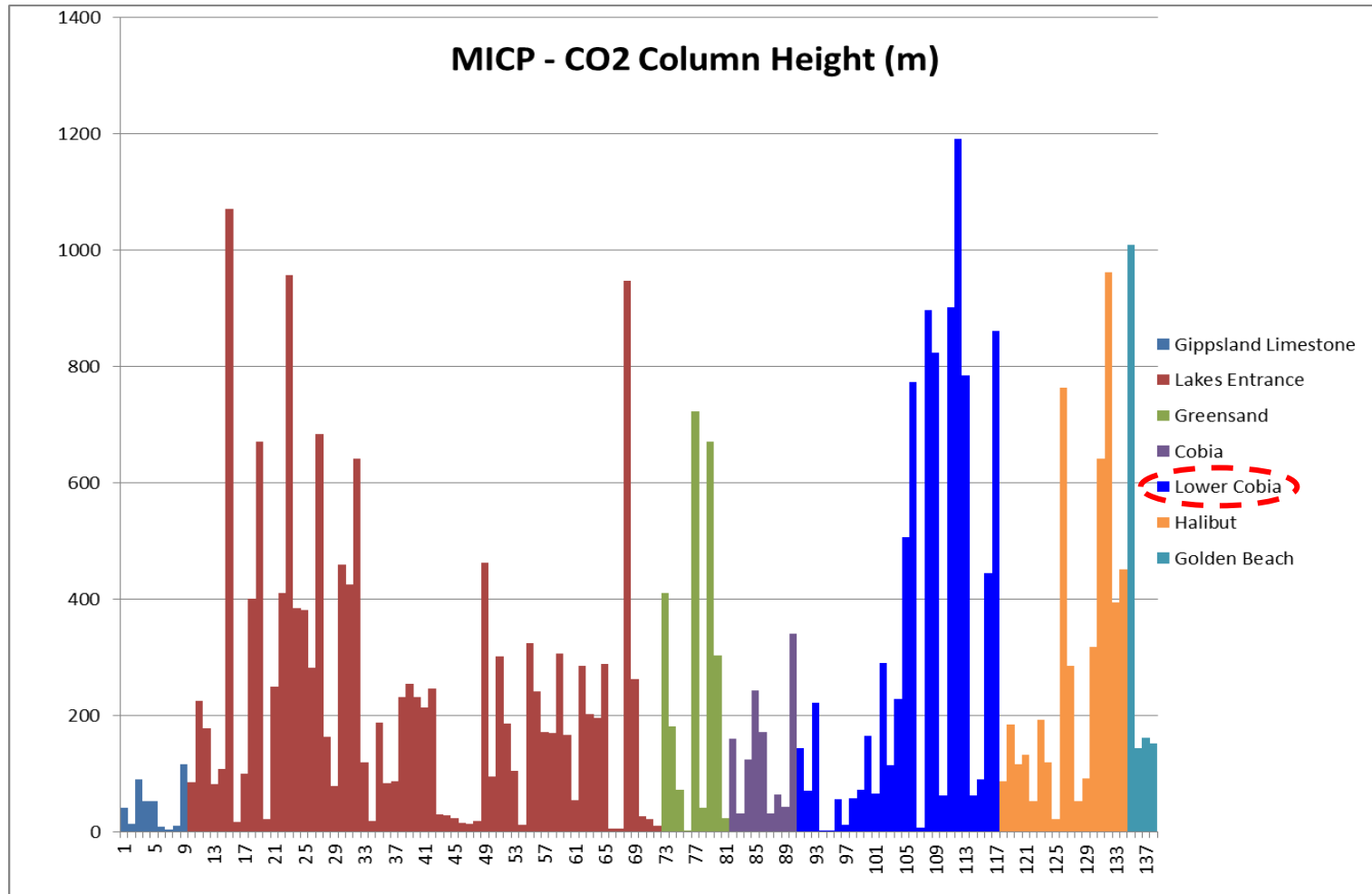
20 km



Oil and gas pools  
200-500m below  
top reservoir

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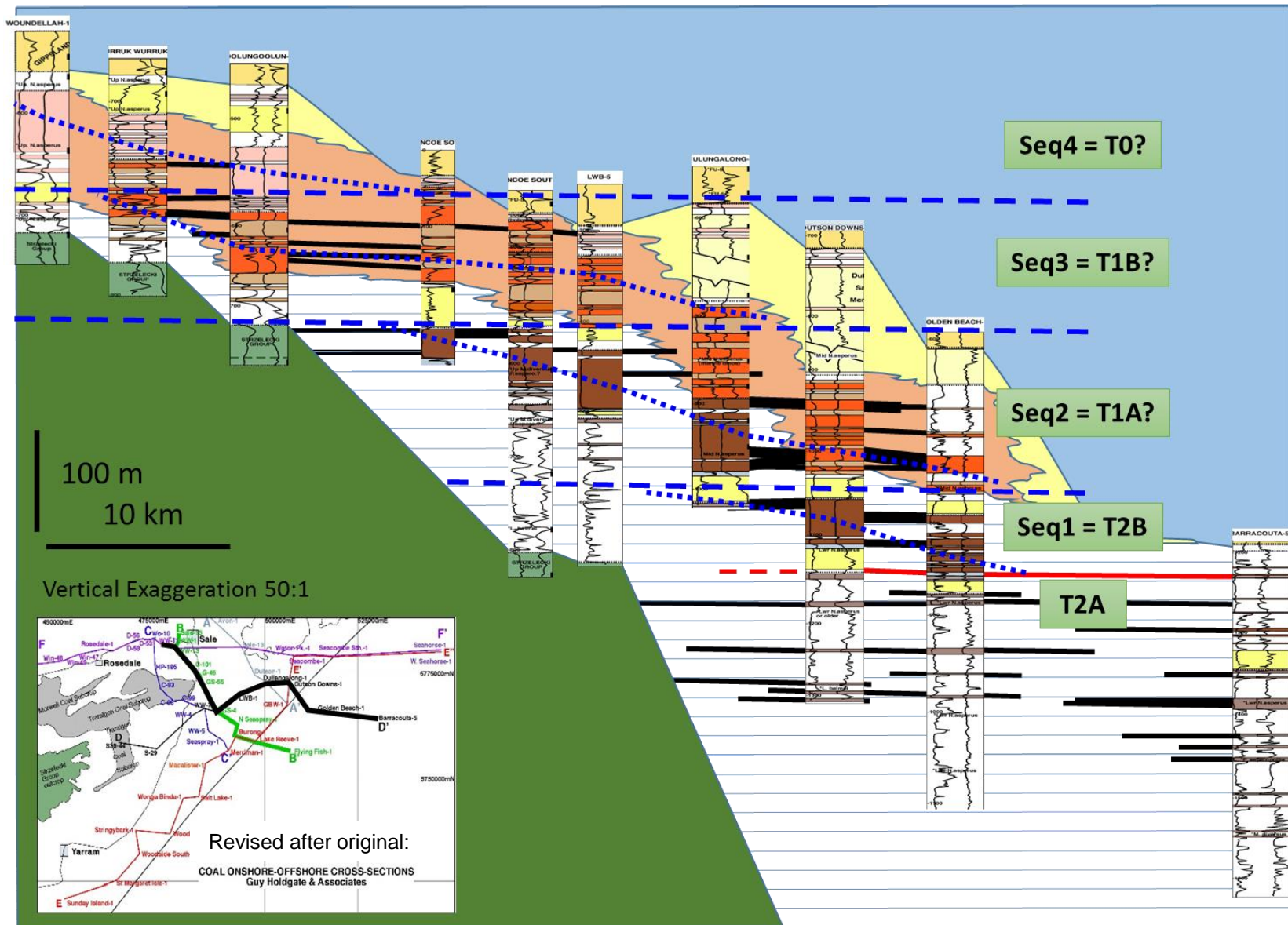
# Seal capacity from MICP analysis



Lower Cobia seals include T2

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# CarbonNet working correlation in nearshore area

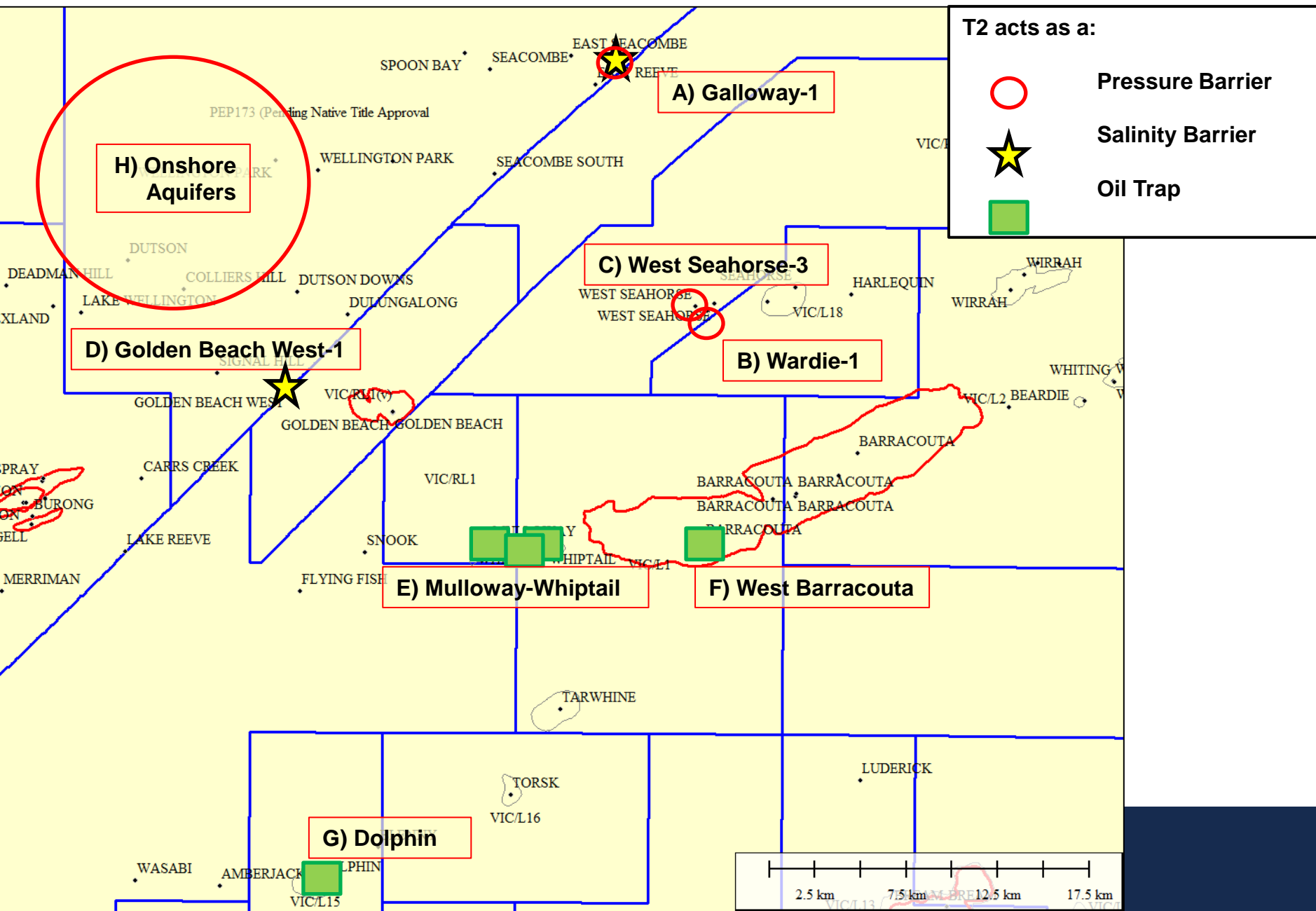


# Traralgon T2 Seal in cores



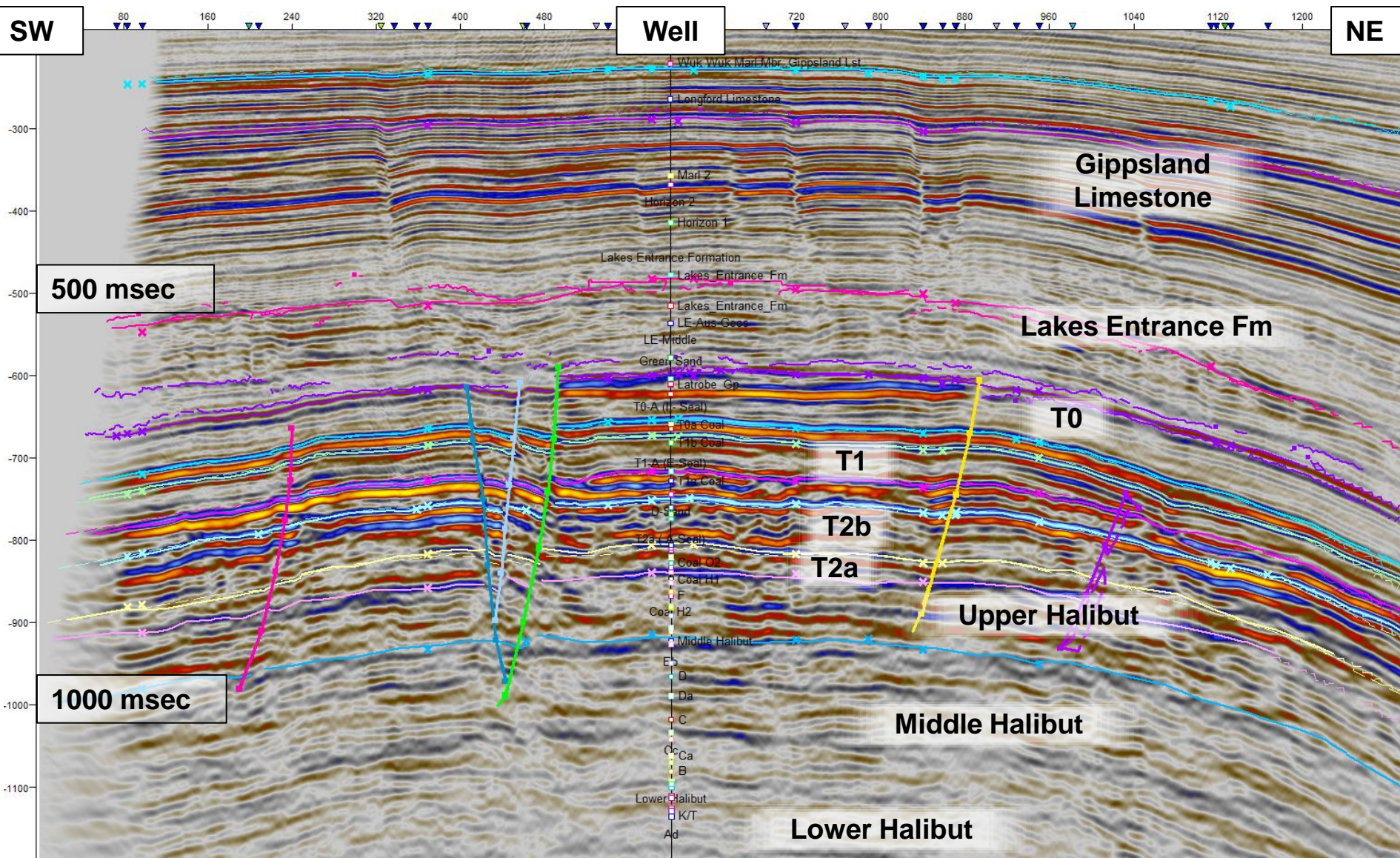
- Database and Depositional Context
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## Well evidence for a T2B Aquitard

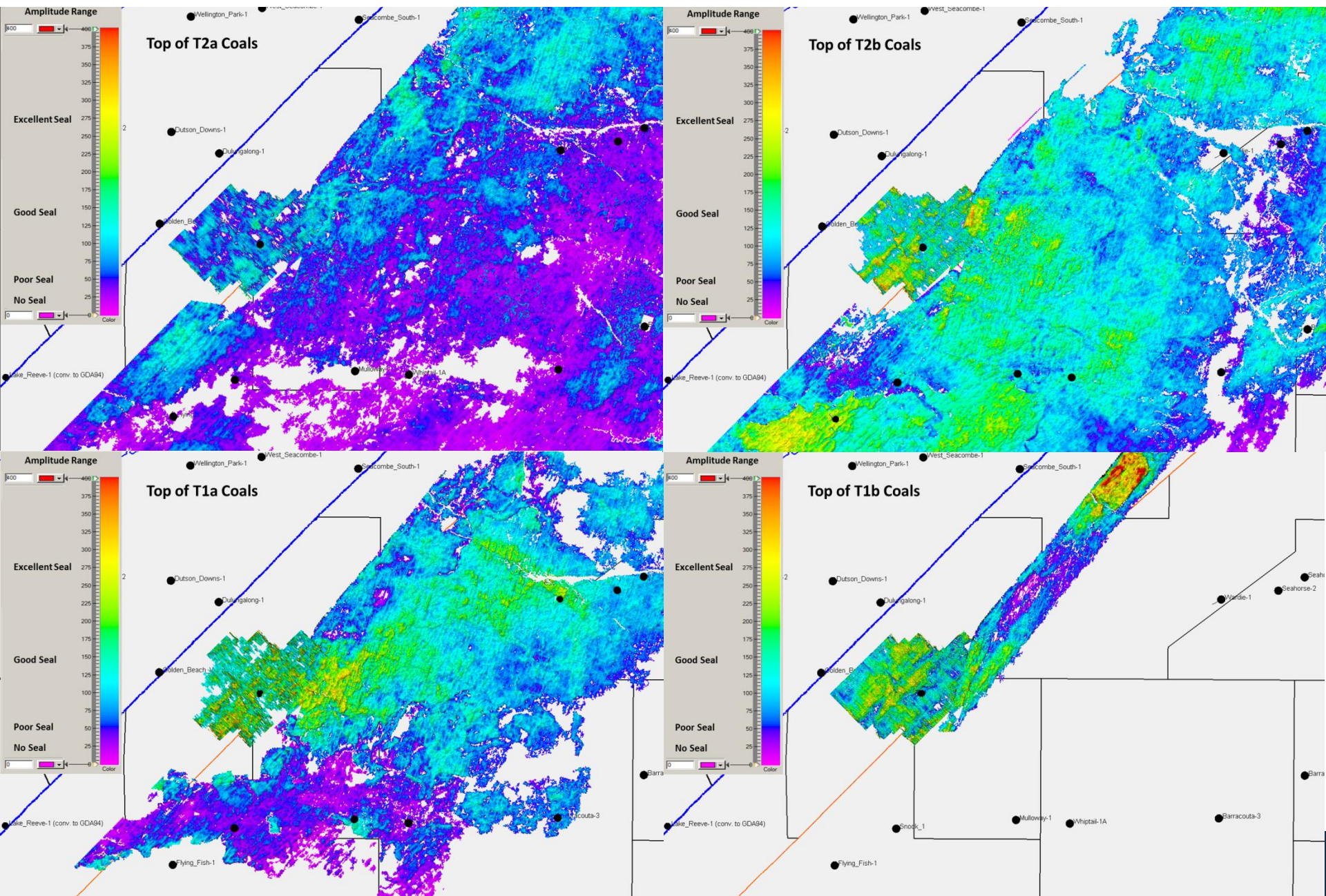


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# 2D/3D Seismic data over a structure



# T2 Seal continuity from 3D Seismic amplitudes





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Thank You  
- Any questions?

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