

# Global Infracambrian Petroleum Systems: A Review

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Geological Survey of Western Australia

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Department of  
Industry and Resources

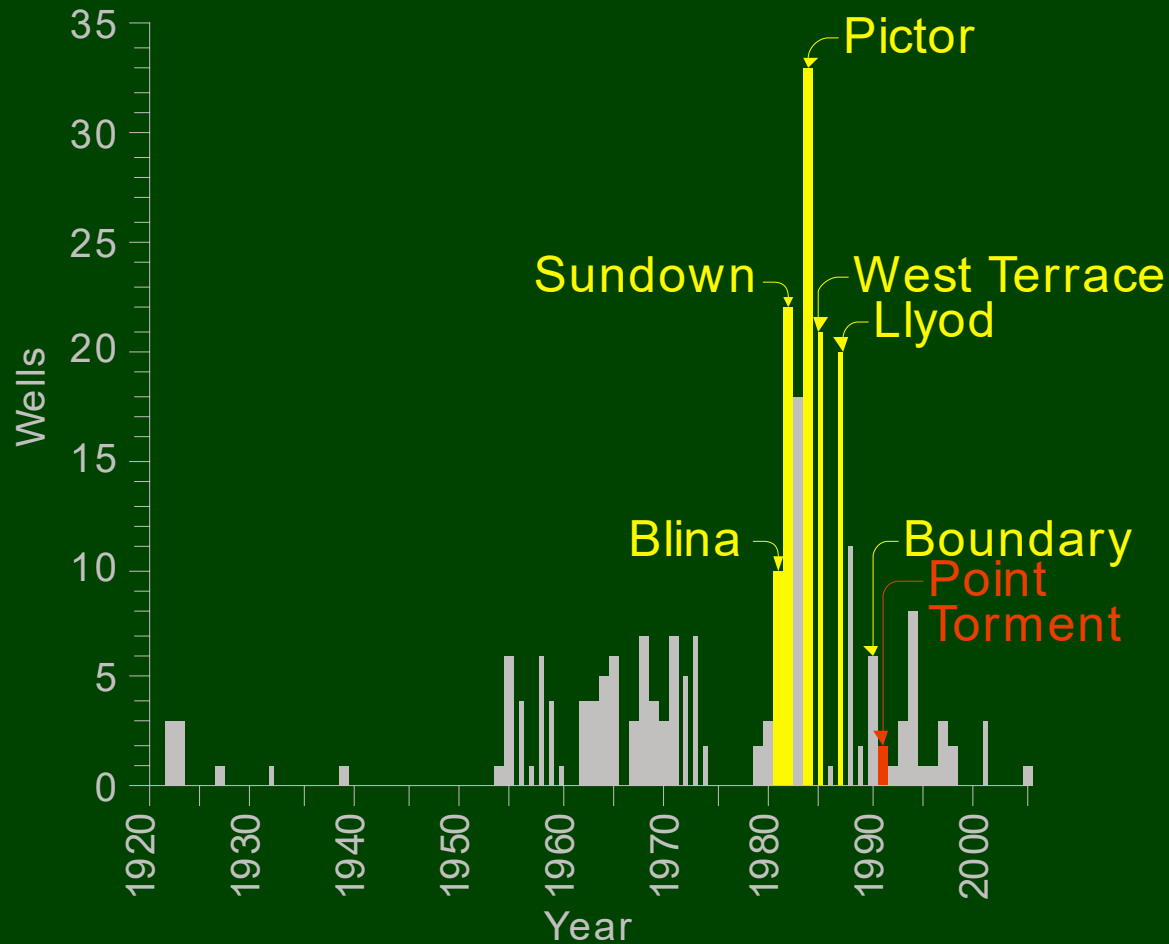
# Presentation

- Introduction
- Infracambrian Source Rocks
- Infracambrian Petroleum Systems
- Petroleum Systems Productivity
- Worldwide Petroleum Systems
- Australian Petroleum Systems
- Conclusions & Recommendations

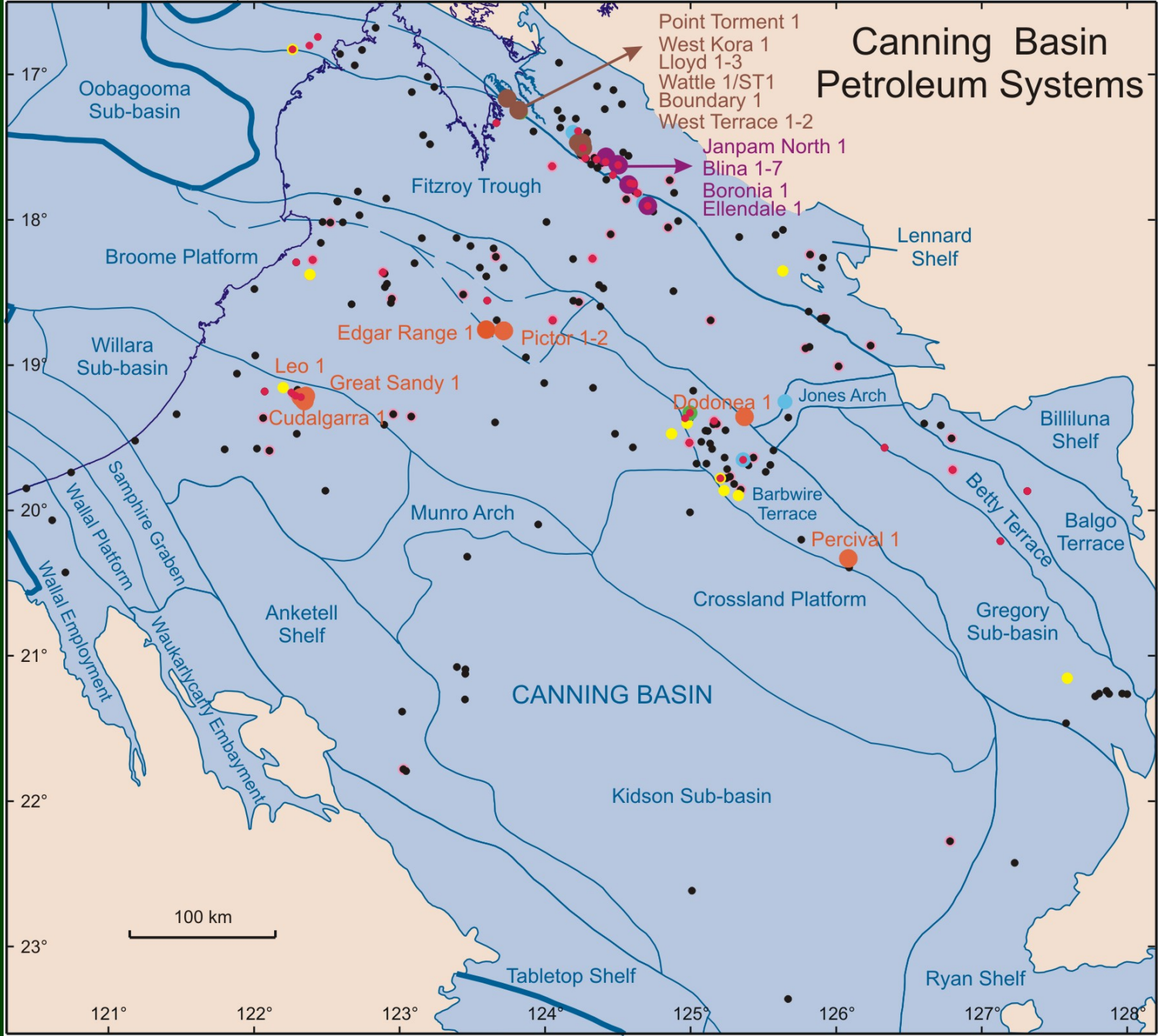
# Infracambrian Petroleum Systems

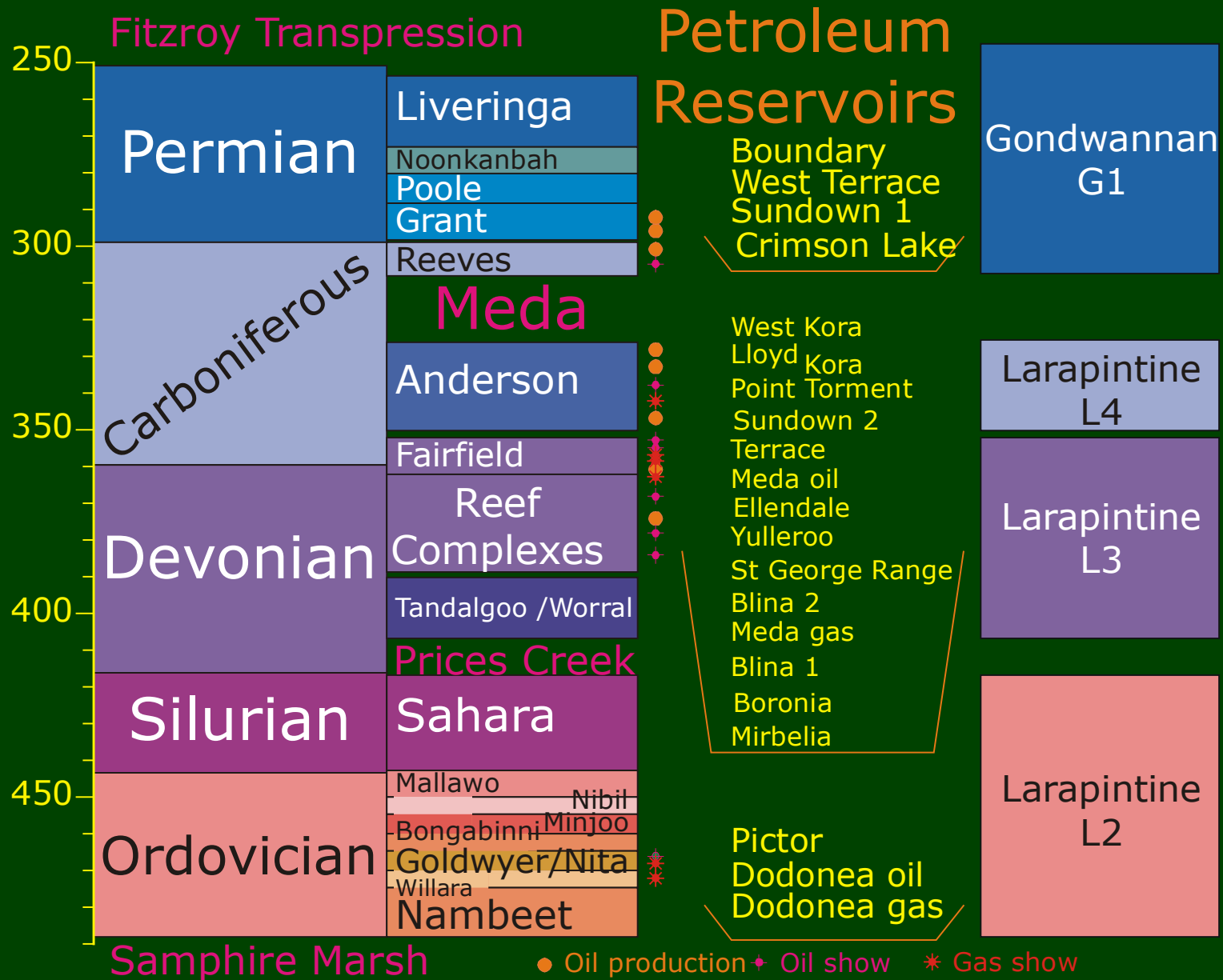


# Drilling & Discovery Histories



# Canning Basin Petroleum Systems





250  
300  
350  
400  
450

Fitzroy Transpression

Petroleum Reservoirs

Gondwannan G1

Permian

Liveringa  
Noonkanbah  
Poole  
Grant  
Reeves

Boundary  
West Terrace  
Sundown 1  
Crimson Lake

Carboniferous

Meda  
Anderson

West Kora  
Lloyd Kora  
Point Torment  
Sundown 2  
Terrace  
Meda oil  
Ellendale  
Yulleroo  
St George Range  
Blina 2  
Meda gas  
Blina 1  
Boronia  
Mirbelia

Larapintine L4

Devonian

Fairfield  
Reef Complexes  
Tandalgoo /Worrall

Larapintine L3

Silurian

Prices Creek  
Sahara

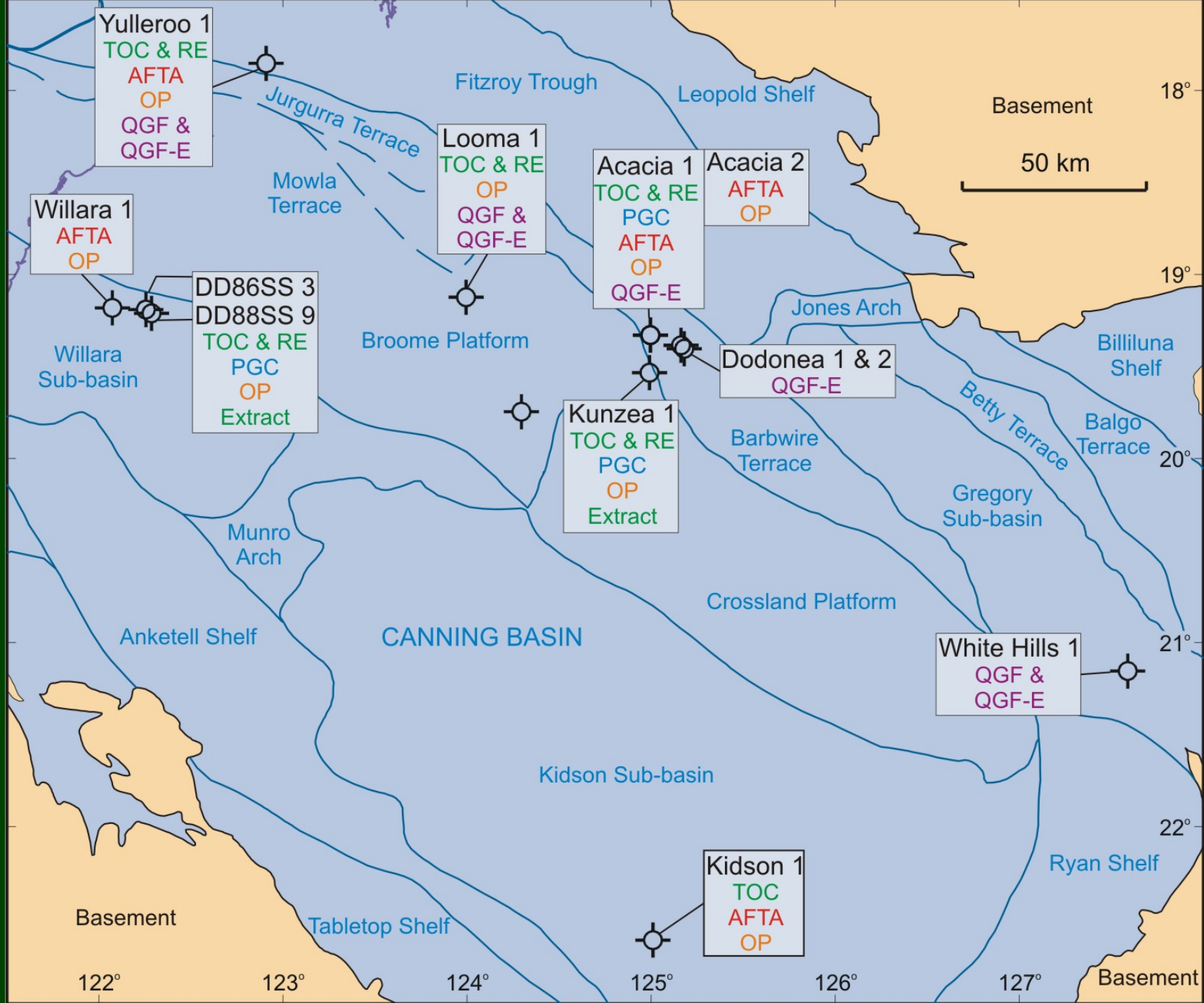
Pictor  
Dodonea oil  
Dodonea gas

Larapintine L2

Ordovician

Mallawo Nibil  
Bongabinni Minjoo  
Goldwyer/Nita  
Willara  
Nambeet

Sapphire Marsh ● Oil production ◆ Oil show \* Gas show



# Number of wells and Samples

0 10 20 30 40 50 60 70 80 90 100



Wells

TOC

Rock-Eval

Pyrolysis-GC

Extract

Liquid Chromatography

GC-MS

Organic Petrology

AFTA

QGF

Quantitative Grain Fluorescence -Extract



# Database

1            10            100            1000            10000



Wells 138

TOC 5968

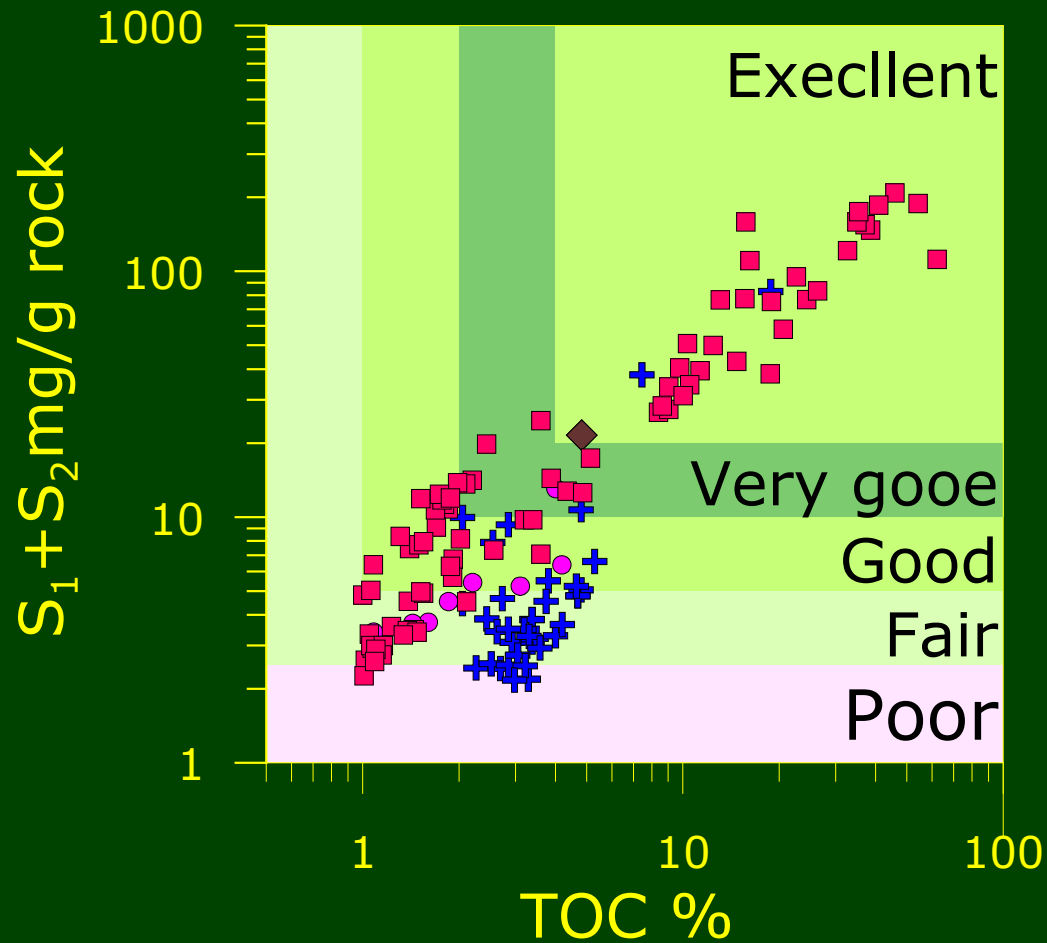
Wells 109

Rock-Eval 1762

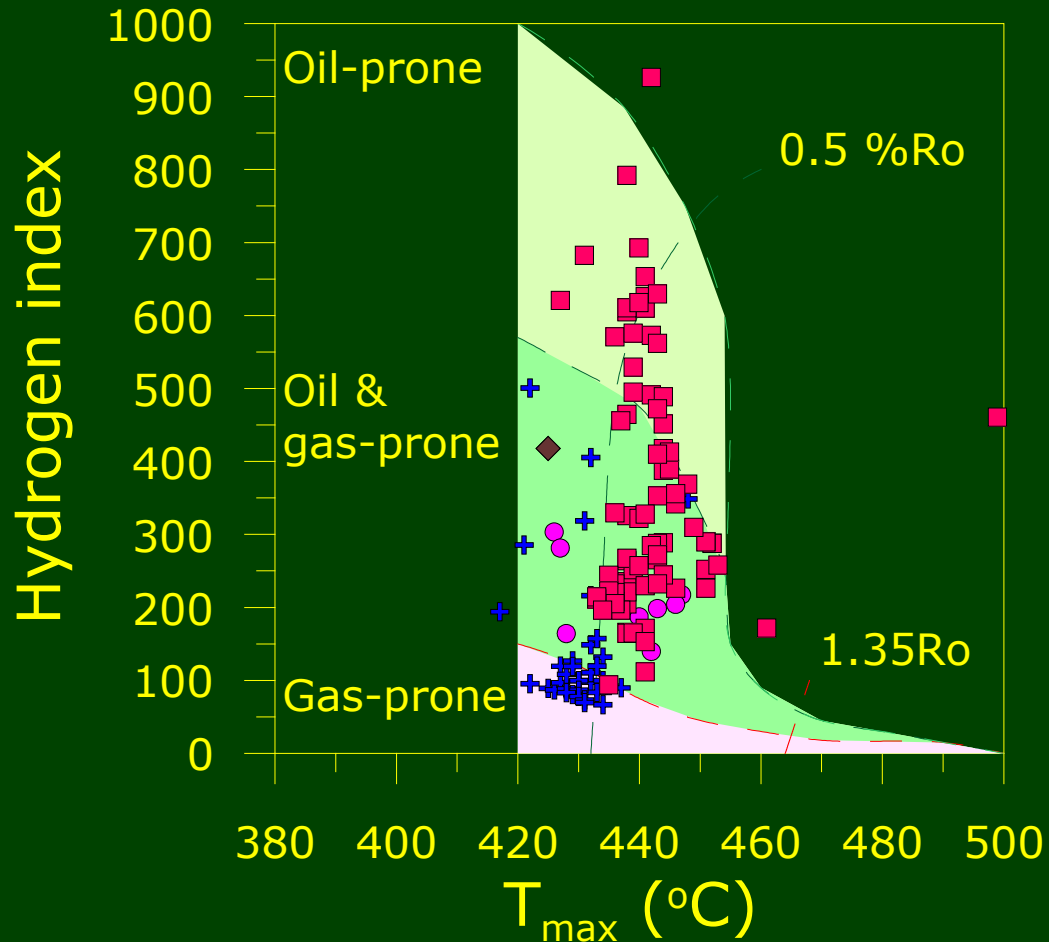
Wells 37

Reliable 106

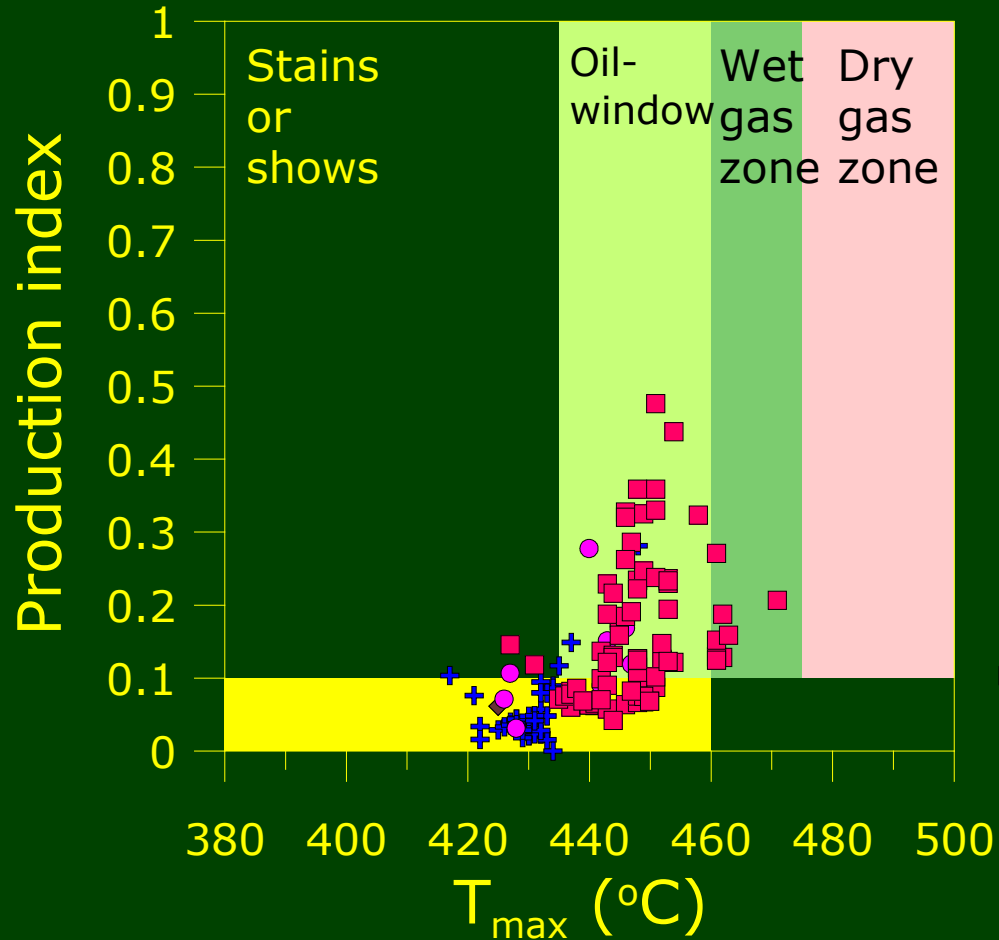
# Generating Potential



# Organic Facies



# Rock-Eval Maturity



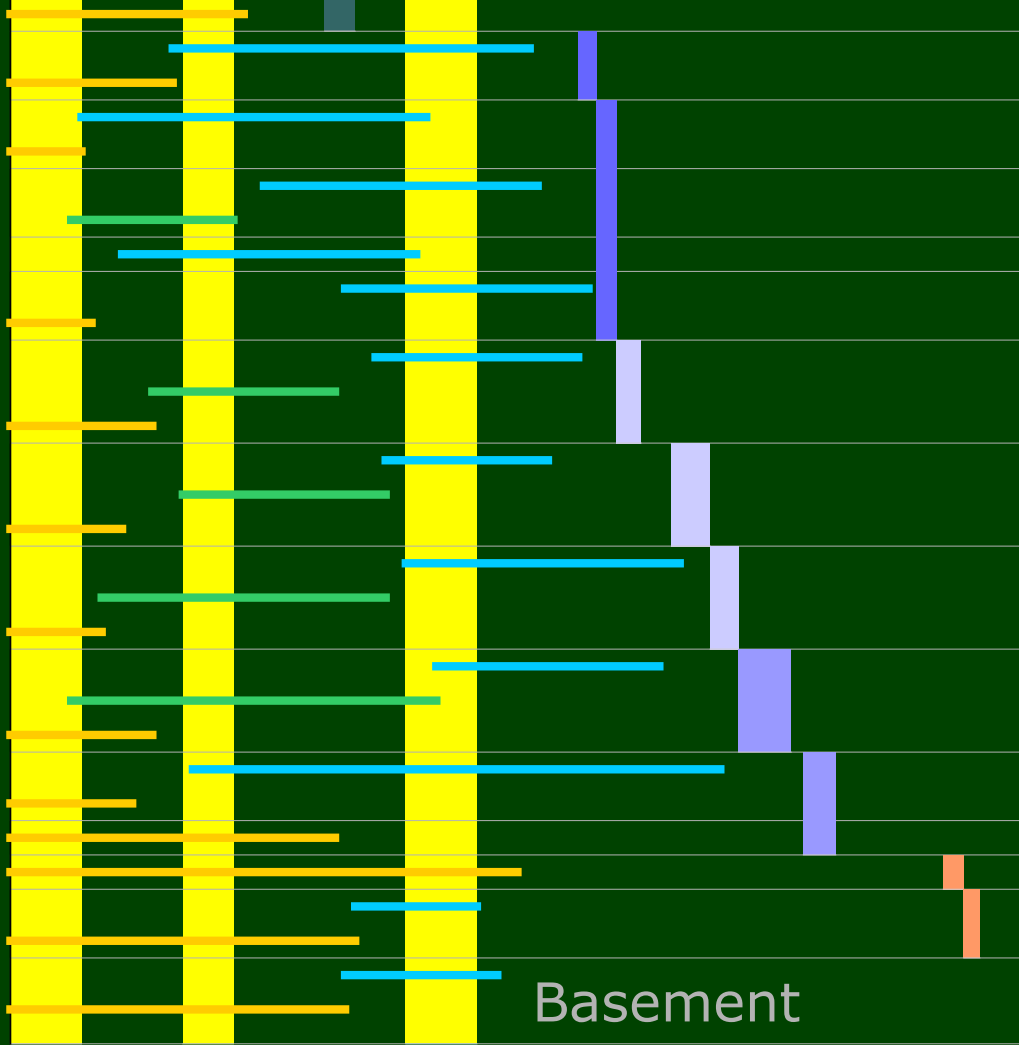
Time (Ma)

0 50 100 150 200 250 300 350 400 450 500



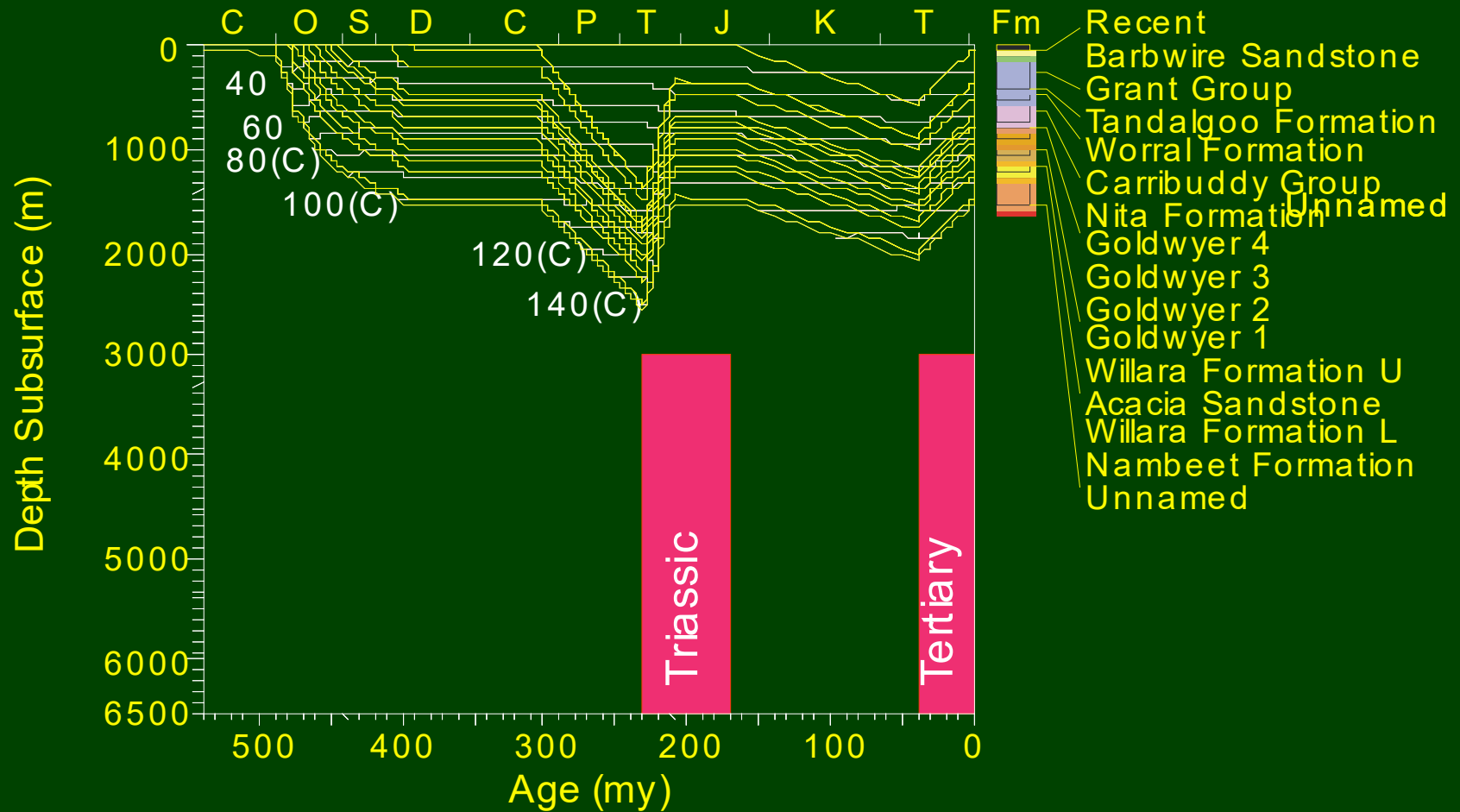
# AFTA Paleothermal Episodes

- Acacia 1 & 2
- Kidson 1
- Willara 1
- Yulleroo 1

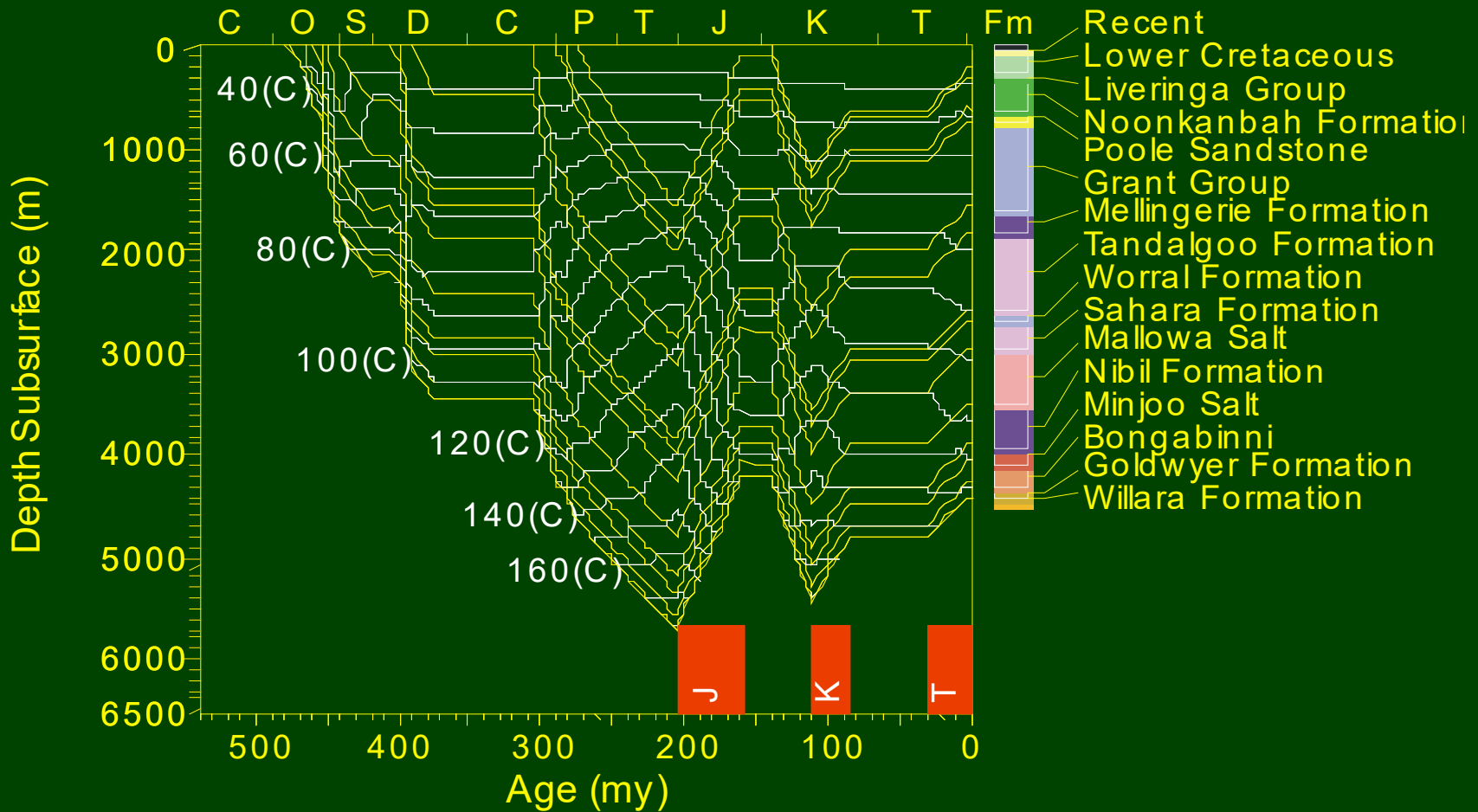


Basement

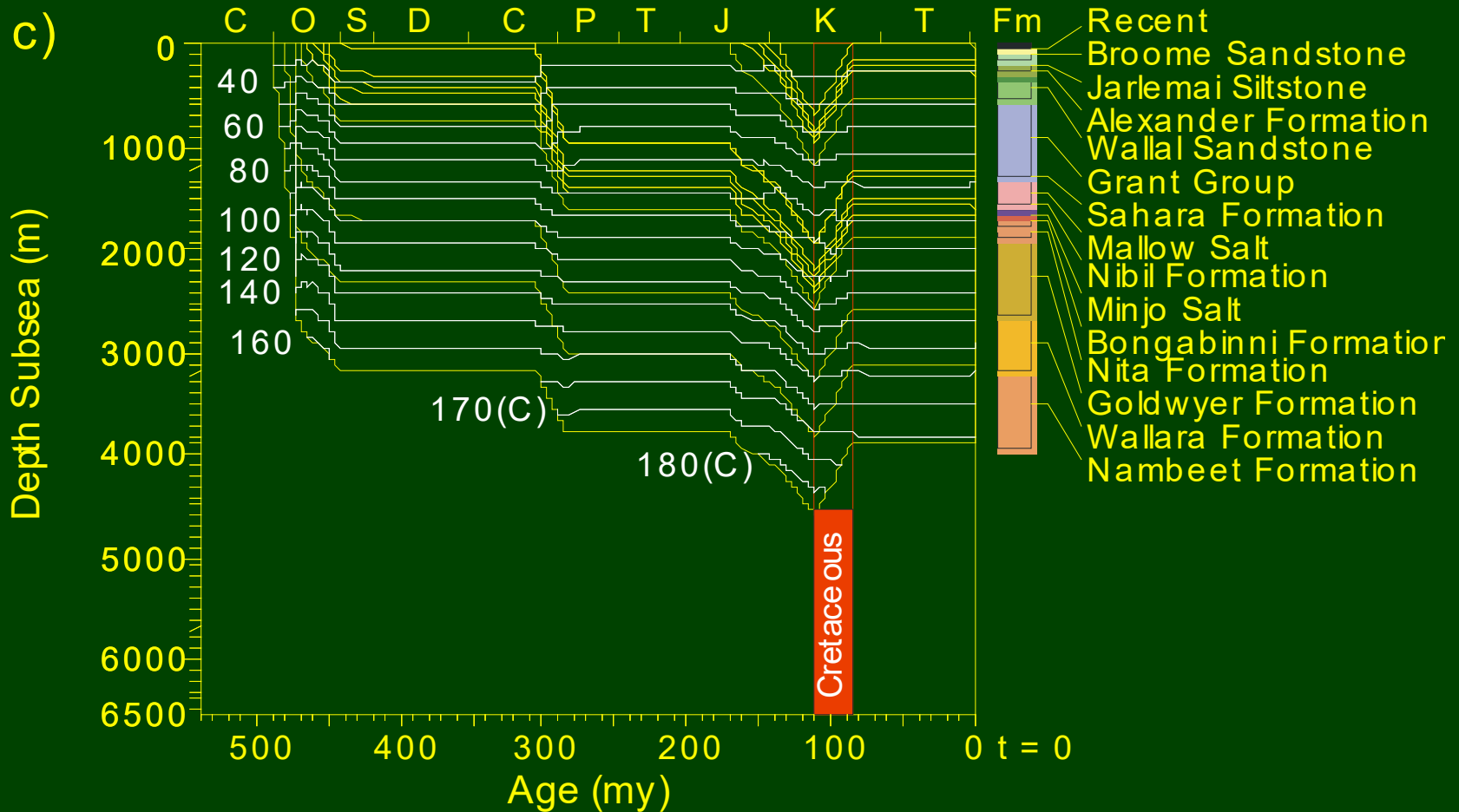
# Acacia 1 & 2 Burial History



# Kidson 1

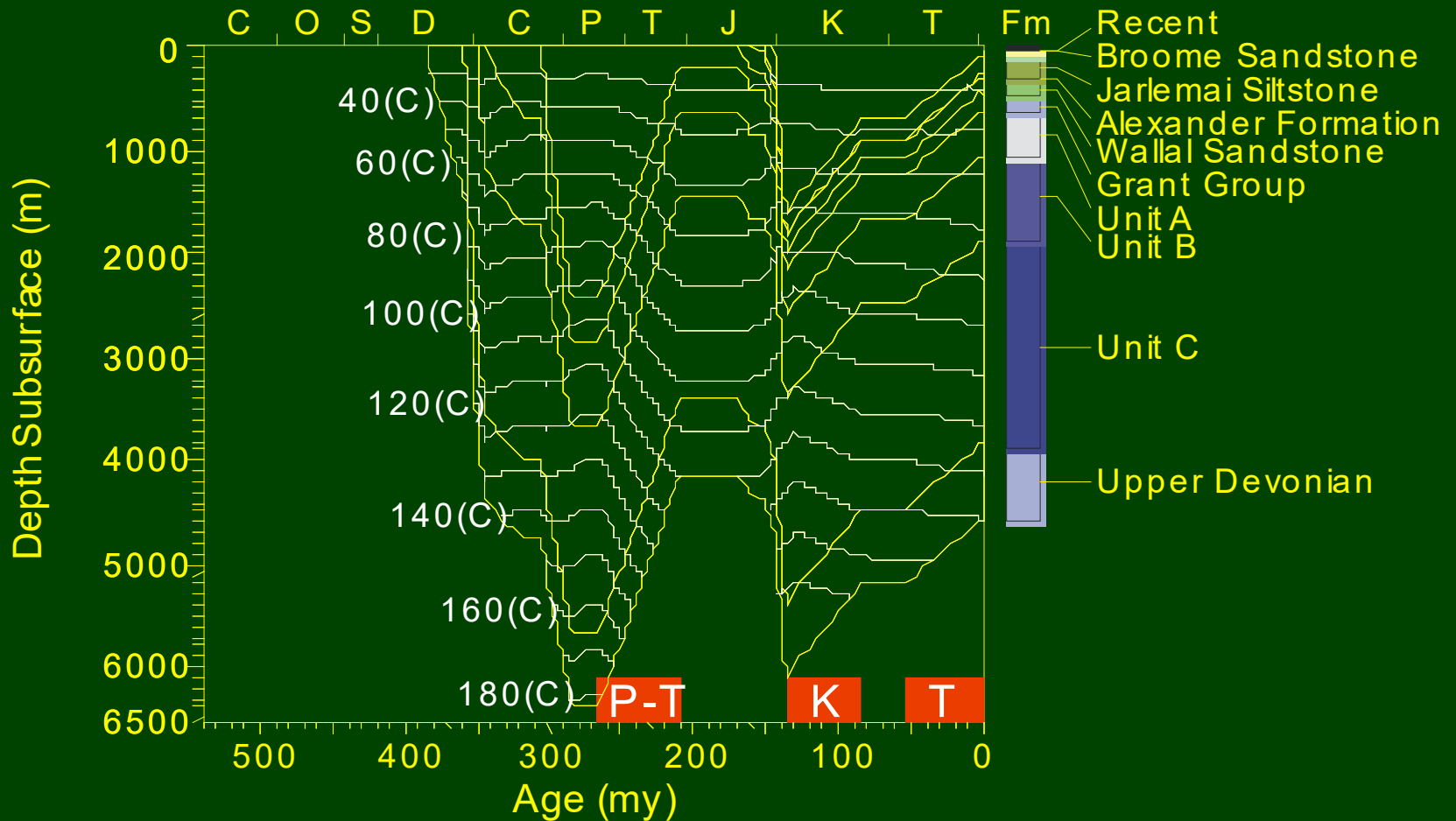


# Willara 1 Burial History

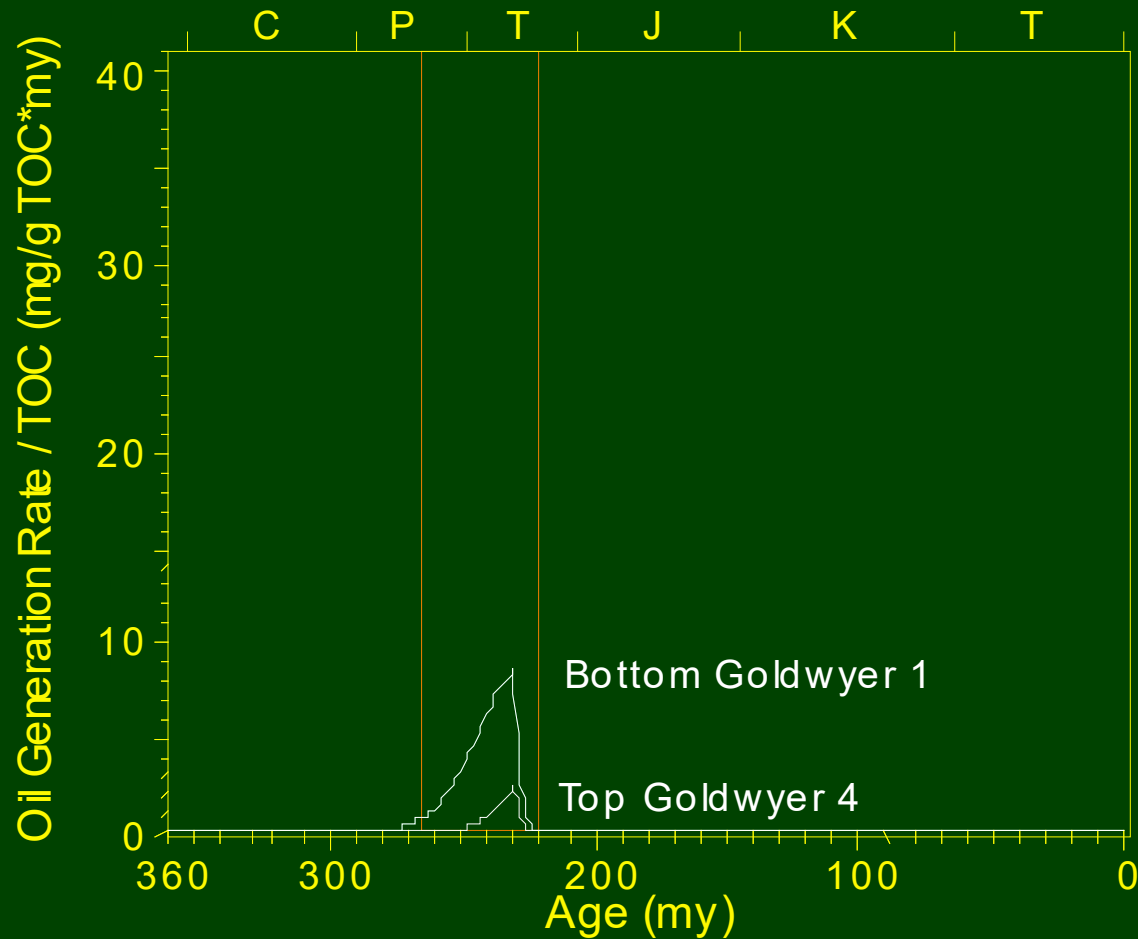




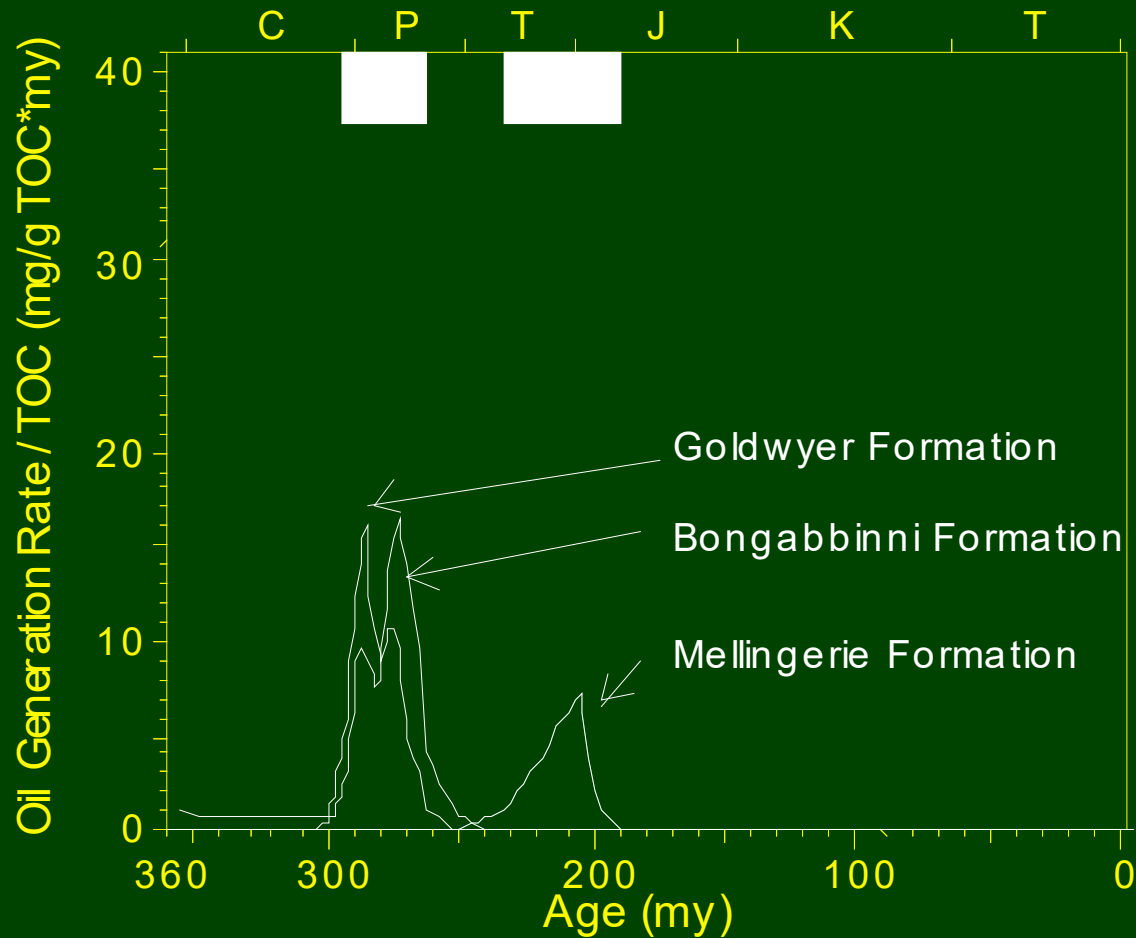
# Yulleroo 1 Burial History



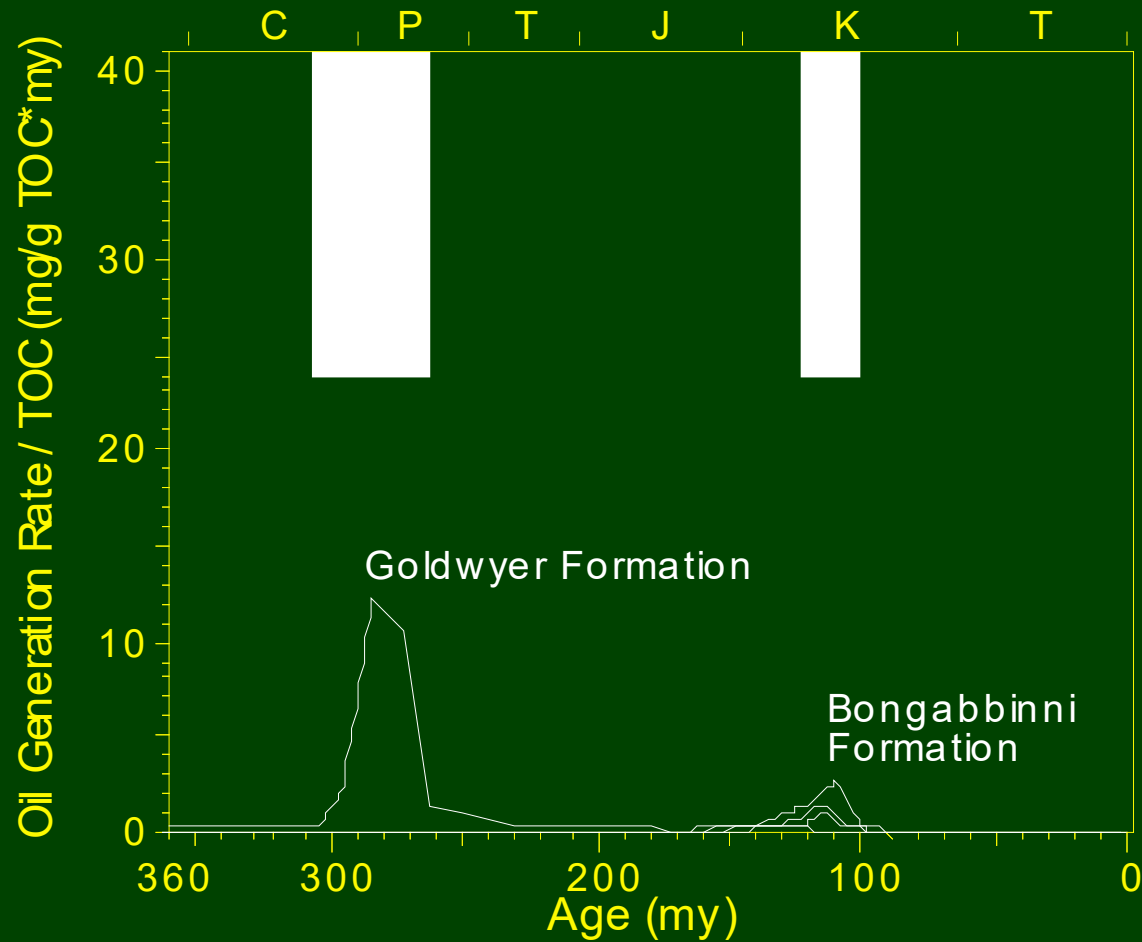
# Acacia 1 & 2 Generation Timing



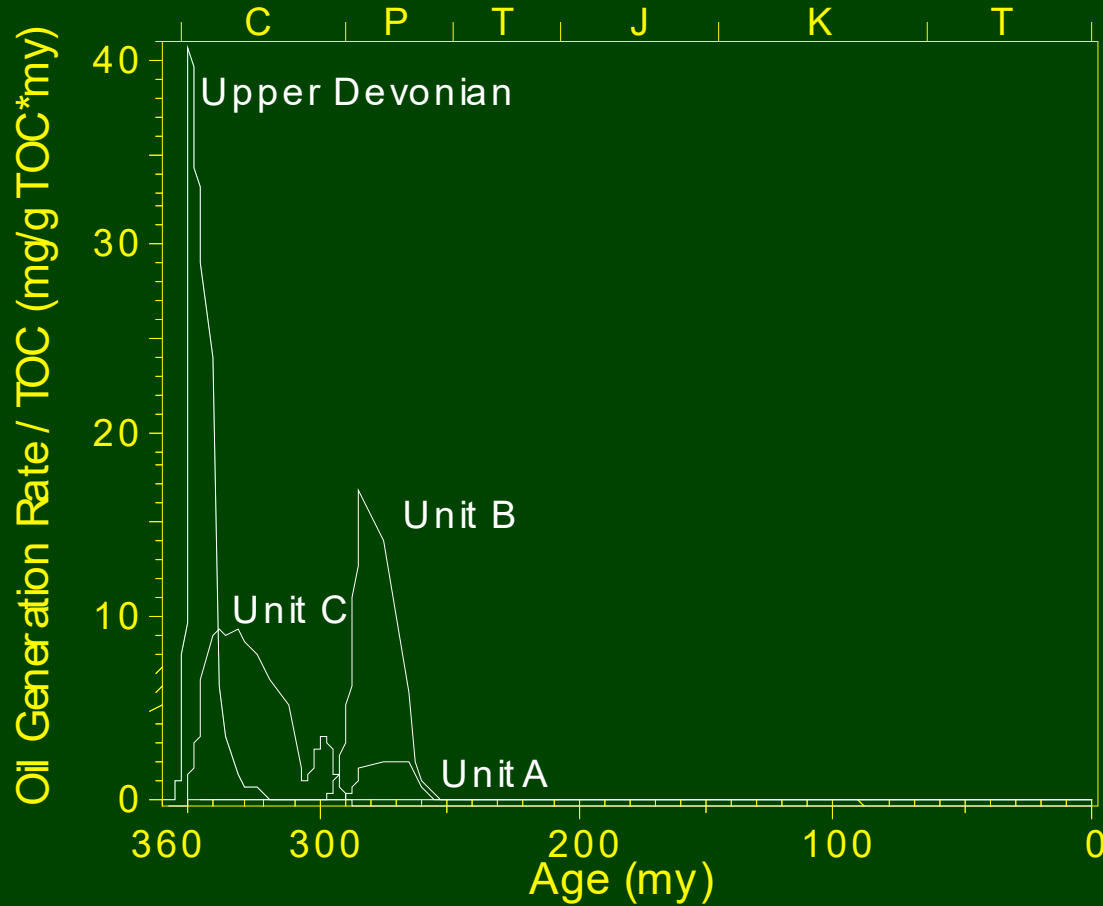
# Kidson 1 Generation Timing



# Willara 1 Generation Timing



# Yulleroo 1 Generation Timing



# Oil Detection—Fluorescence Techniques

- 100 samples of potential reservoir lithologies:
  - Acacia 1
  - Dodonea 1 and 2
  - Looma 1
  - White Hills 1
  - Yulleroo 1
- Quantitative Grain Fluorescence (QGF)
- Quantitative Grain Fluorescence – Extract)
- Quantitative Grain Fluorescence + (QGF+)
- Total Scanning Fluorescence (TSF)

# Observation

- Paleo or residual oils indicating multiple source kitchens and hydrocarbon charge events:
  - Middle Ordovician dolomite.
  - Early Carboniferous sandstone (White Hills, Yulleroo-1).
  - fluid inclusions oils from White Hills-1 are of mature and light nature.

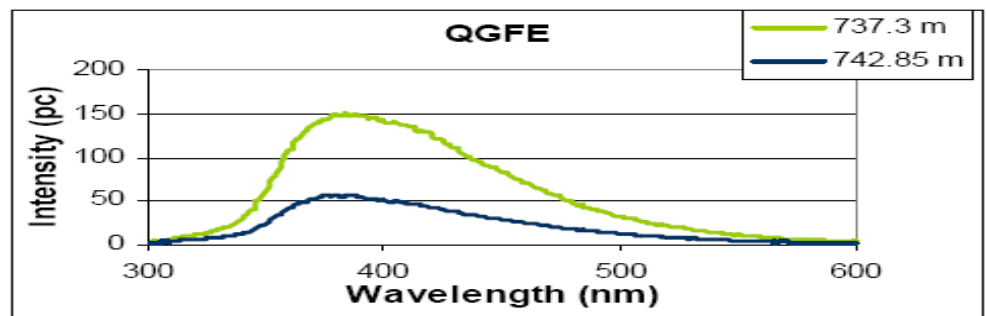
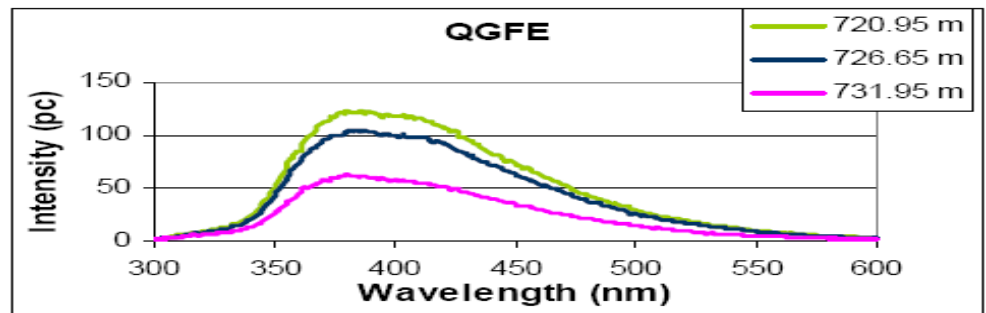
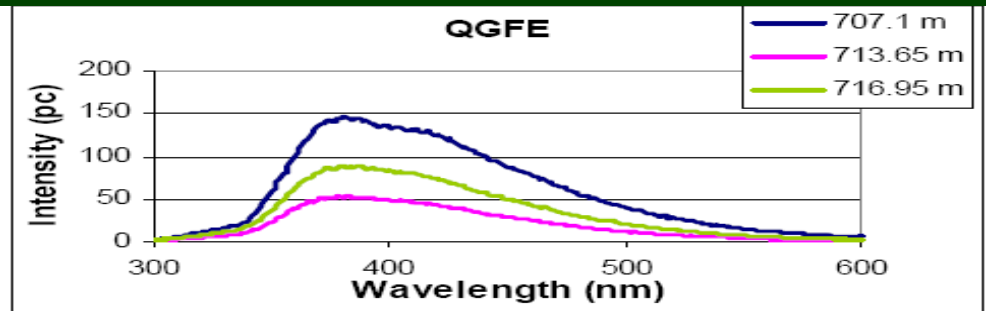
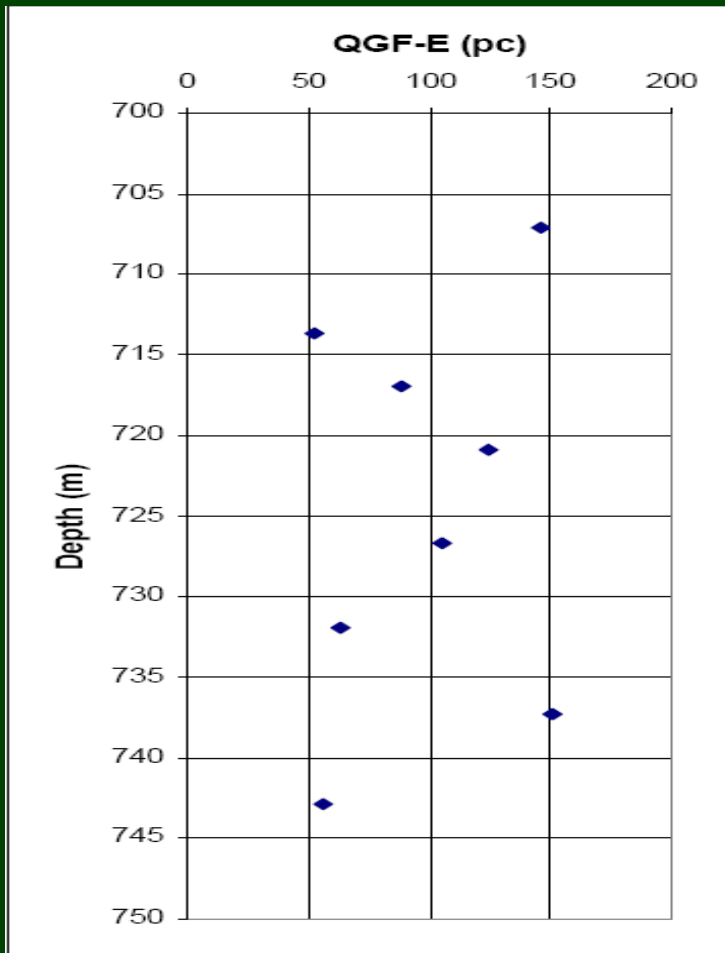
# Acacia 1



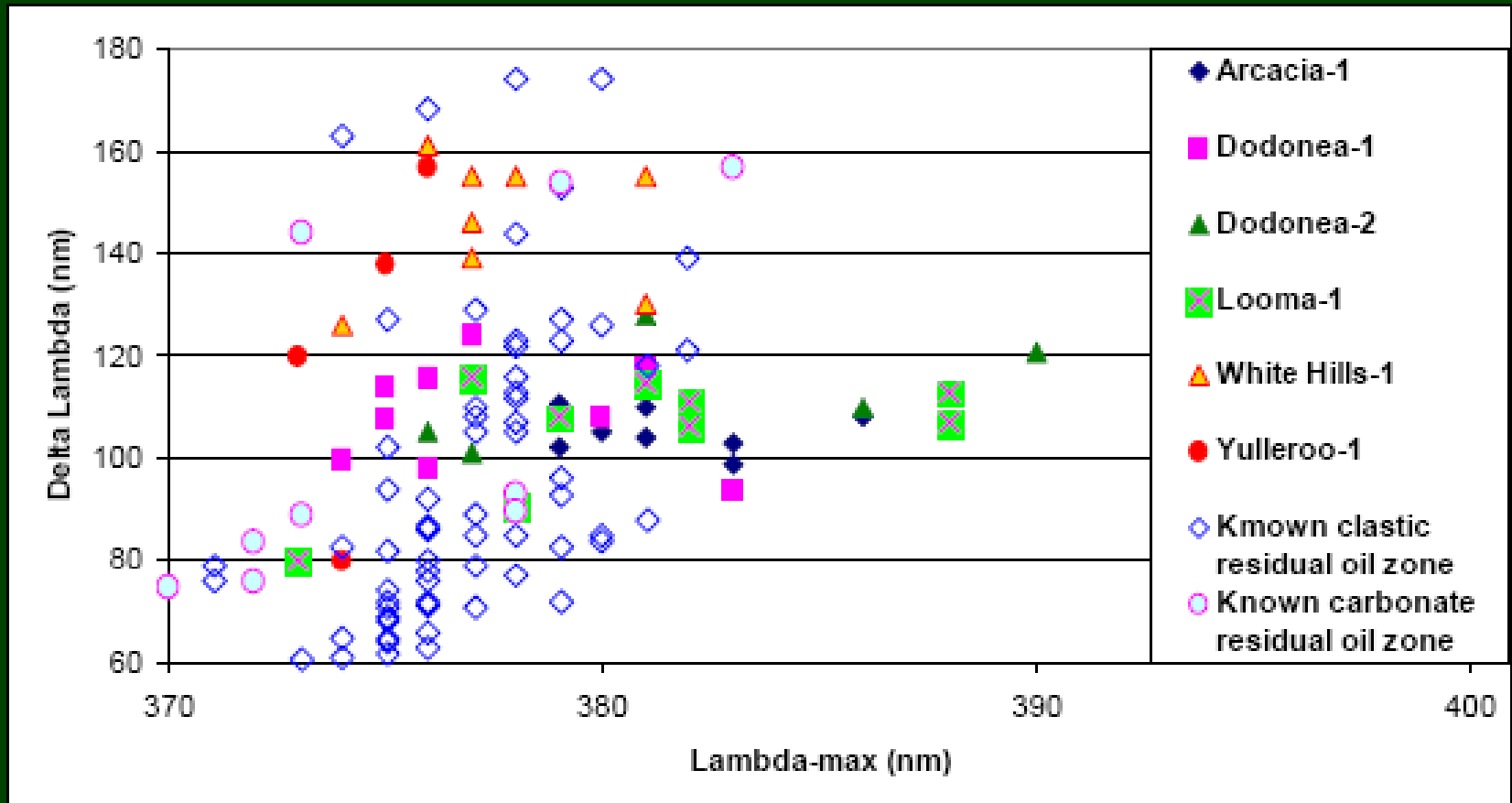
Scale is 1mm.



# QGF-E intensity and spectra — Acacia-1

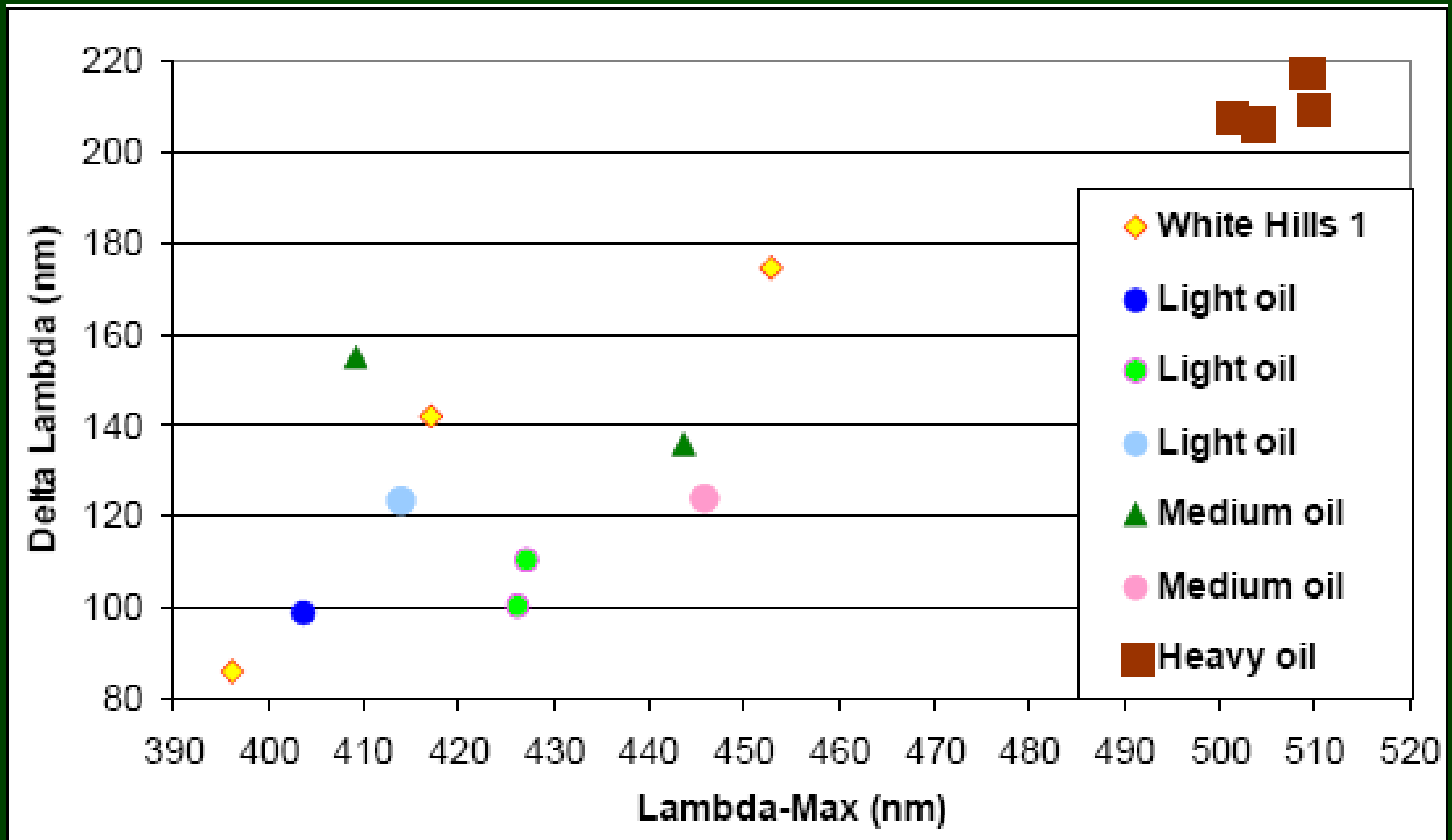


# Known Residual Oil Zone



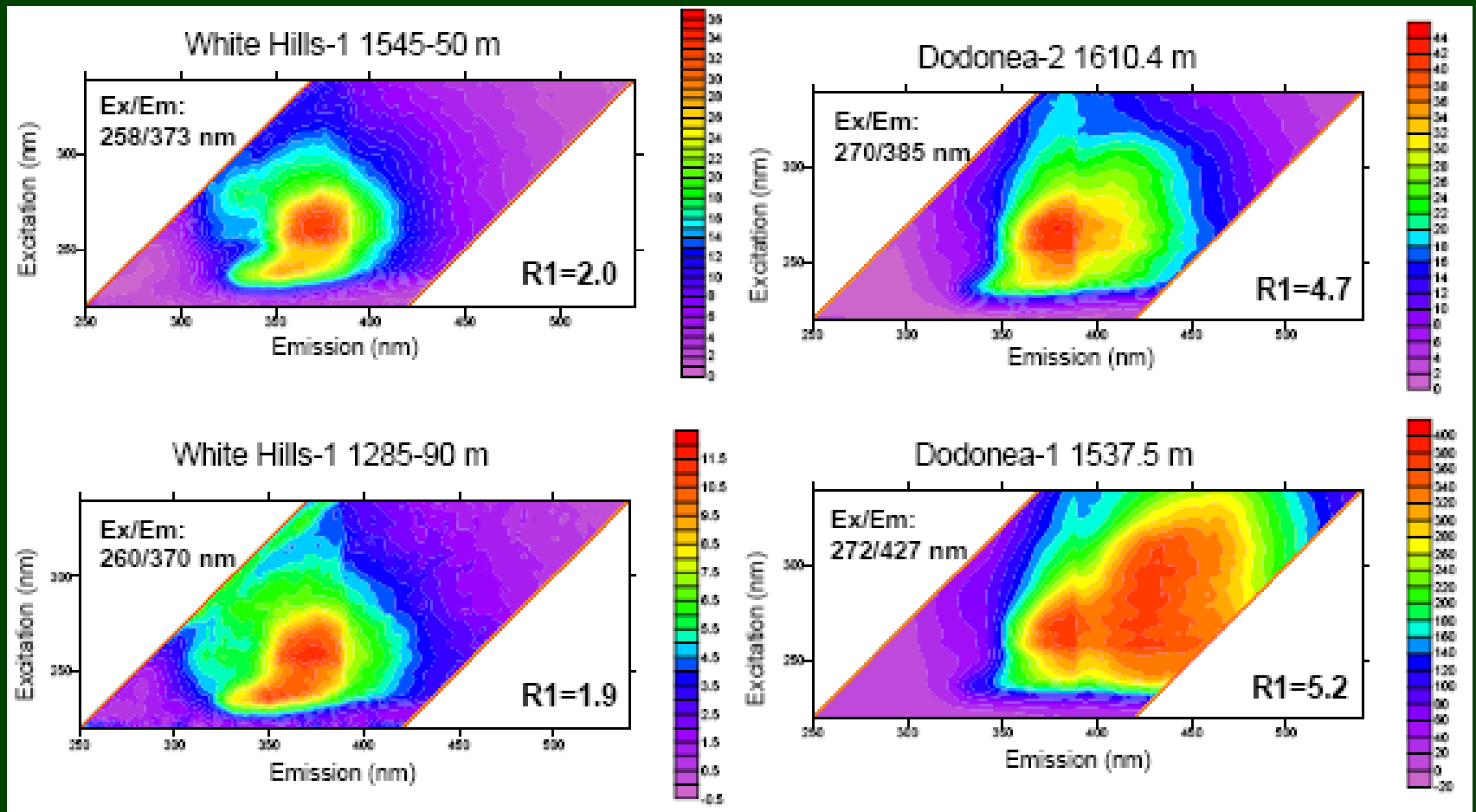
Cross Plot of QGF-E Lambda-max and Delta Lambda

# QGF+ Known petroleum fluid inclusions



Cross Plot of QGF+ Lambda-max and Delta Lambda for White Hills-1.

# TSF Spectra of



White Hills-1 (light oil) and Dodonea 1 & 2 (heavy oil)

# Conclusions

- Oil and Gas Distribution — Widespread
  - Geographically & Stratigraphically
- Source Rock Distribution — Varies
  - Limited data on Kidson, Gregory, Willara
- Discoveries —
  - Drilling versus Discoveries
- Charge Timing — Varies

# Conclusions

## Charge Timing — Permian to Jurassic

- **Ordovician Source**

- Early Permian — Kidson 1
- Early Jurassic — Acacia 1 & 2

- **Devonian Source**

- Early Carboniferous — Yulleroo 1
- Early Jurassic — Kidson 1

# Conclusions

- The characteristics of the QGF-E and QGF spectra indicate that there are multiple residual or Palaeo oils presence in the wells investigated, possibly indicating multiple source kitchens and hydrocarbon charge events.
- Additional QGF+ and TSF analyses confirmed that the fluid inclusions oils from White Hills-1 are of mature and light nature.

# Recommendations

## Key Risks

- **Source Rocks** — Gregory, Kidson, Willara
- **Reservoirs** — Subsalt Plays
- **Seals** — Suprasalt Plays
- **Charge Timing** — Gregory Sub-basin
- **Preservation** — Fitzroy Trough



# Thanks

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Geological Survey of Western Australia  
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