

# **Hydrocarbon Potential of Jurassic Source Rock in the Guiana-Suriname Basin\***

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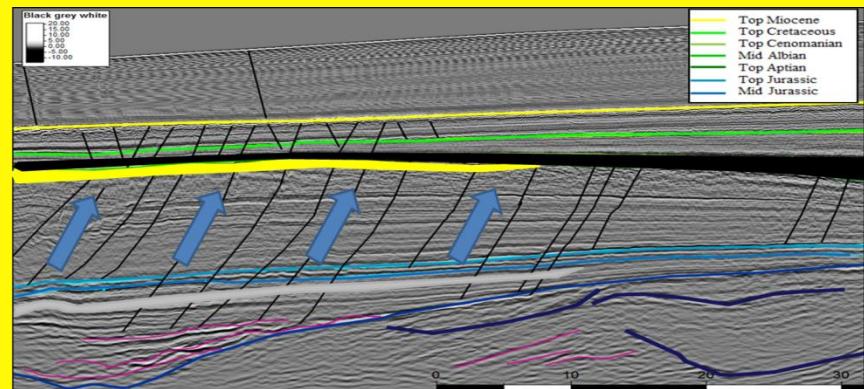
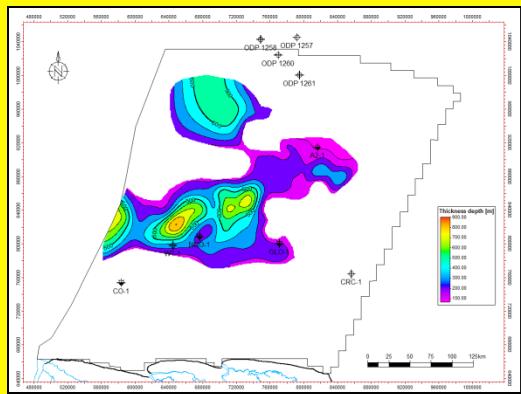
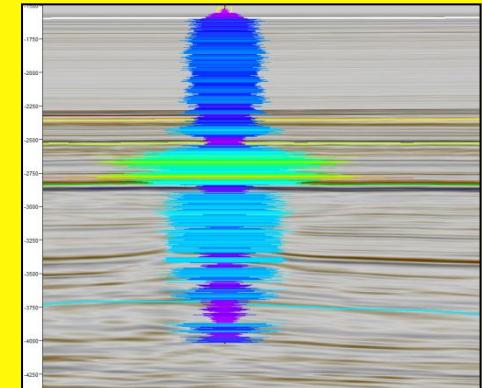
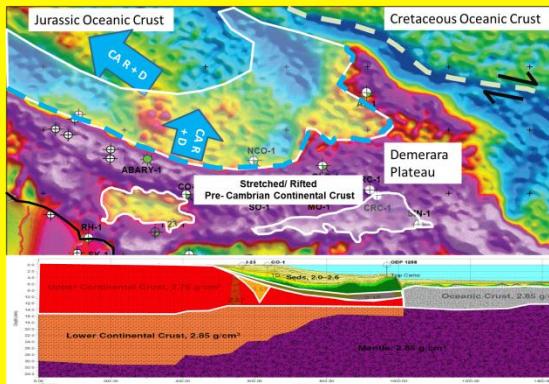
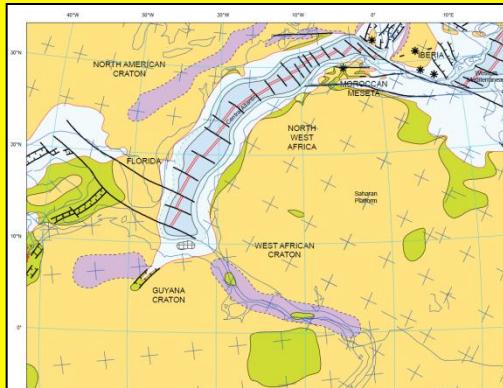
## **Abstract**

Mid to upper Jurassic age source rocks, and their related petroleum systems, have played a major role in generating some of the world's largest oil and gas fields. Middle-Upper Jurassic source rocks are mainly found in the Middle East (Hanifa-Naokelkan-Sargelu-Dukhan formations), the Caspian region (various formation names), West Siberia (Bazhenov Formation), North Sea (Kimmeridgian Clay), and Gulf of Mexico (Haynesville Shale). These rocks are predominantly marine shale and marly limestone with kerogen types II and III, and have charged Upper Jurassic to Cretaceous oil and gas reservoirs. The Guyana – Suriname Basin displays the geologic elements described above. Mid to late Jurassic age graben structures, filled with syn-rift sediments, overlain by post rift, passive margin, prograding marine sediments from mid Cretaceous to present can be identified on seismic lines offshore Suriname. None of these graben structures have been penetrated by wells. The questions therefore are: ‘Is there mature source rock and related petroleum systems within the grabens of the Guyana – Suriname Basin similar to that of the North Sea graben and the Kimmeridgian Petroleum System?’ “How much hydrocarbons has been generated?” “What are the implications for the Suriname part of the Guiana Basin?” Analysis of crude oil in the Upper Cretaceous reservoirs onshore Suriname revealed the presence of a possible Mid Jurassic Source Rock. In addition, offshore well A2-1, drilled on the Demerara Plateau in the Guyana – Suriname Basin, penetrated pre-rift lower to middle Jurassic sediments and confirmed the presence of non-graben related Jurassic source rocks in the basin. Similarly, the Takutu Graben of onshore Guyana, interpreted as a failed arm of the early Jurassic North Atlantic rifting, has proven source rock and a unique Petroleum System within the graben. The evidence presented indicate: The Jurassic source rock is mature for hydrocarbon generation, The Jurassic source rock has generated tremendous amounts of hydrocarbons, and The Jurassic source rock in the Suriname part of the Guiana Basin can play an important role within the oil and gas industry for Suriname.

## **Selected References**

- Erlich, R.N., and J. Keens-Dumas, 2007, Late Cretaceous Palaeogeography of Northeastern South America: Implications for source and Reservoir Development: In Proceedings of the 4th Geological Society of Trinidad and Tobago Geological Conference – Caribbean Exploration – Planning for the Next Century, 17–22 June 2007, Port of Spain, Trinidad.
- Hanou, M.J., 1981, Geologic and Petroleum Analysis of the Suriname Coastal Region: GEOMAN International Report, Gulf Oil Company, Houston, TX, HTSC Report 442A2981, 52 p.
- Lawrence, S., and P. Coster, 1985, Petroleum Potential of Offshore Guyana: Oil and Gas Journal, v. 83, p. 67-74.
- Staatsolie, 2015, Geology of the Guyana-Suriname Basin: <http://opportunities.staatsolie.com/en/geology-of-the-guyana-suriname-basin/>. Website accessed May 2017.
- Staatsolie, 2010, Company Profile - Confidence In Our Own Abilities: Staatsolie Maatschappij Suriname N.V., 2 p.
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# Hydrocarbon Potential of Jurassic Source Rock in the Guiana-Suriname Basin



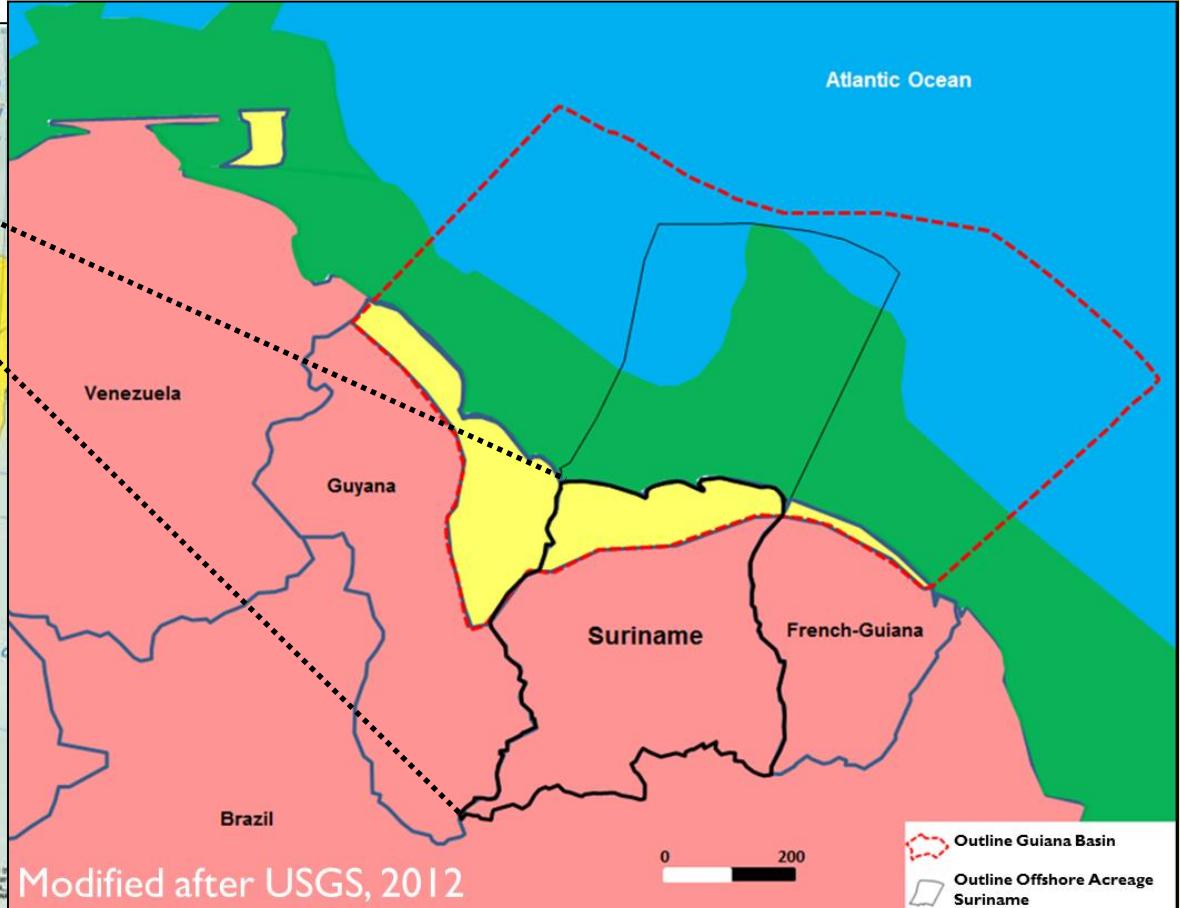
# Outline

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- ✓ **Geological Setting**
- ✓ **Equatorial Atlantic Petroleum System**
- ✓ **Evidence for Jurassic Source Rock**
- ✓ **Methods and Techniques**
- ✓ **Results**
  - ✓ Distribution of the Jurassic Source Rock
  - ✓ Oil/ Gas Generation
  - ✓ Reservoir Porosity Distribution
  - ✓ Seal Capacity
  - ✓ Migration Model
- ✓ **Conclusions and Recommendations**

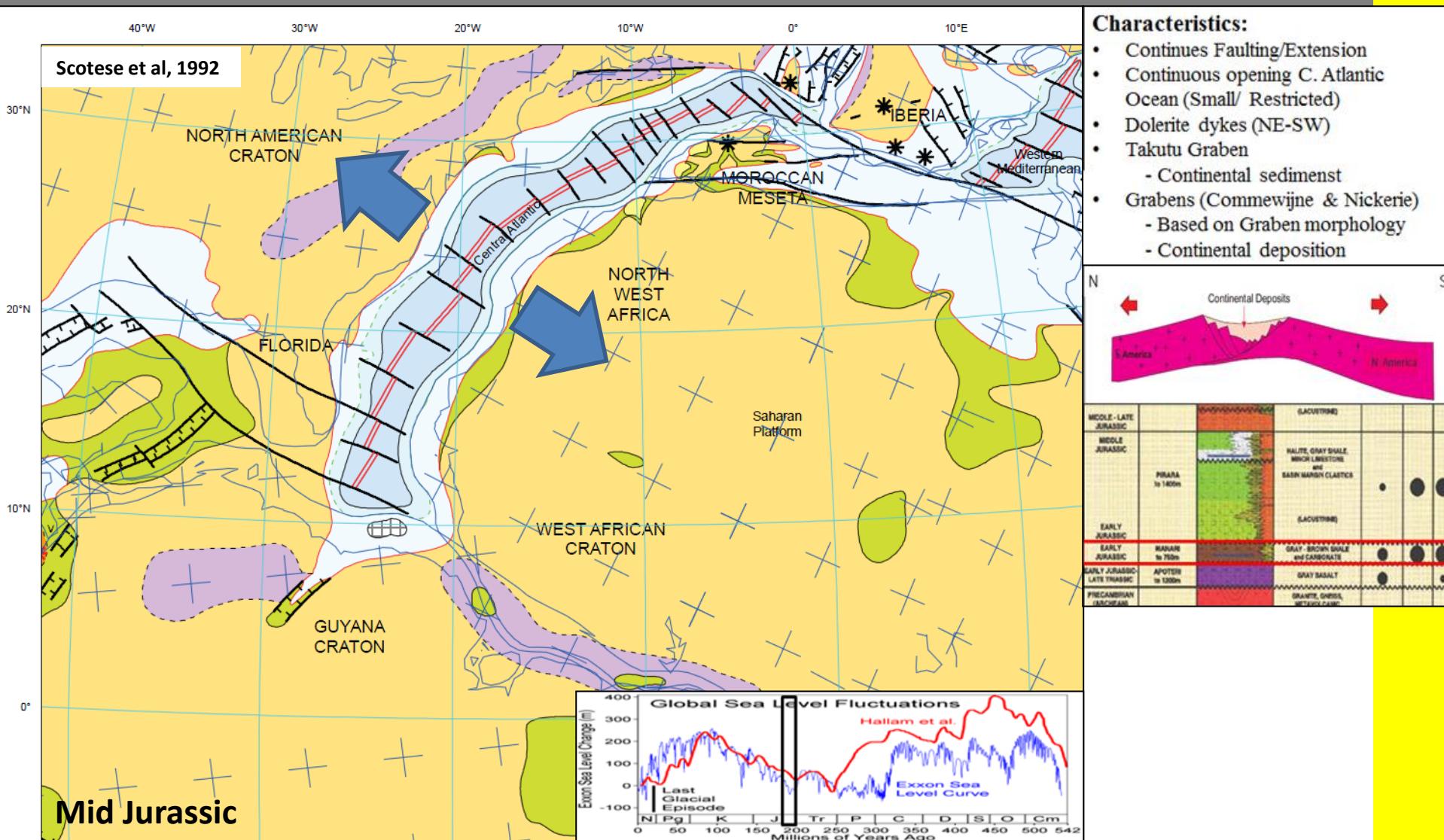
# Geological Setting-1

Outline Guiana Basin



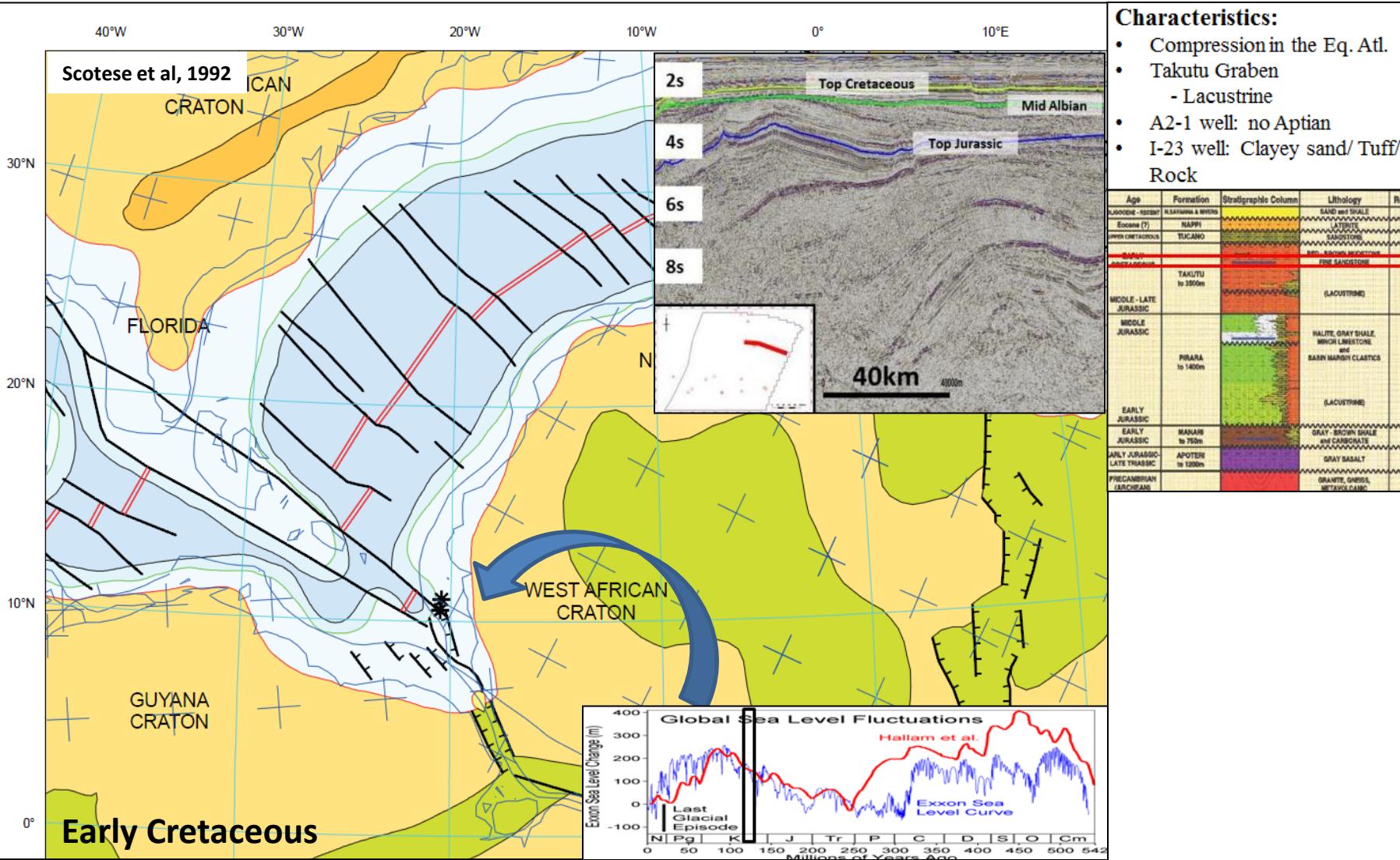
# Geological Setting-2

## Tectonic Evolution: Central Atlantic Rifting



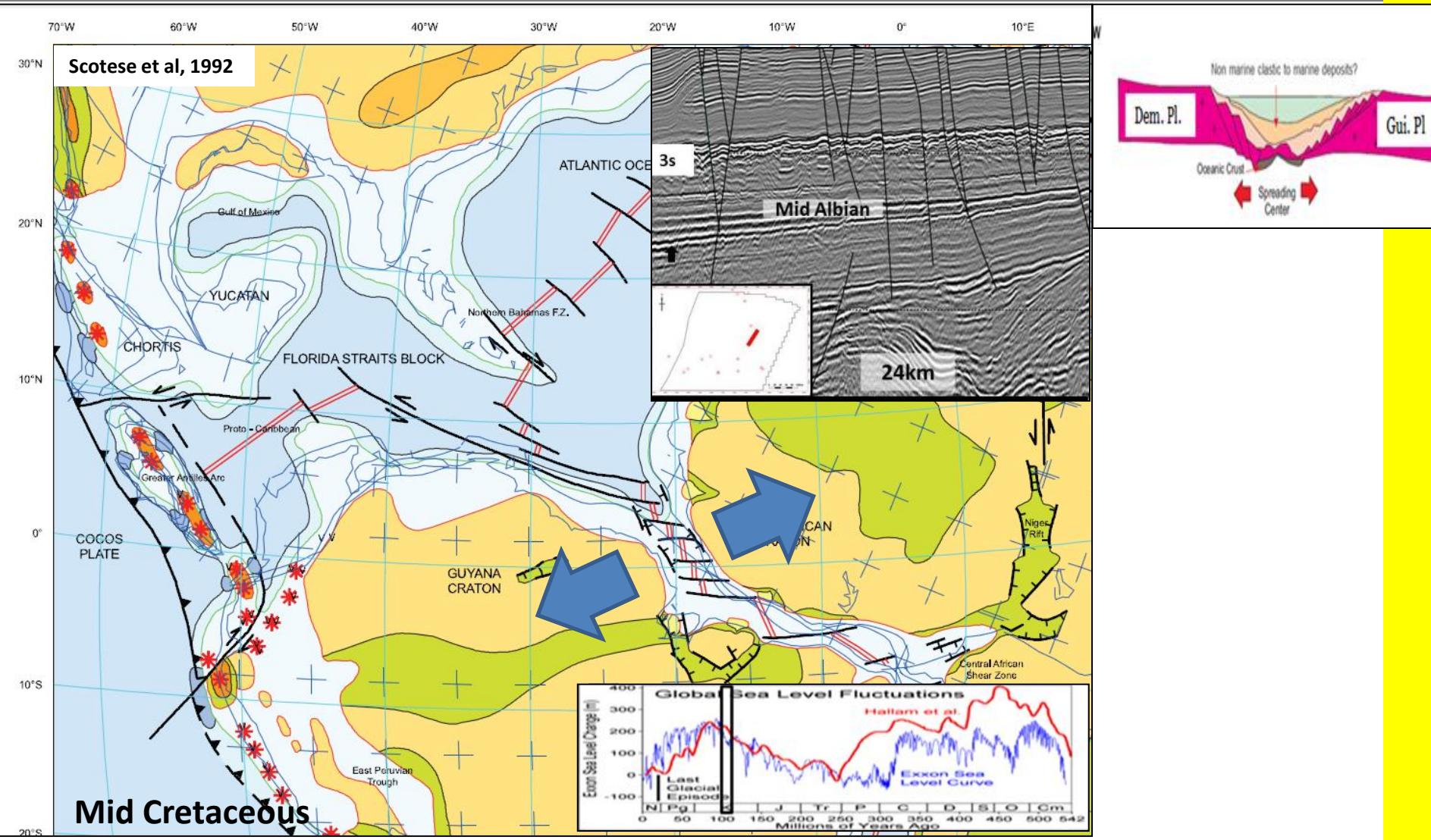
# Geological Setting-2

## Tectonic Evolution: South Atlantic Rifting



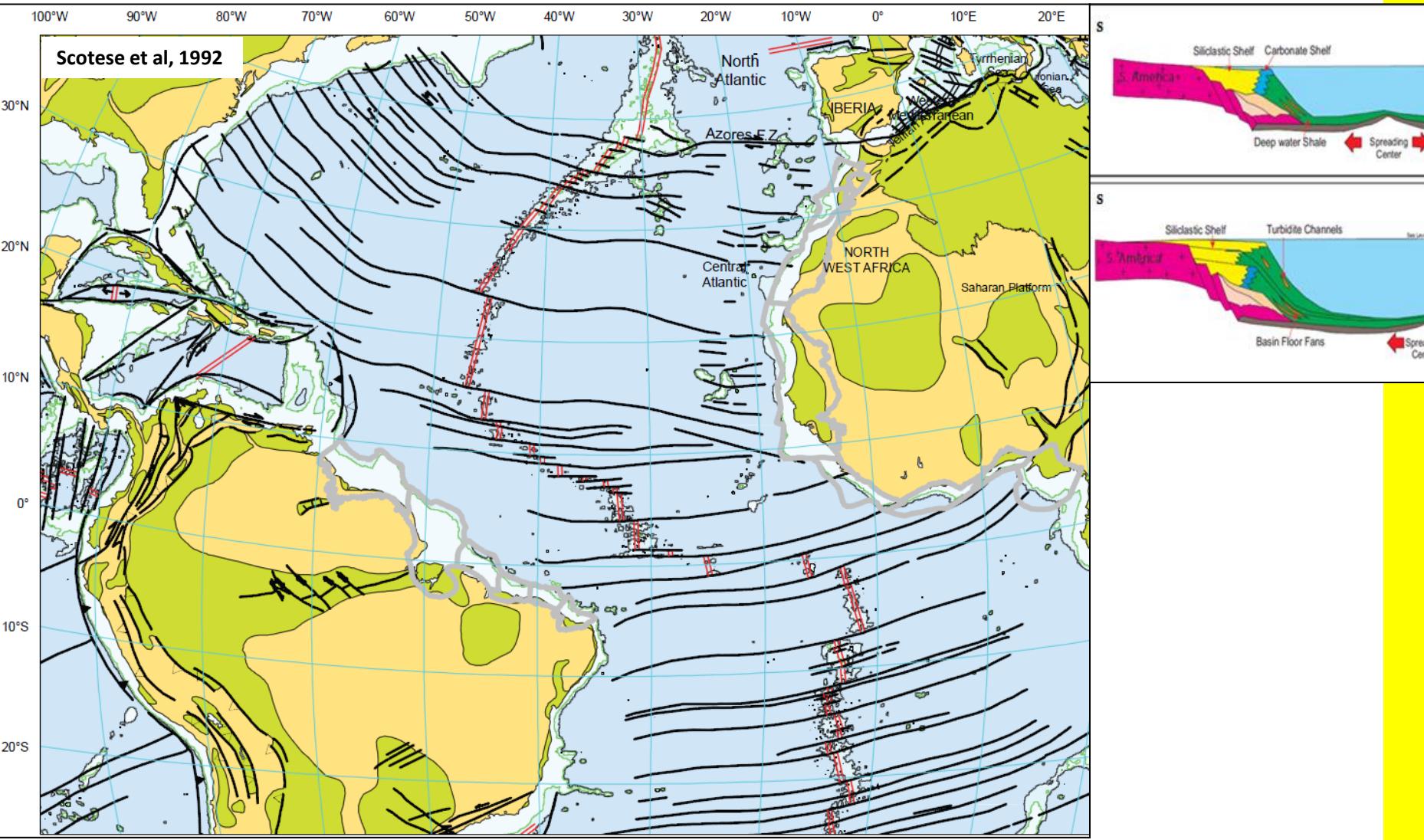
# Geological Setting-2

## Tectonic Evolution: Equatorial Atlantic Rifting



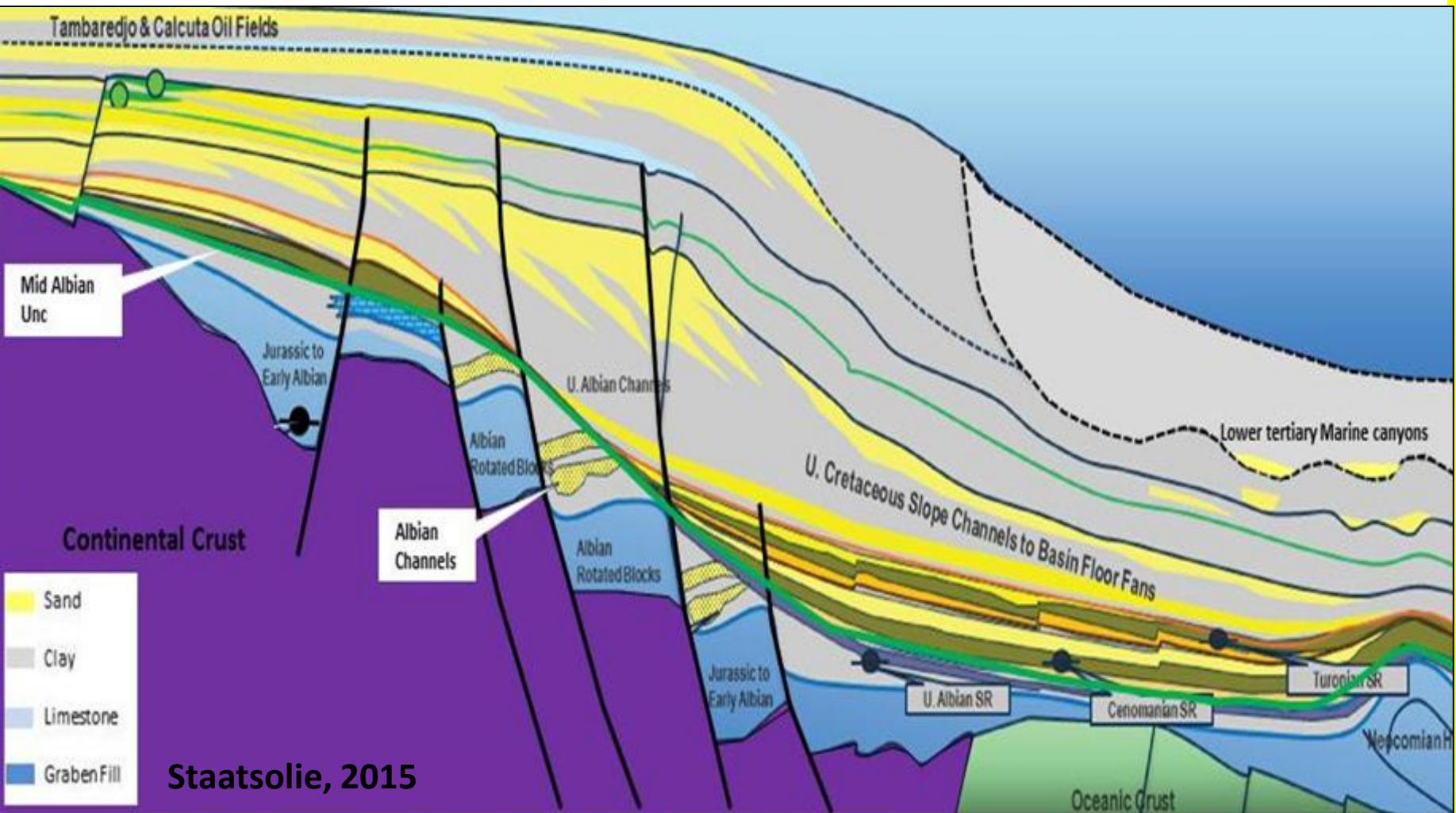
# Geological Setting-2

## Tectonic Evolution: Present Day

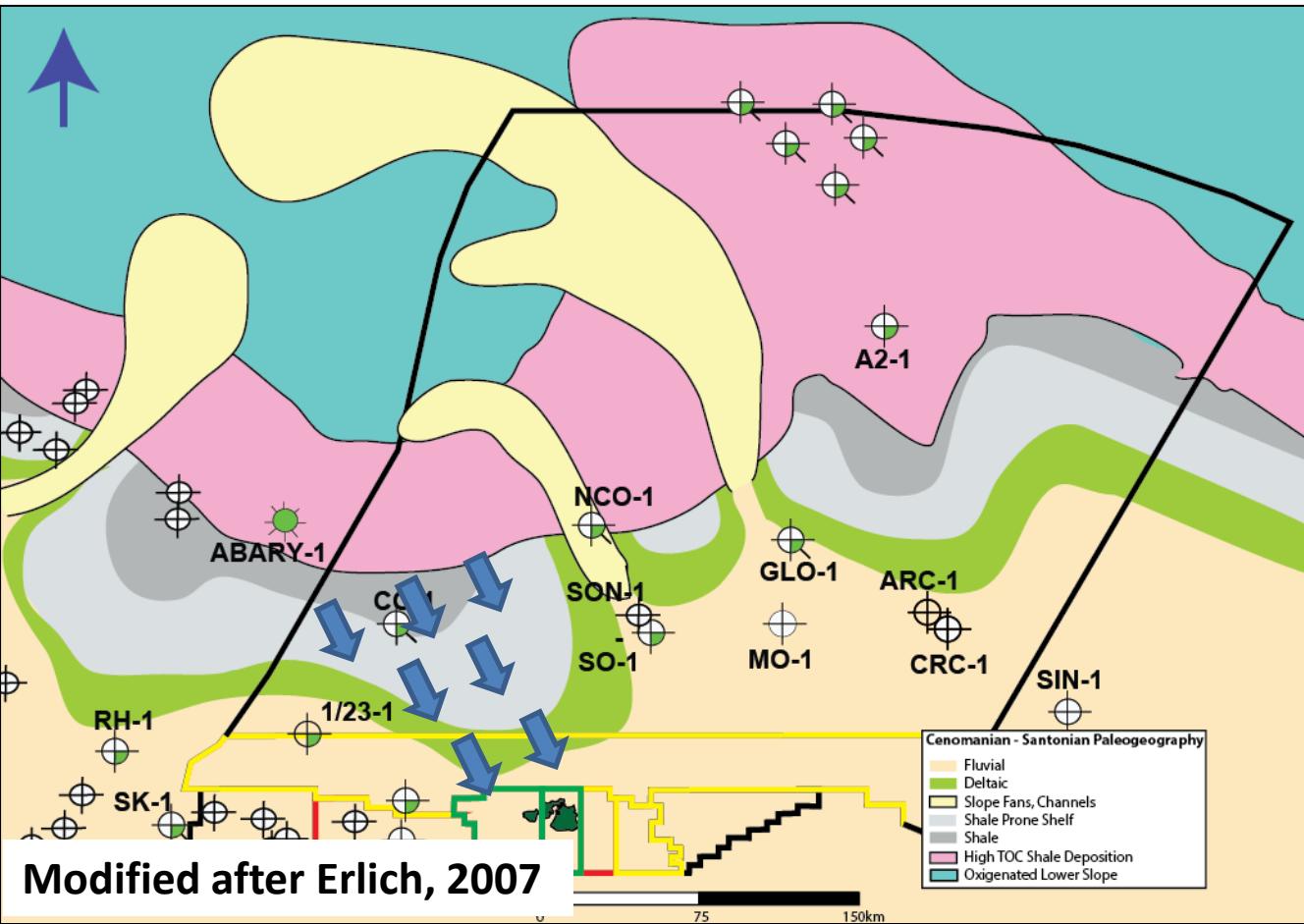


# Geological Setting-3

## Stratigraphy Guiana Basin



# Equatorial Atlantic Petroleum System



## Characteristics:

- Thickness: up to 550m
- TOC: - 4-7% in shelf break setting  
- up to 30% in deep water setting
- Type SR: Marine Type II
- Maturity: 40 to 45 Ma
- Migration: up to 100-150km to Onshore Oil Field

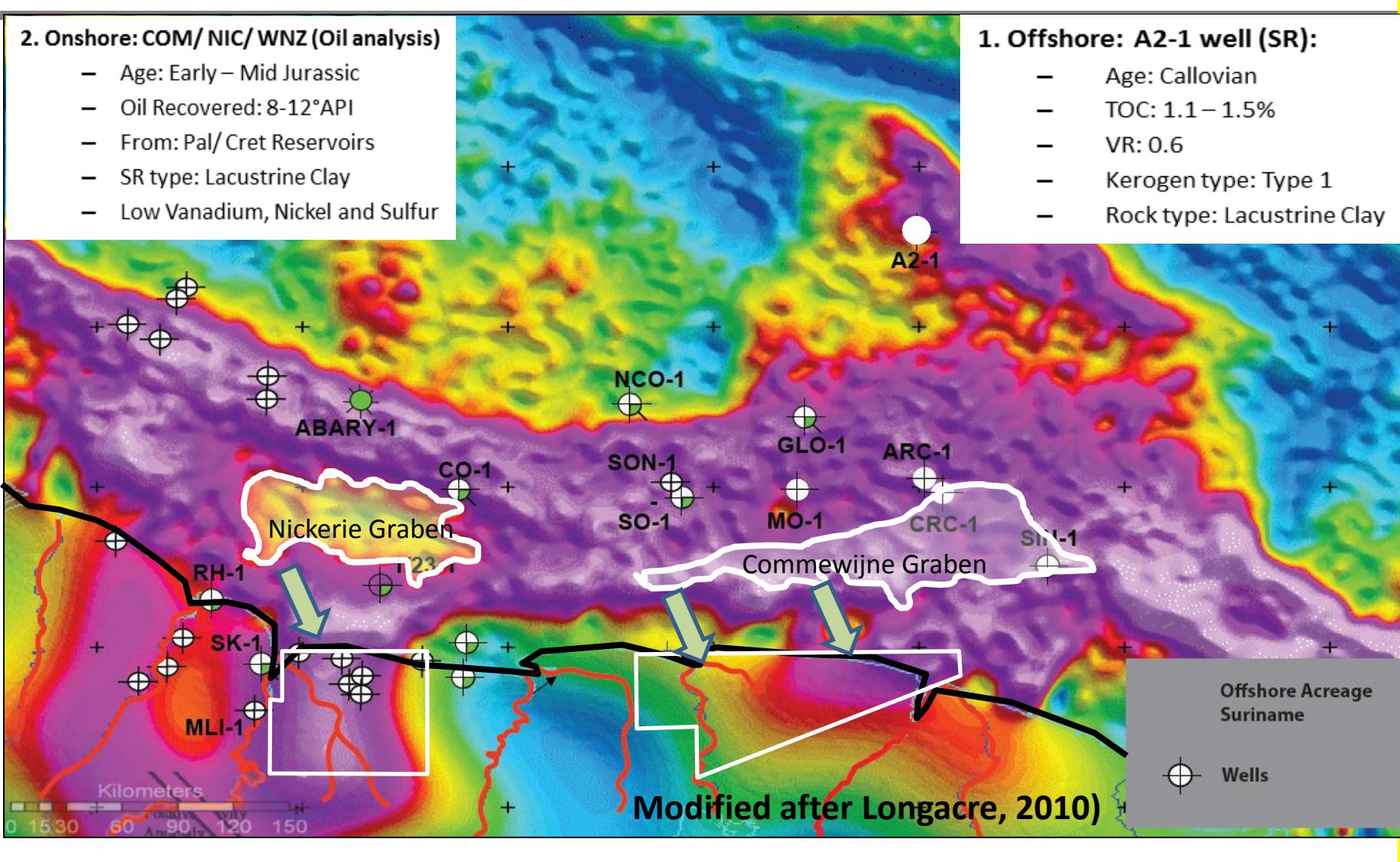
**ACT Source Rock!**

# Evidence for Jurassic Source Rock

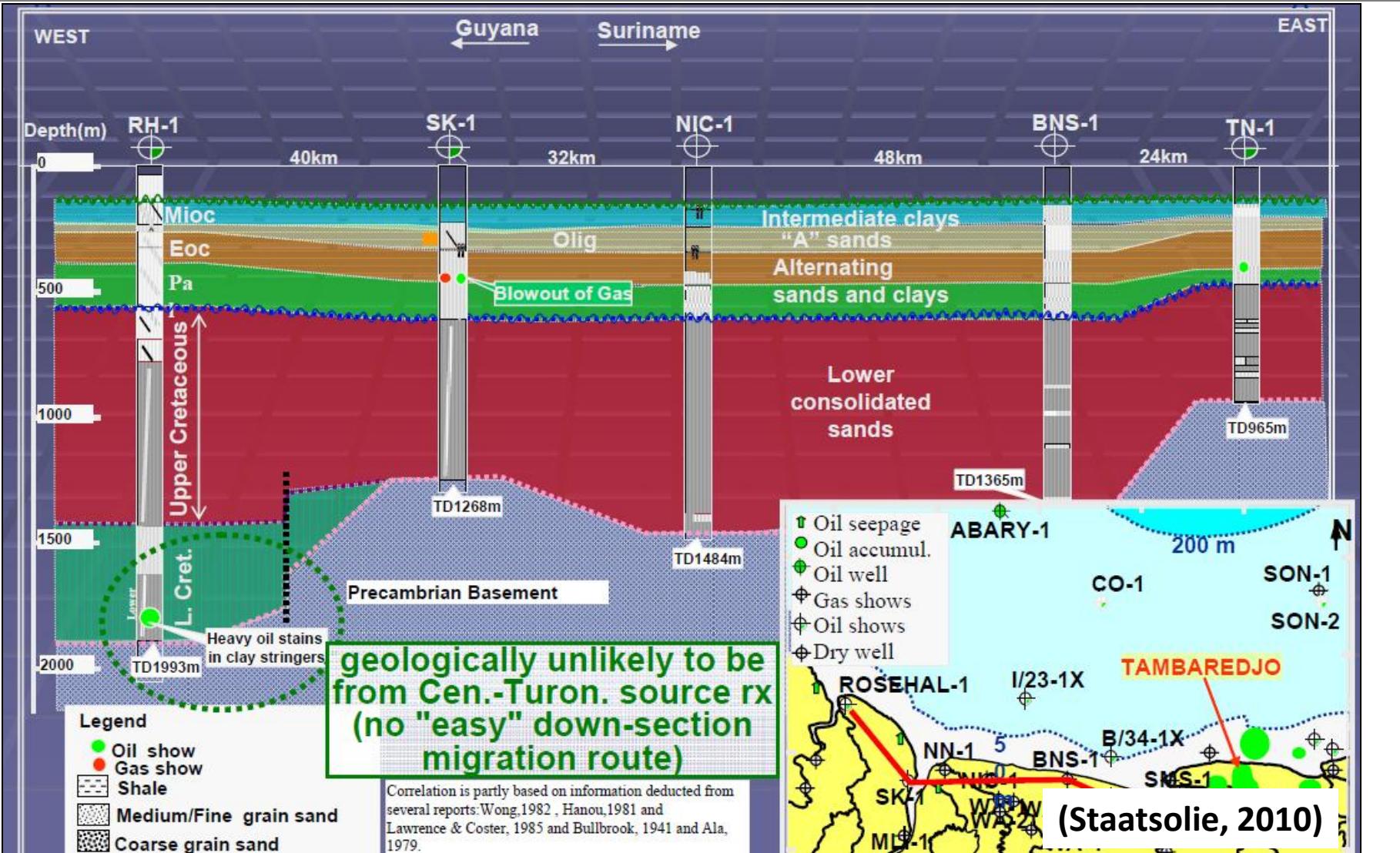
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- Analysis of crude oil in the Upper Cretaceous reservoirs onshore Suriname revealed the presence of a possible Mid Jurassic Source Rock.
- In addition, offshore well A2-1, drilled on the Demerara Plateau, penetrated Syn Rift Middle Jurassic Source Rock with TOC 1-2%.
- Similarly, the Takutu Graben of onshore Guyana, interpreted as a failed arm of the early Jurassic North Atlantic rifting, has proven source rock with TOC <2.5%).

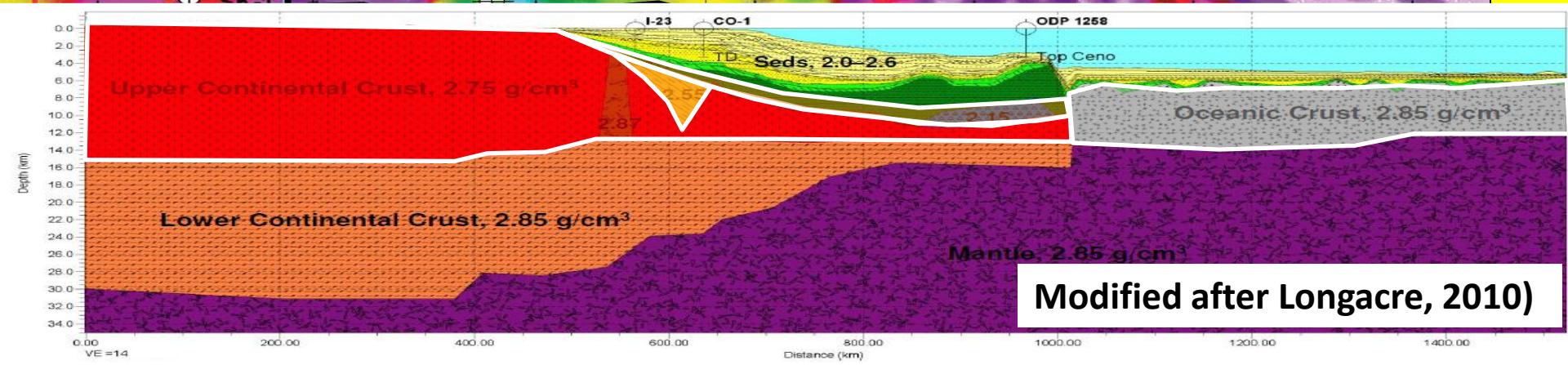
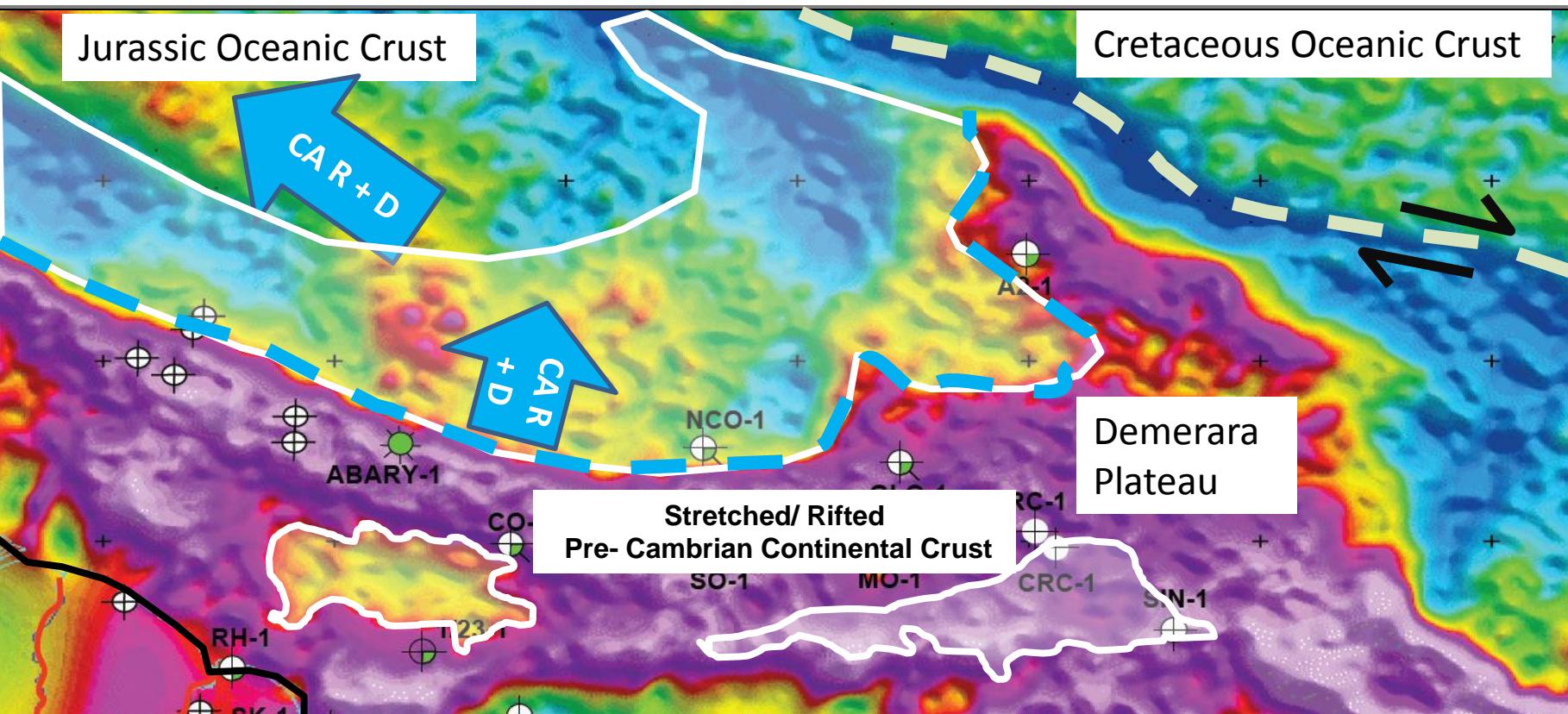
# Well Results

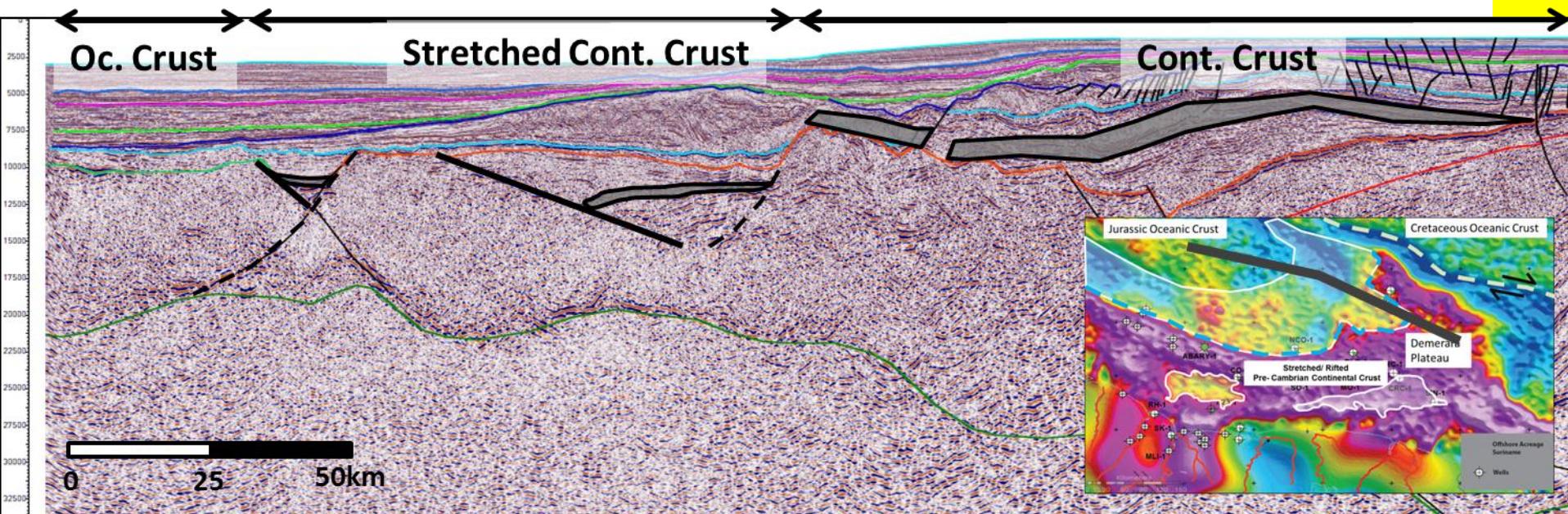
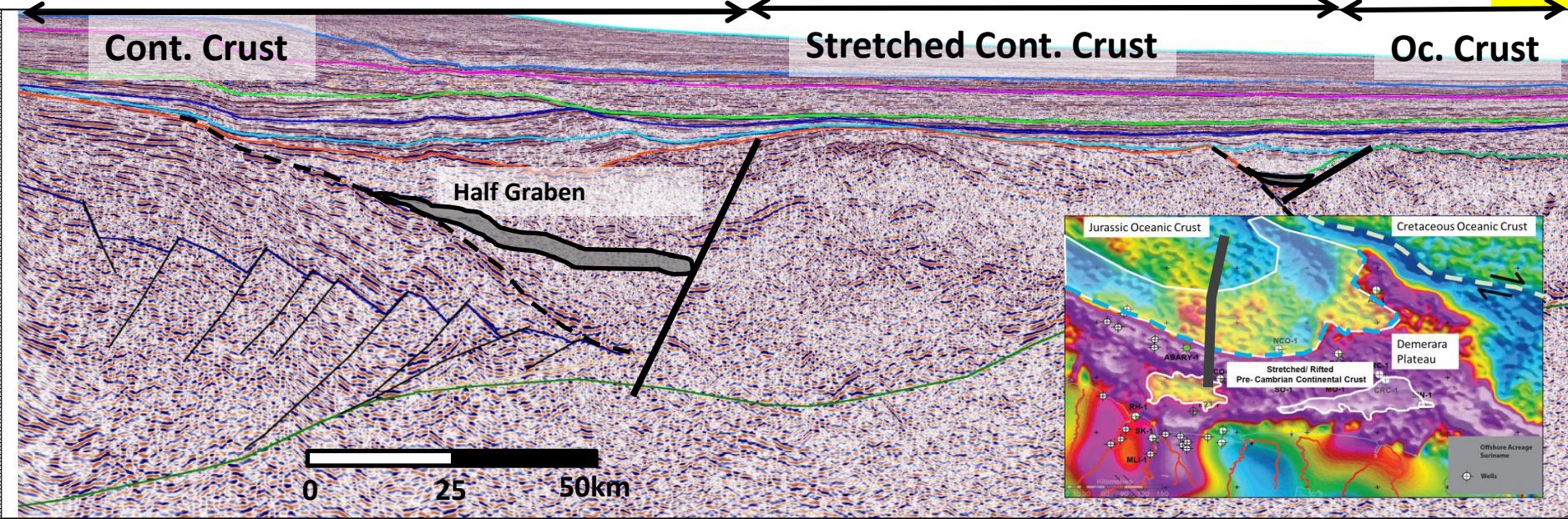


# Onshore Oil - Guiana Basin

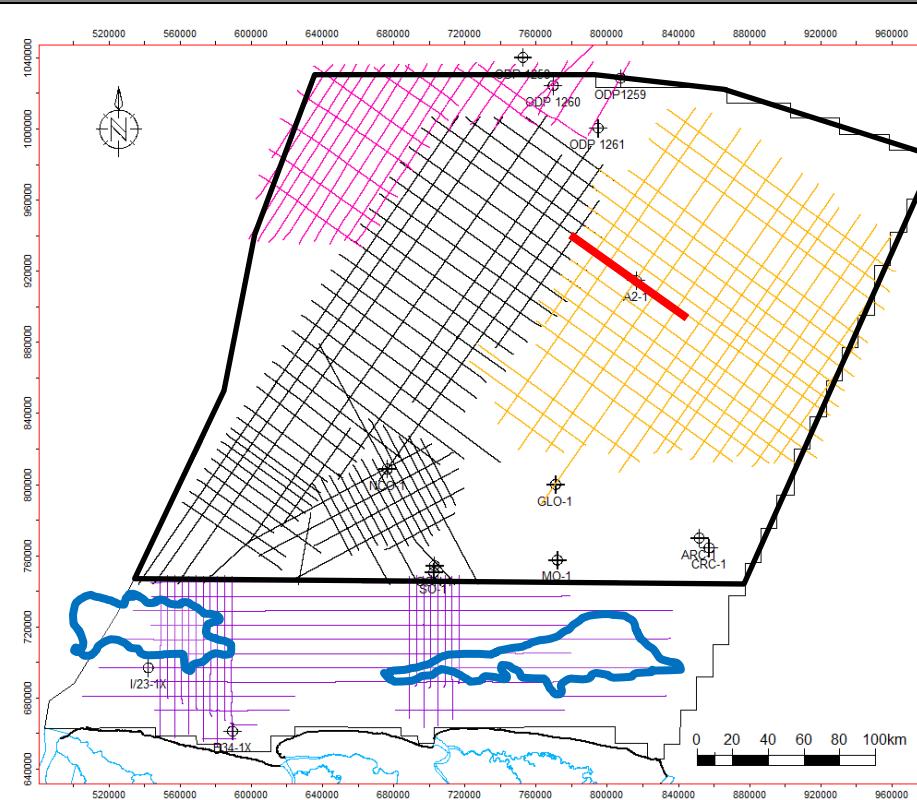


# Outline Jurassic Source Rock





# Methods and Techniques

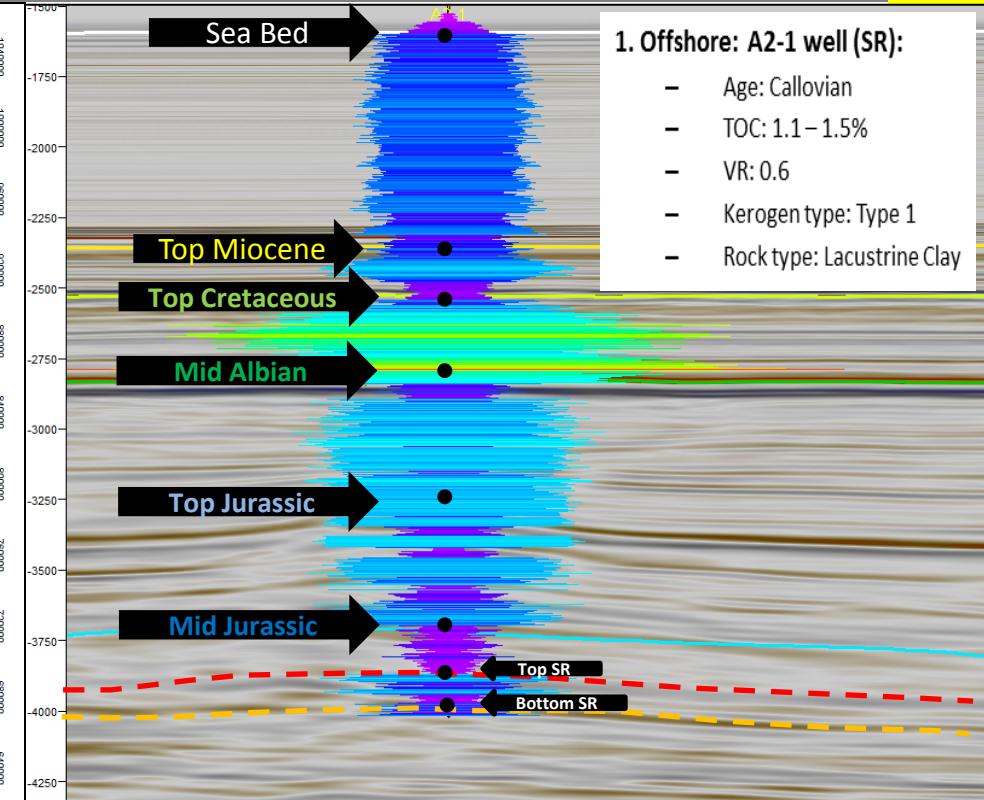


Regional Data set/ A2-1 was used

Petroleum System Model constructed

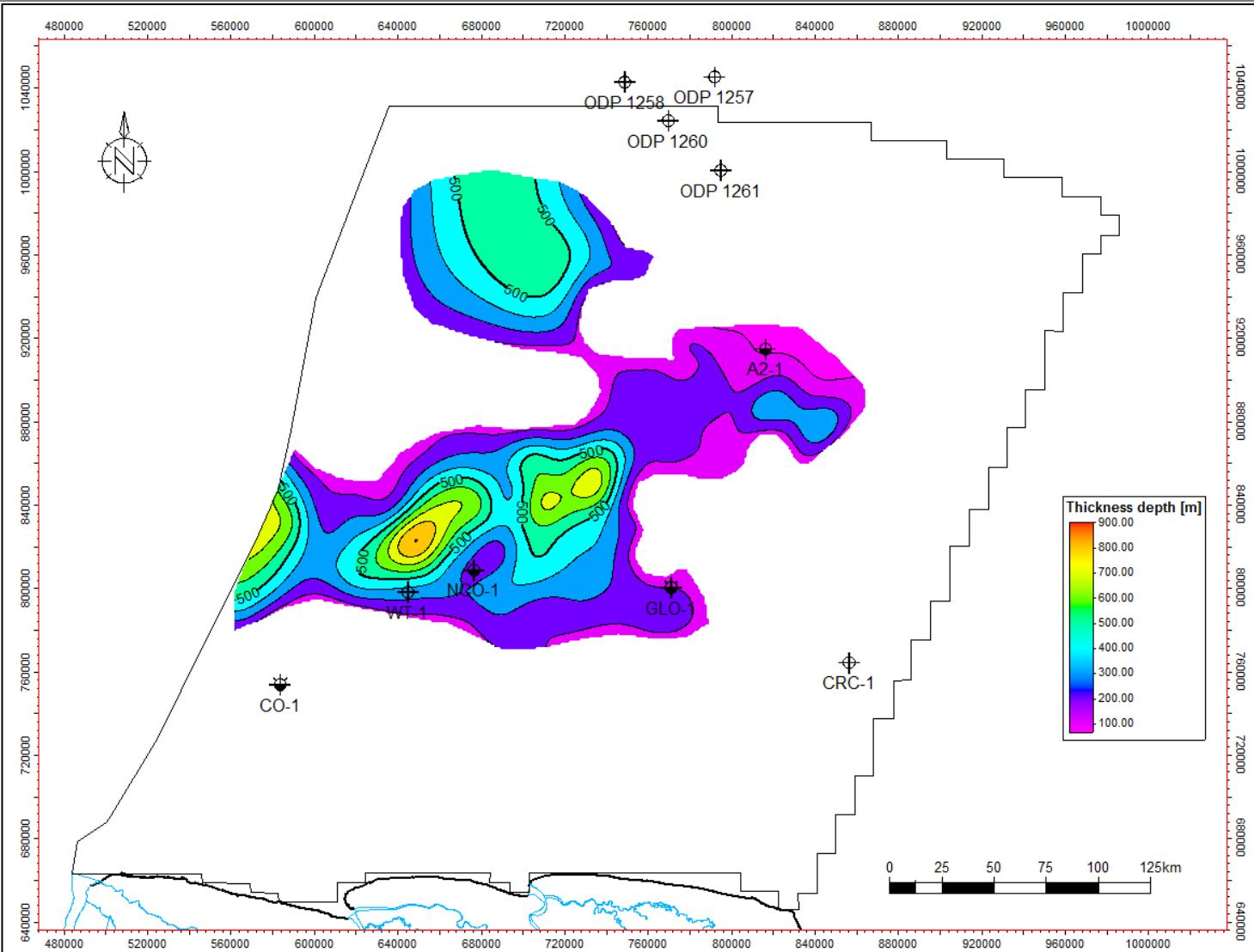
Generated Potential Estimated

Migration Model Proposed



Interpretation of Top and Bottom Jurassic Source Rock

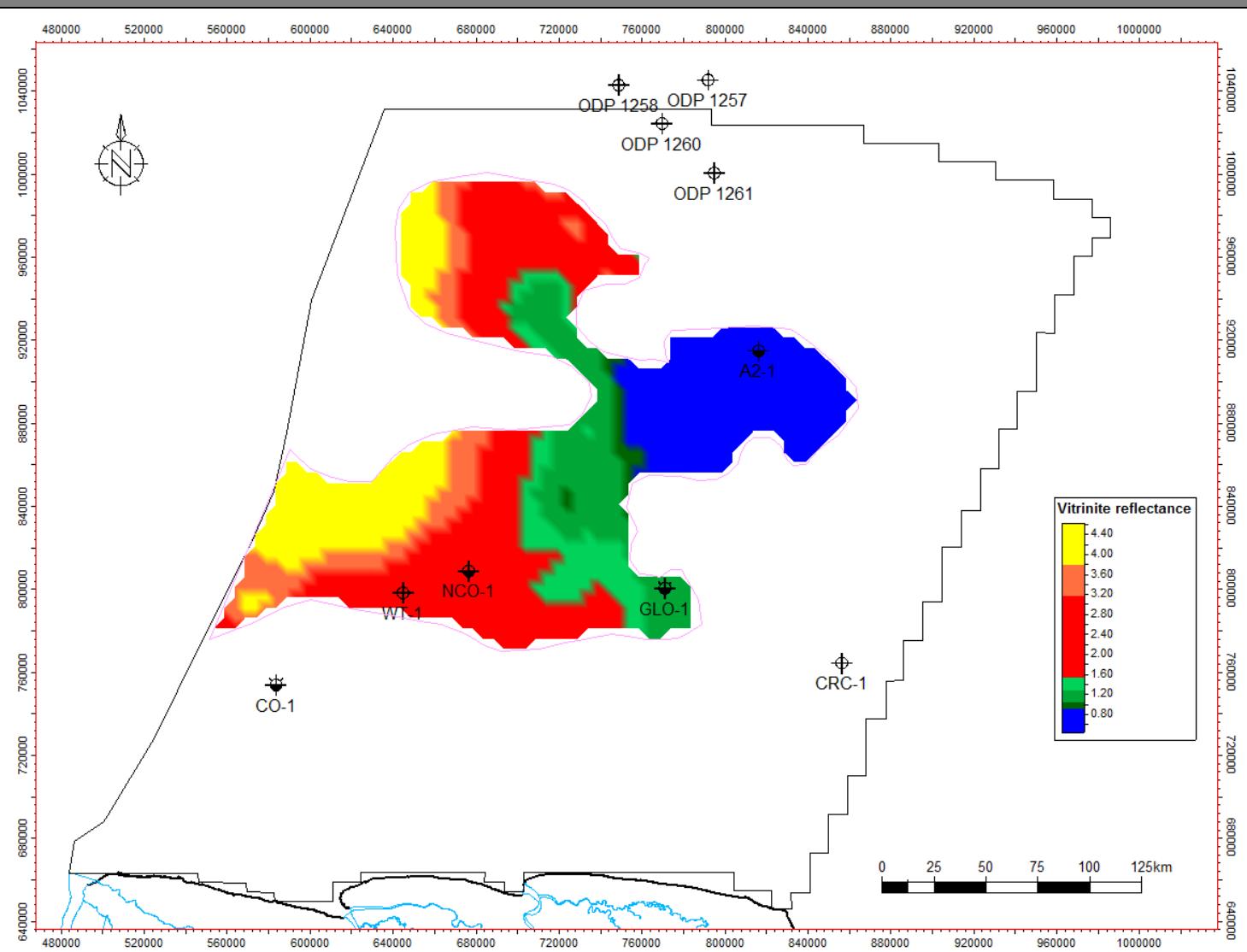
# Distribution Jurassic Source Rock



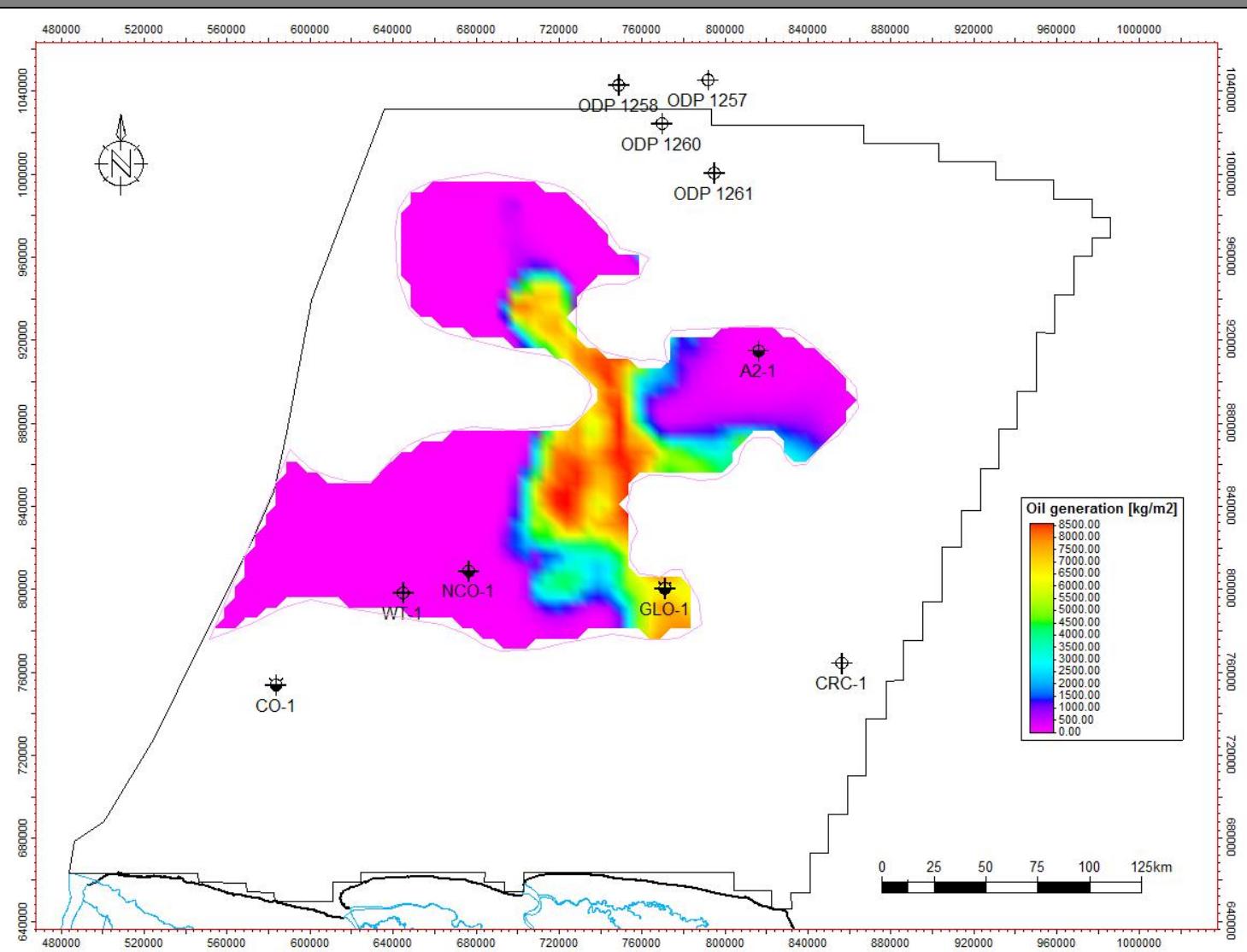
## Characteristics:

- Av. Thickness: 350m
- Area: 31MM km<sup>2</sup>
- VG: 150B bbls

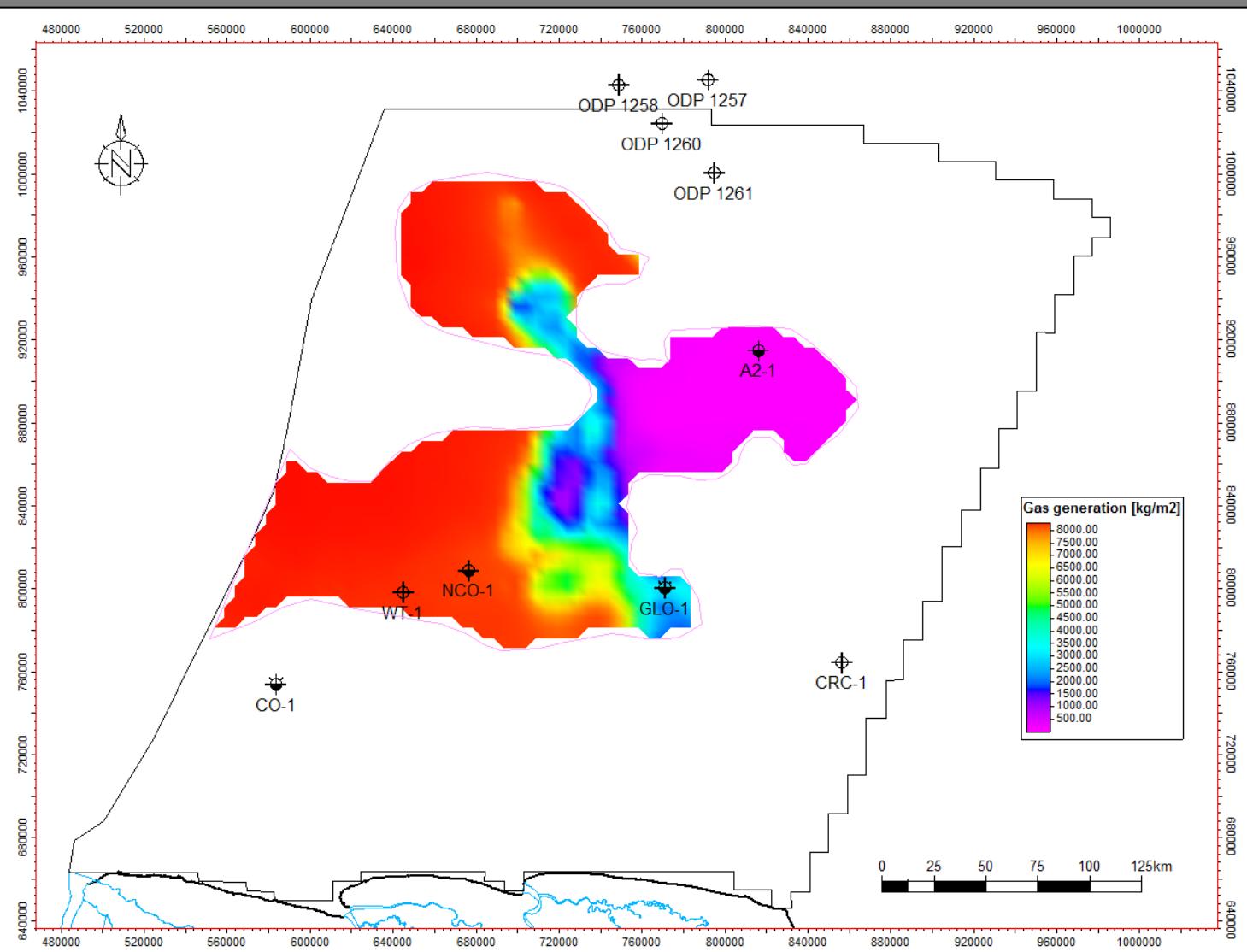
# Maturity Map @ Albian



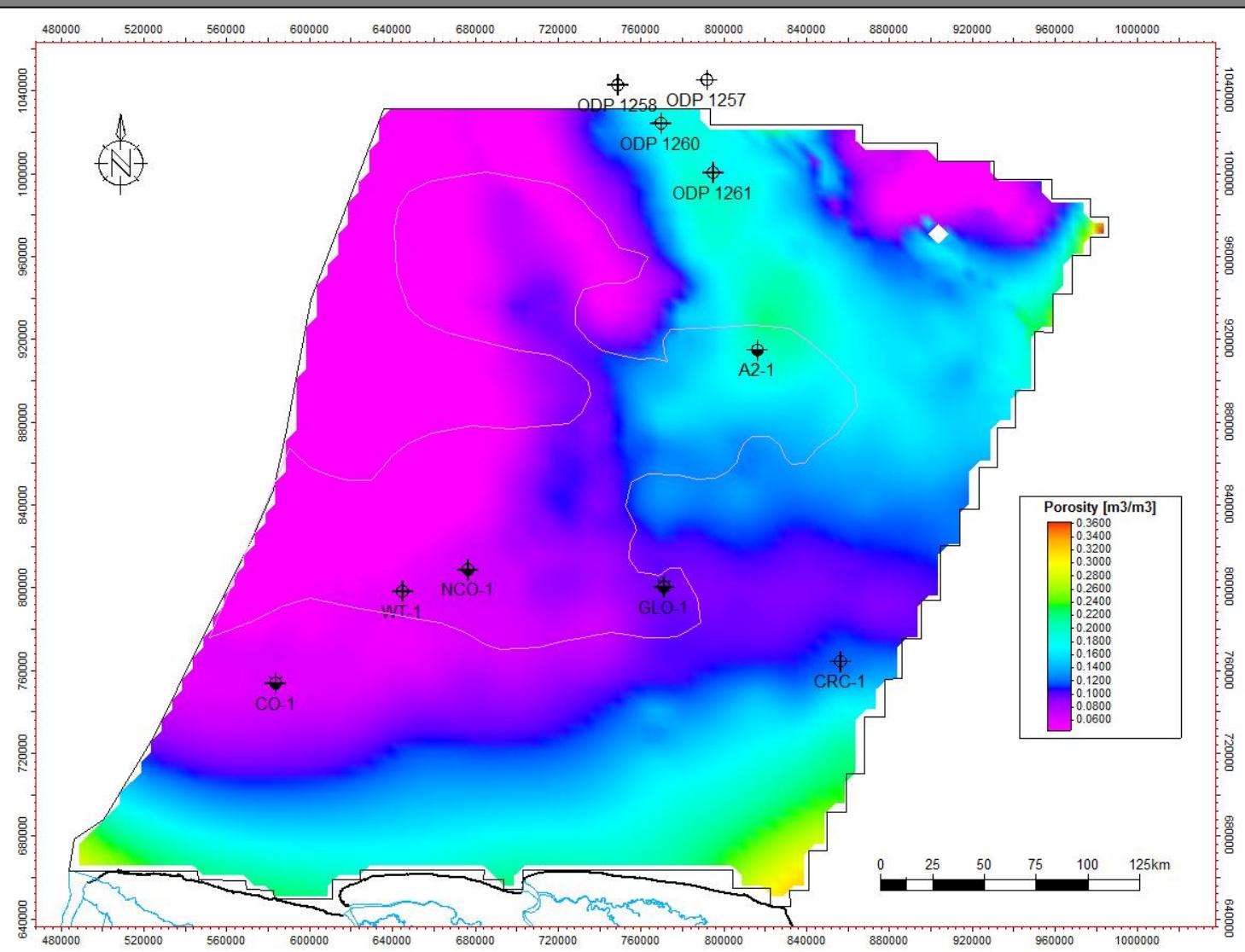
# Oil Generation @Albian



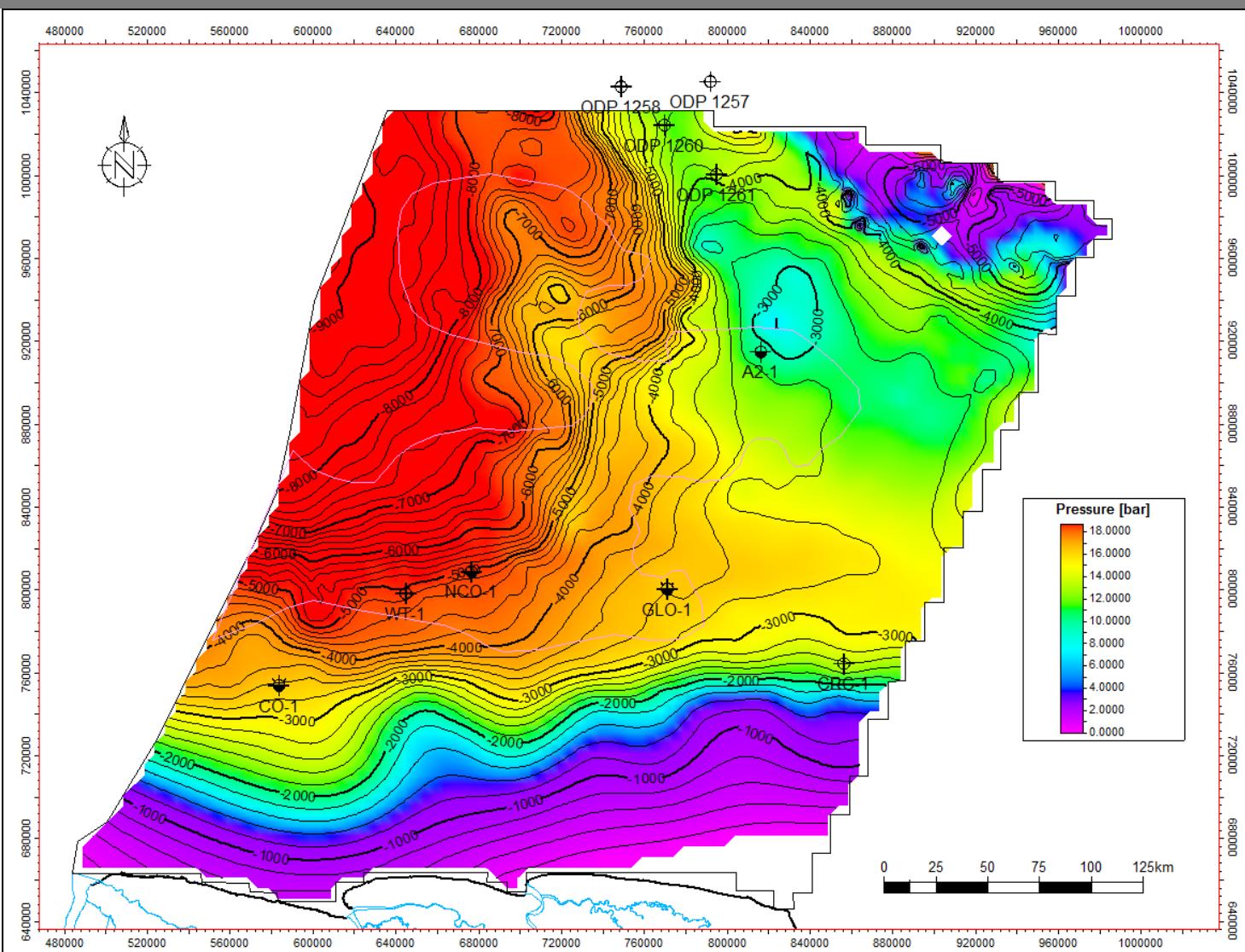
# Gas Generation @Albian



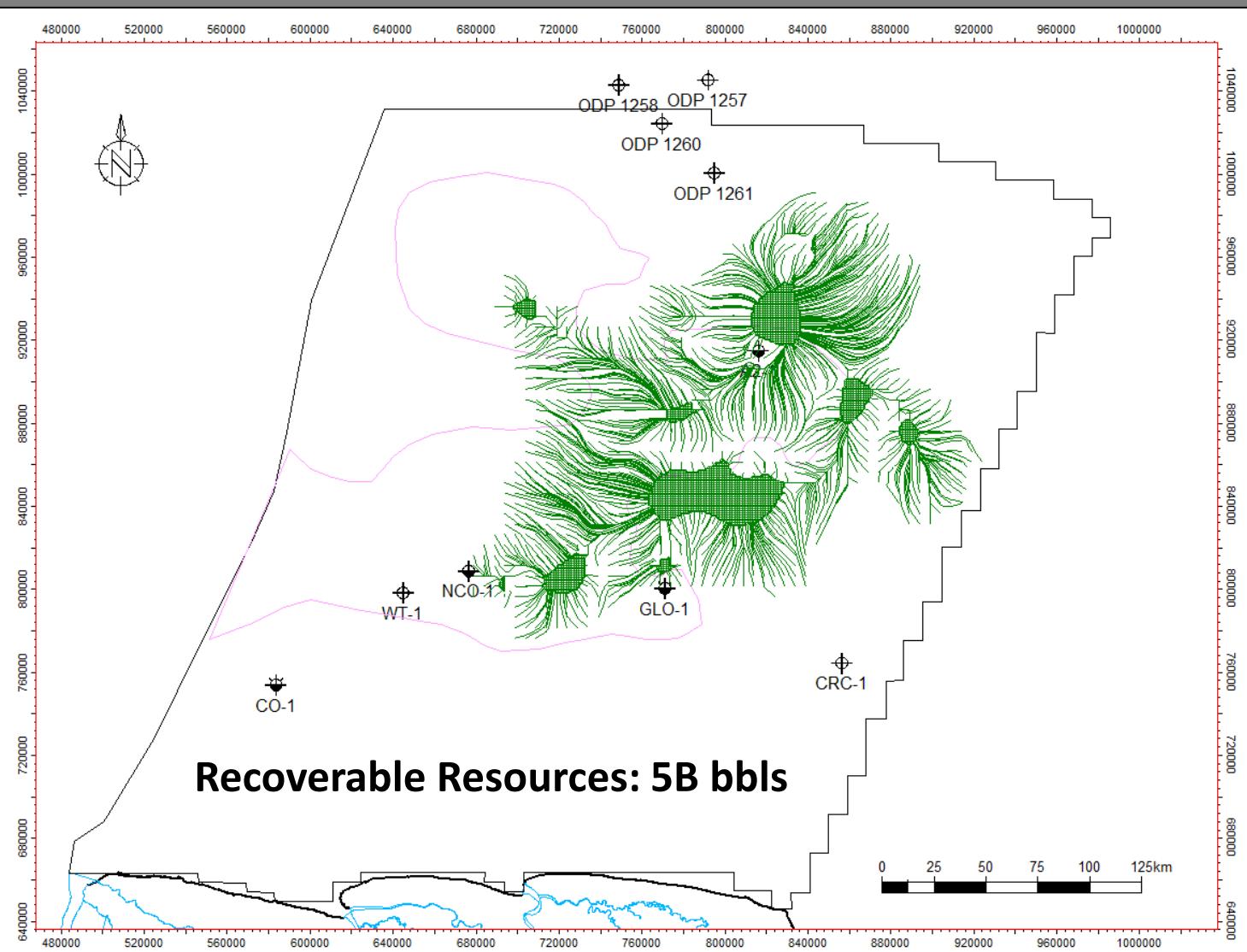
# Albian Reservoir Porosity Distribution



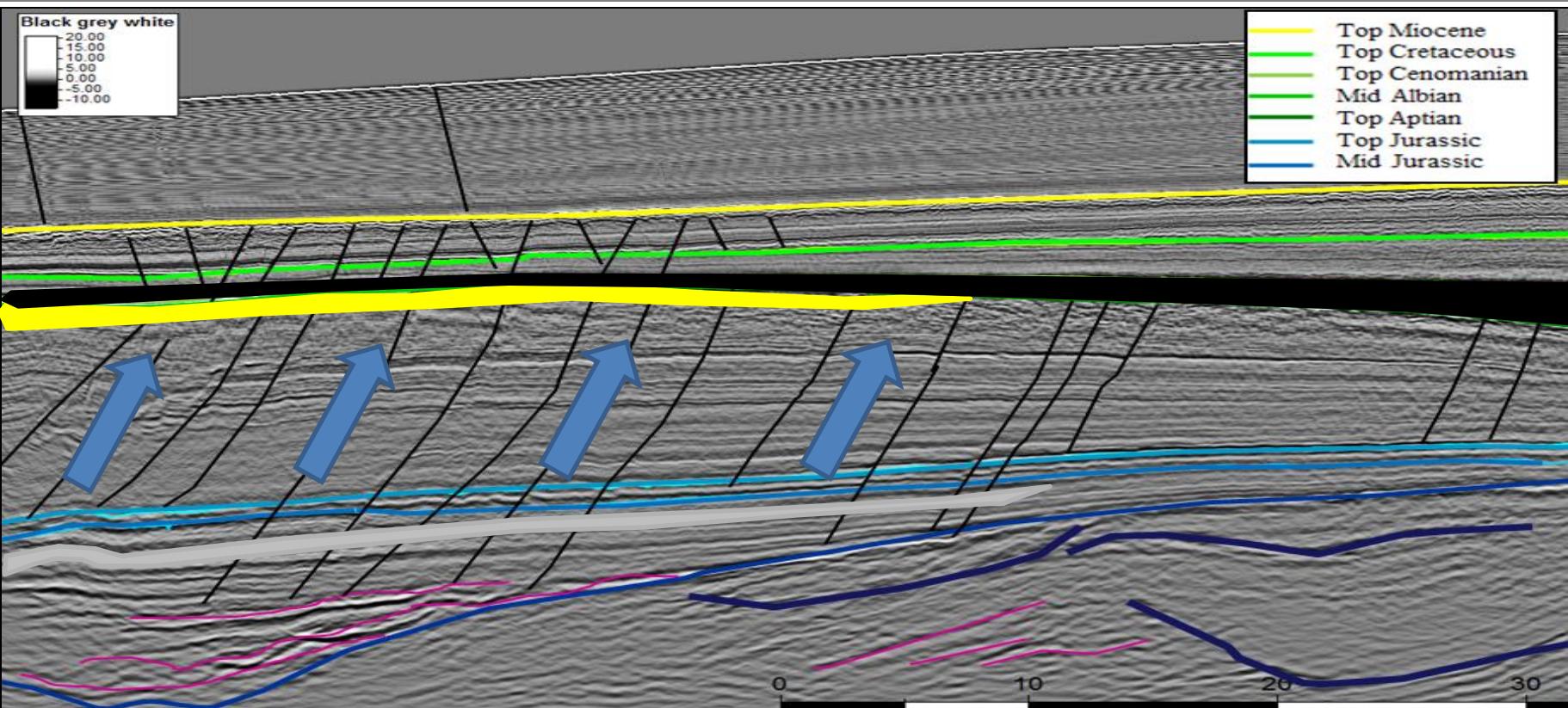
# Seal Capacity Upper Cretaceous



# Oil Migration Model @Albian



# Proposed Migration Model



## Mid Jurassic Petroleum System:

1. Source Rock: Mid Jurassic
2. Trapping: Structural: Anticline fault related
3. Reservoir: Albian Sands
4. Migration: Through faults
5. Seal: Transgressive shales

# **Conclusions**

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- 1. There is strong evidence for the presence of a Jurassic Source Rock within the Guiana – Suriname Basin, based on:**
  - 1. Penetration of the Callovian Source Rock in the A2-1 well**
  - 2. Indications of Jurassic biomarkers in Paleocene/ Cretaceous Reservoirs in Onshore wells**
  - 3. Analog perspective of the Takutu Graben in relation with the Nickerie and Commewijne Graben**
- 2. Based on this model 150B bbls hydrocarbons has been generated**
- 3. There is potential for accumulation of 5B bbls**
- 4. Risks for Jurassic Source Rock for the Guiana – Suriname Basin are over-maturity**

# **Recommendations**

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- Further studies and analysis are required
  - Detailed Source Rock facies mapping
- Well penetration in the Jurassic Source Rock

**Thank you very much  
for  
your attention**