

The Reservoir Potential of the Lower Cretaceous Interval in the Western Block of the Shallow Offshore Suriname*

Jamish Bholasing¹ and Ilaisha Goelaman¹

Search and Discovery Article #11299 (2020)**

Posted February 3, 2020

*Adapted from oral presentation given at 2019 AAPG Latin America & Caribbean Region Geosciences Technology Workshop, Recent Discoveries and Exploration and Development Opportunities in the Guiana Basin, Paramaribo, Suriname, November 6-7, 2019

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Abstract

Exploration activities within the Suriname part of the Guiana Basin are primarily focused on Lower Cretaceous (Albian) to Tertiary sequences. Recently the prospectivity of the Lower Cretaceous interval (Pre-Albian) is being assessed mainly because the ATK-1ST2 well indicated 52-degree API condensate in a thin limestone bed within the partly drilled and overpressured Upper Albian. The latter indicates potential migration from the Turonian (?) SR as well as possibility for deeper hydrocarbon potential in the Lower Cretaceous, which is stratigraphically overlapping in the Shallow Offshore (SHO) study area. As the presence of effective seals is also proven in this area, the main uncertainty is the reservoir potential, which led to the objective of this research: the assessment of the reservoir potential within the Lower Cretaceous interval.

The study area for this research is limited to the Western part of the SHO. The research included a structural evaluation in terms of understanding the impact of the tectonic evolution on sedimentary systems, as well as a stratigraphic evaluation in terms of sequence stratigraphic analysis. The main findings showed that the tectonic evolution resulted in the development of paleo-highs related to fault-controlled hinge lines. The Lower Cretaceous interval is interpreted as an overall transgressive back stepping system bounded by unconformities and flooding surfaces. Finally, this study resulted in two potential reservoir models for the Lower Cretaceous interval of the Western Block of the SHO area: (1) karstified carbonates, and (2) clastic shoals.



AAPG
Latin America & Caribbean Region

SURINAME 2019
Geosciences Technology Workshop

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6 November 2019

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Presentation Outline

1. Introduction

- Significance and objectives
- Stratigraphic study Interval
- Overview of study area and data

2. Regional Geology

- Structural setting
- Stratigraphic setting

3. Reservoir potential

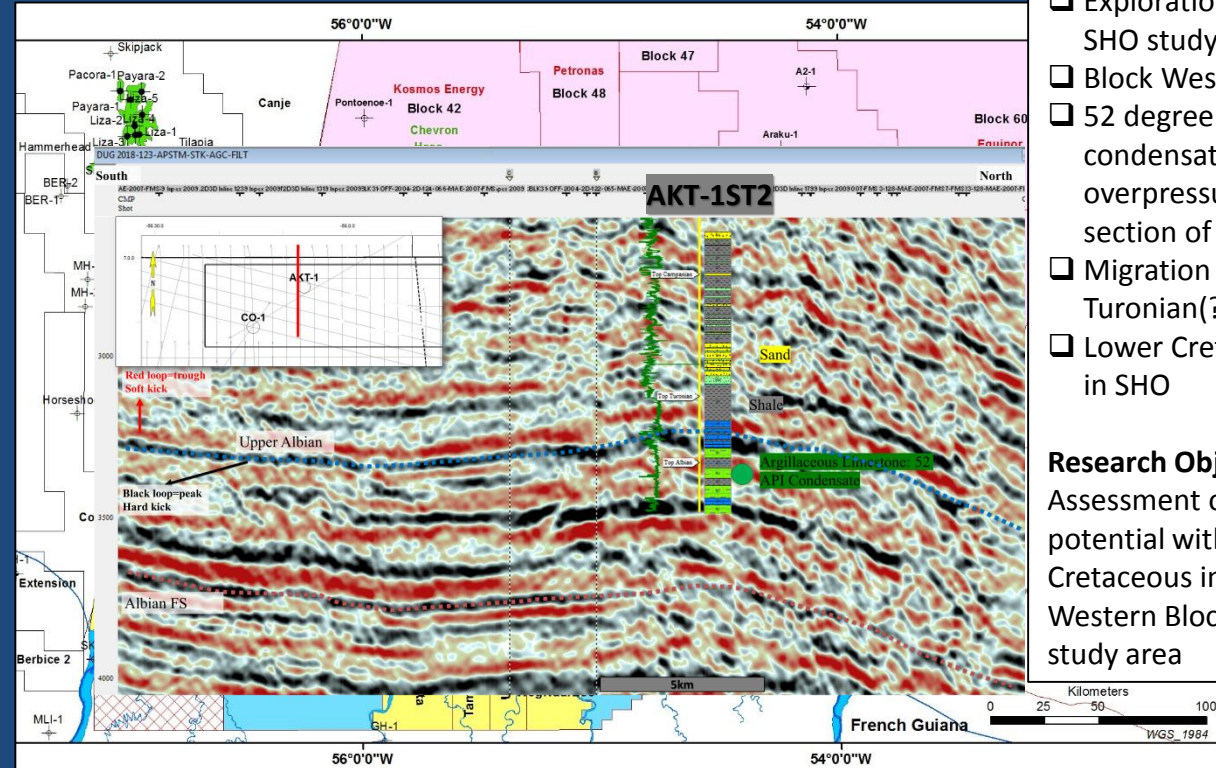
- Prominent Seismic observations
- Depositional system
- Reservoir models

4. Conclusions

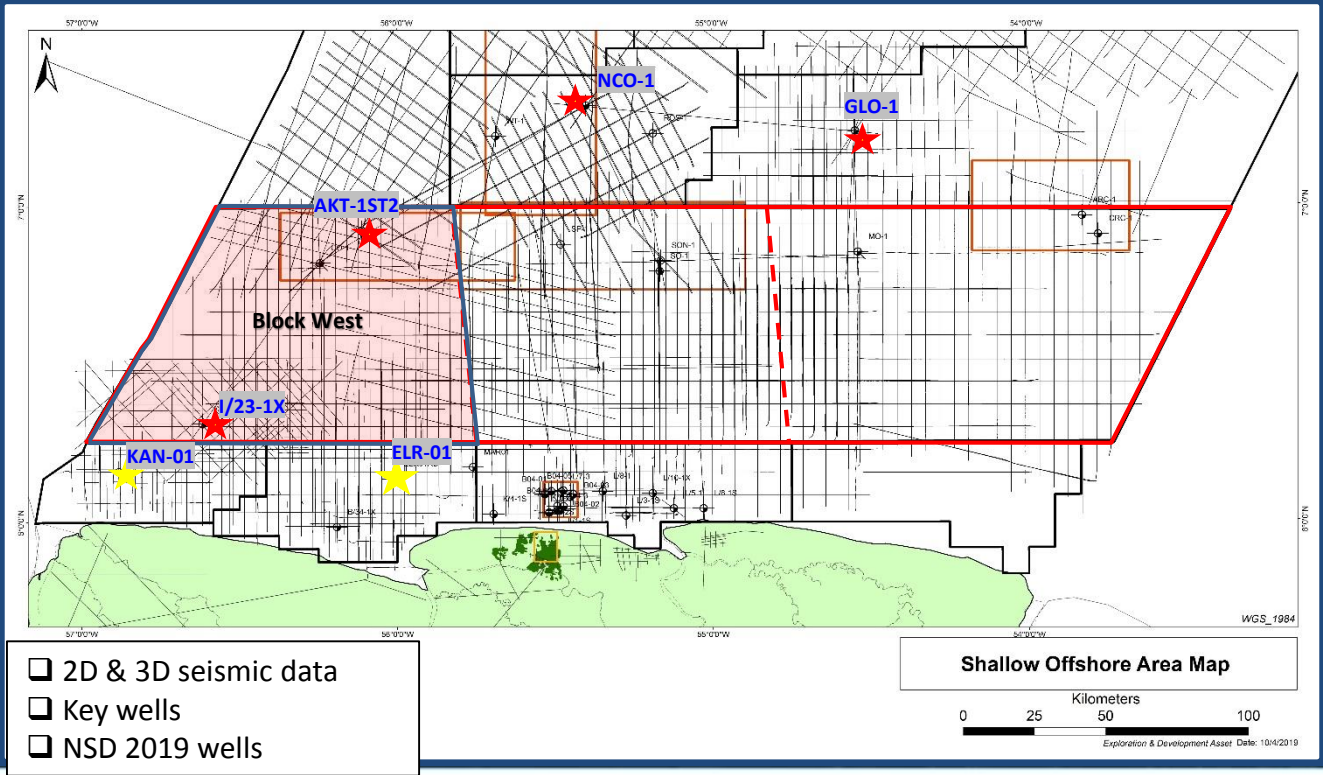
Introduction

- ☐ Exploration Evaluation SHO study area
- ☐ Block West
- ☐ 52 degree API condensate in overpressured Albian section of AKT-1ST2
- ☐ Migration from Turonian(?) SR
- ☐ Lower Cretaceous onlaps in SHO

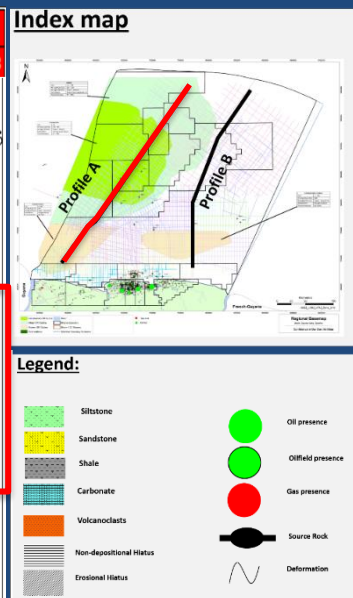
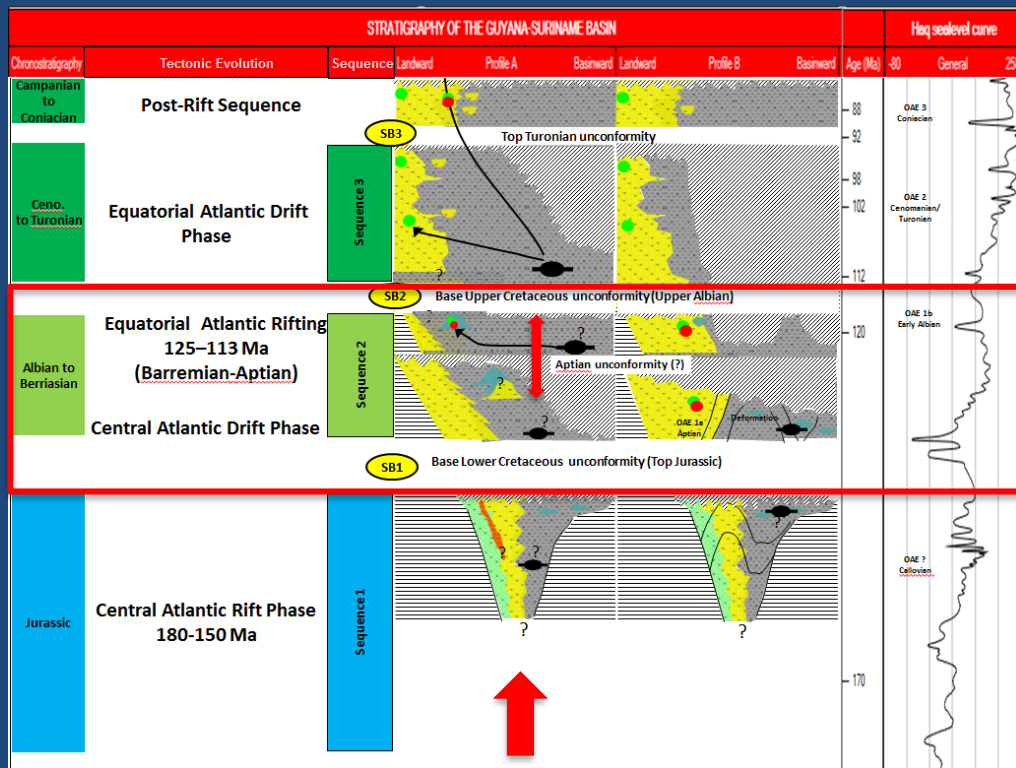
Research Objective:
Assessment of the reservoir potential within the Lower Cretaceous interval in the Western Block of the SHO study area



Data Overview

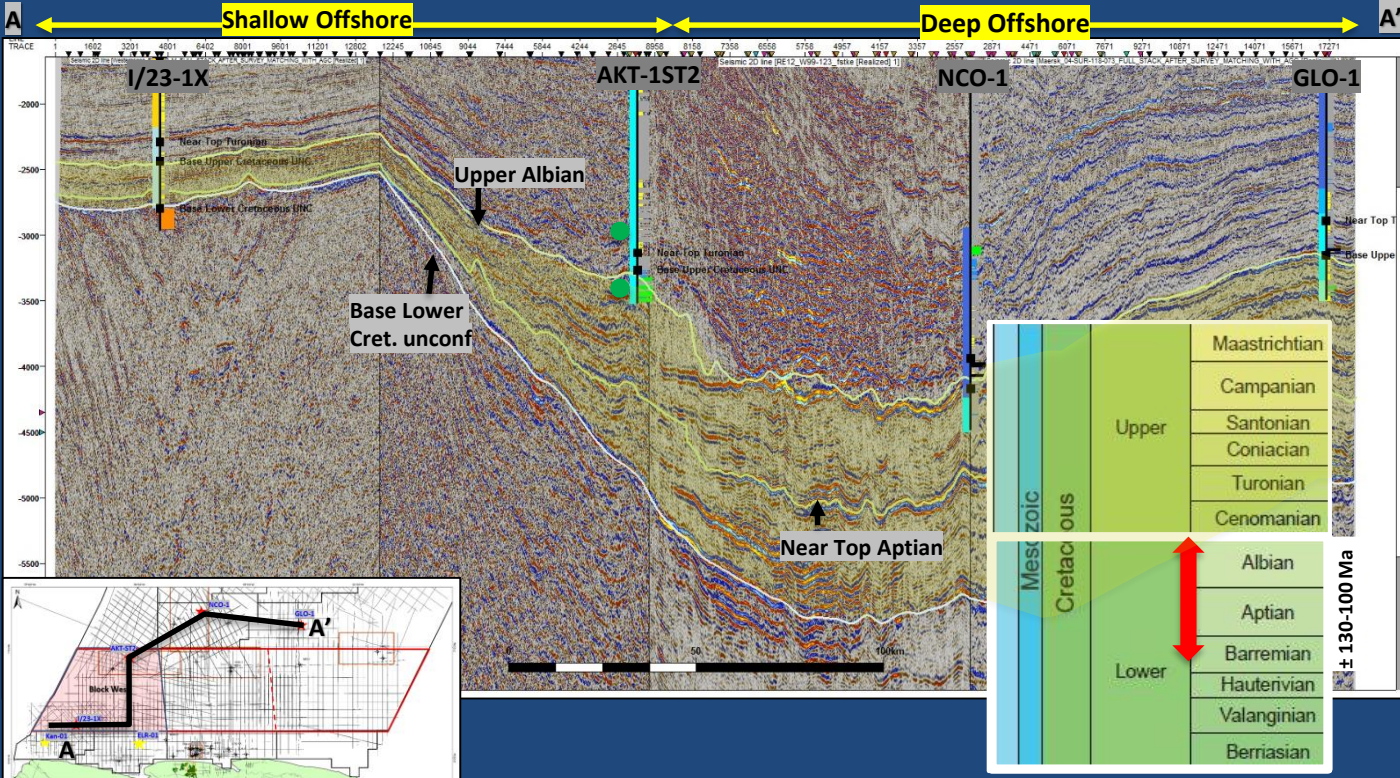


Introduction: Lower Cretaceous Interval



Modified from: Staatsolie, E&D Asset internal database 2019

Well Penetration



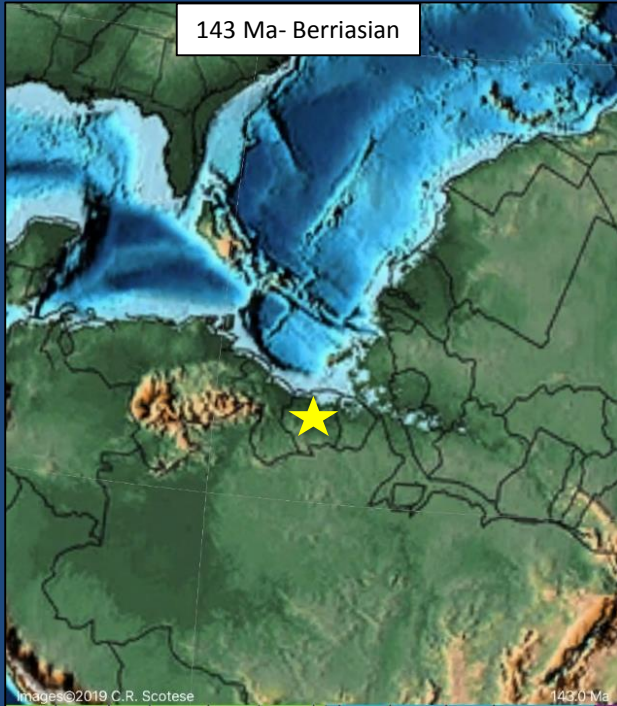
Regional Geology

- Structural setting
 - Tectonic Evolution
 - Significance of Structures

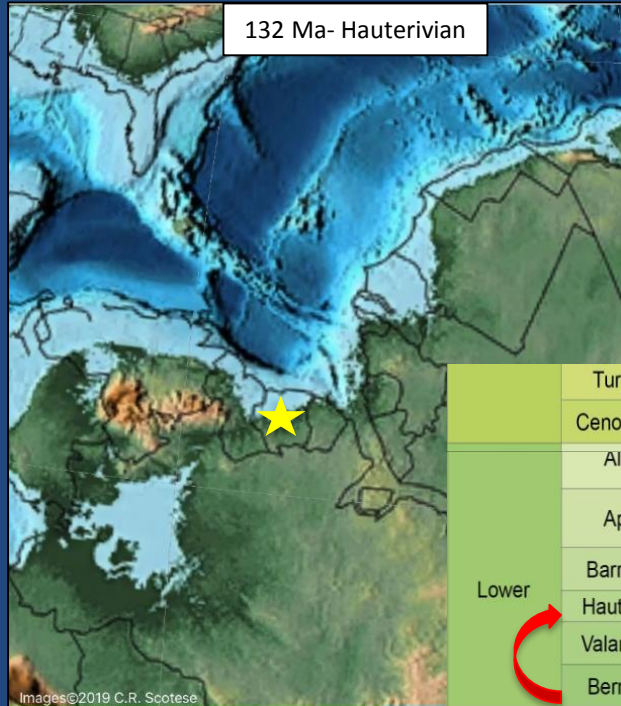
Central Atlantic Drifting Phase – Berrasian to Hauterivian

- SL rise at the Hauterivian

143 Ma- Berriasian



132 Ma- Hauterivian



Lower	Turonian	93.9
	Cenomanian	100.5
	Albian	~ 113.0
	Aptian	~ 125.0
	Barremian	~ 129.4
	Hauterivian	~ 132.9
	Valanginian	~ 139.8
	Berriasian	~ 145.0

Equatorial Atlantic Rifting Phase – Barremian to Aptian

- SL fall late Aptian

121 Ma- Aptian



Equatorial Atlantic Drifting Phase – Albian & ongoing

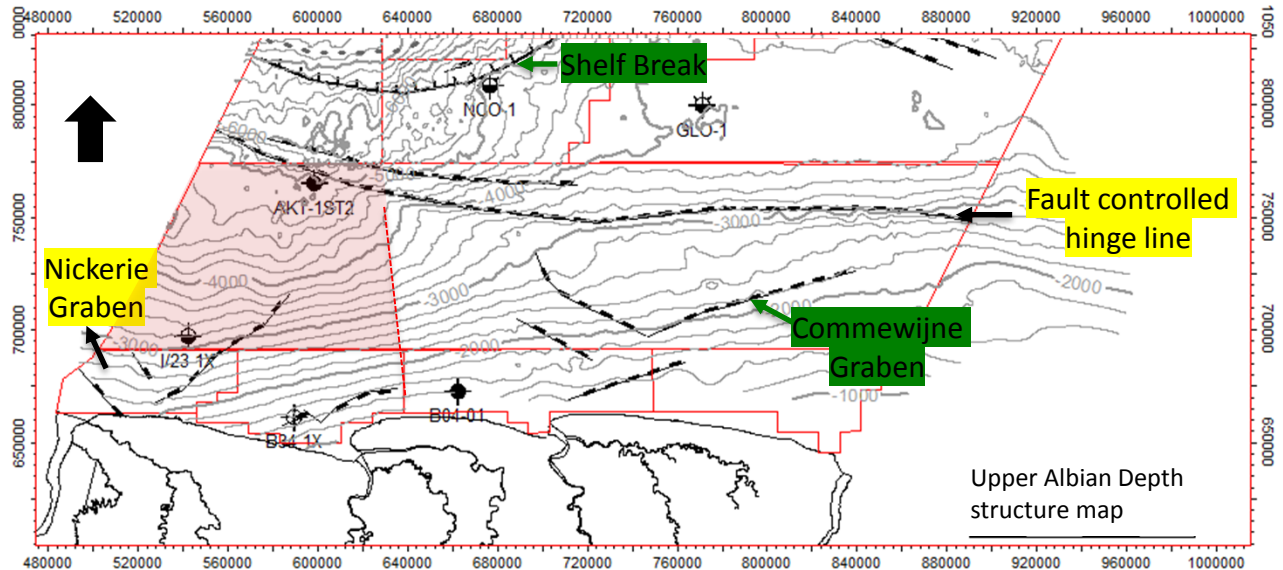
- SL rise : Turonian Source rock

101 Ma- Albian



Lower	Turonian	93.9
	Cenomanian	100.5
	Albian	~ 113.0
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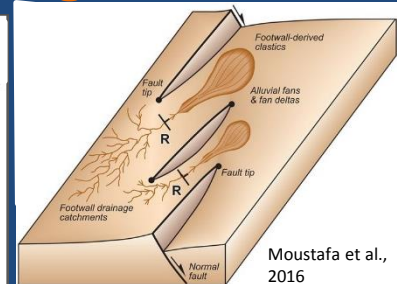
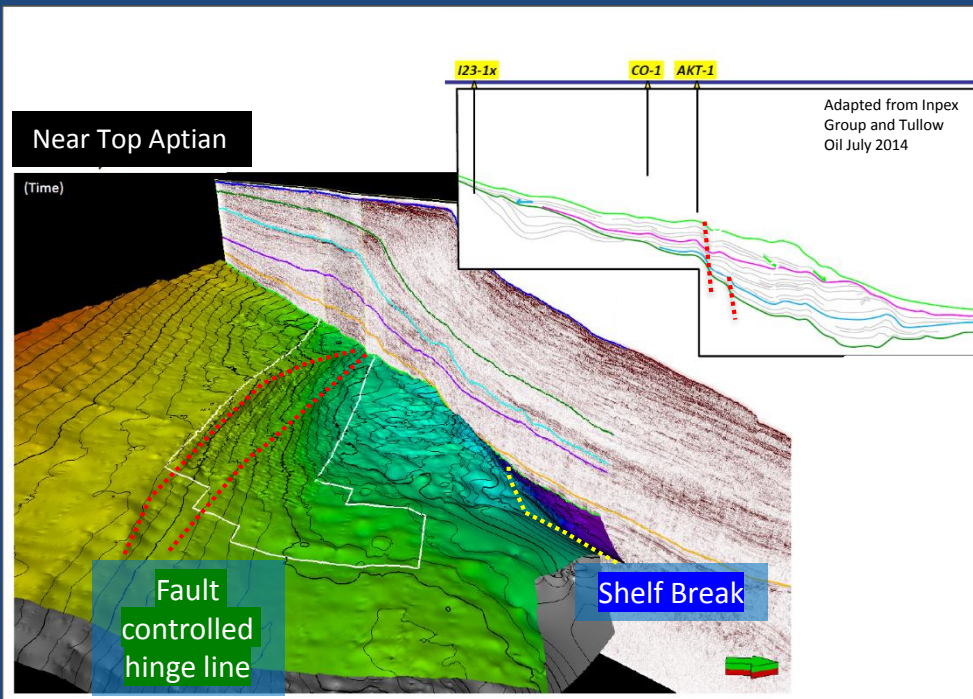
Structural setting: Significance of Hinge lines -1



Main Structures SHO Block West:

- ☐ Nickerie graben (reactivated) faults
- ☐ Hinge lines

Structural setting: Significance of Hinge lines -2

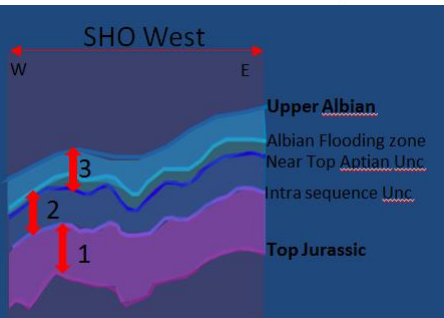
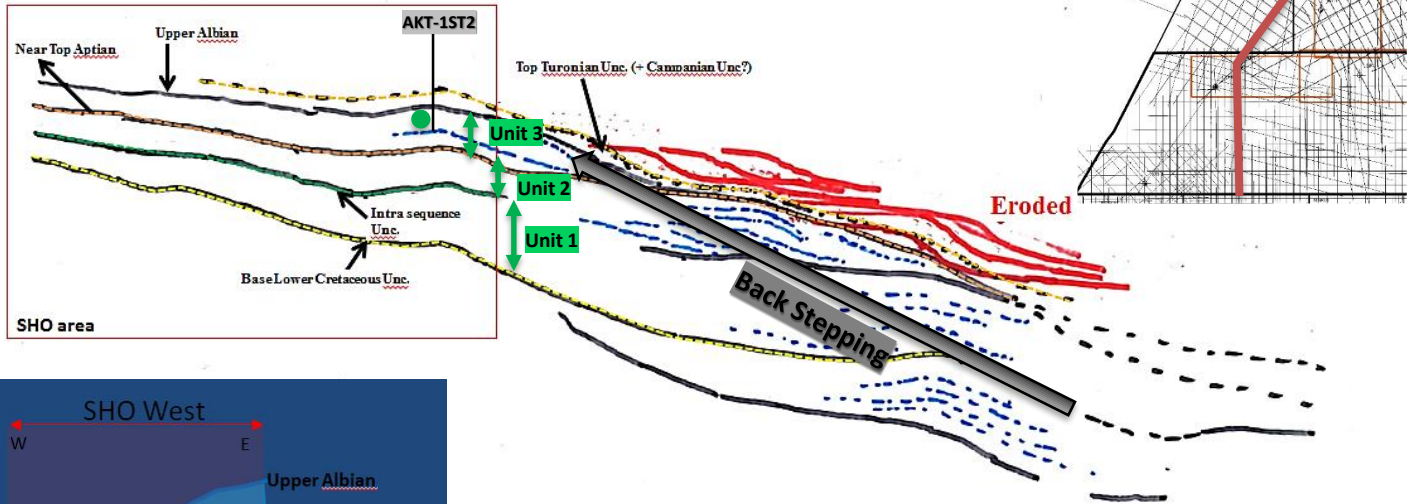


- ☐ Faults growth and linkage during rifting
- ☐ Evolution of transfer zones with basement highs and half-graben depocenters
- ☐ Impact on depositional systems

Regional Geology

- Stratigraphic setting
 - Sequence stratigraphy
 - Gross depositional Environment

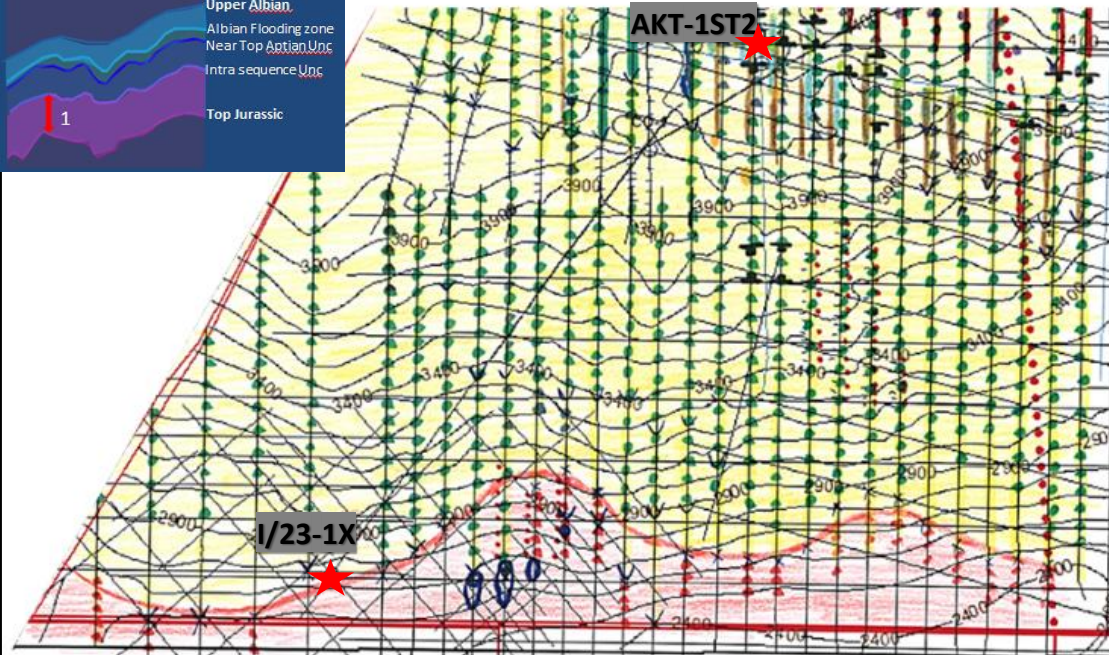
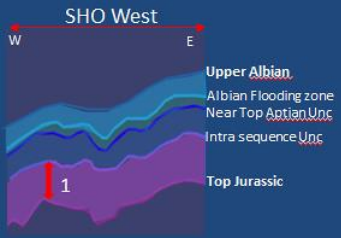
Systems tract analyses – 1



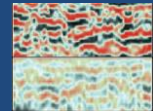
Regional Seismic mapping, Fore set mapping and well calibration:

- ☐ Transgressive back stepping system
- ☐ Internal erosional surfaces
- ☐ Flooding surfaces

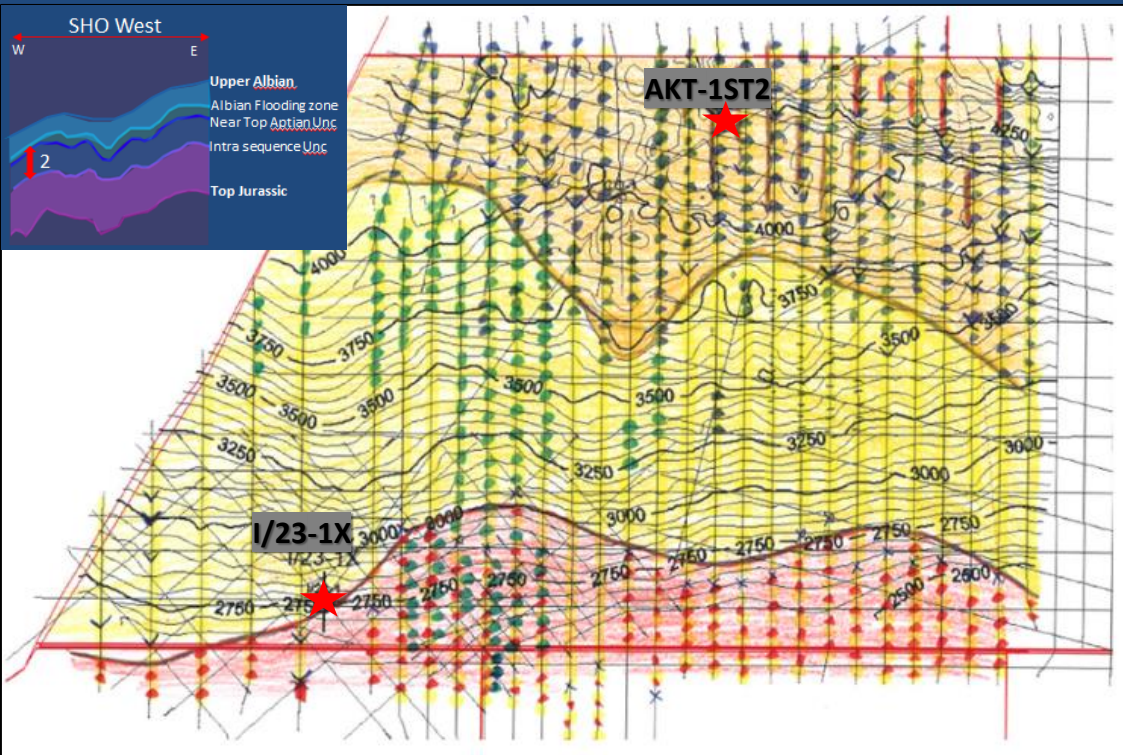
Seismic Reflectivity Analysis



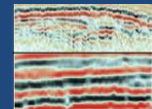
- transparent and very chaotic, low amplitude
- transparent, sub-parallel, low amplitude
- transparent, parallel to sub-parallel, some high amplitudes
- continuous, parallel, high amplitude
- mounded, chaotic, high amplitude, internal reflections
- out-building features, wedge



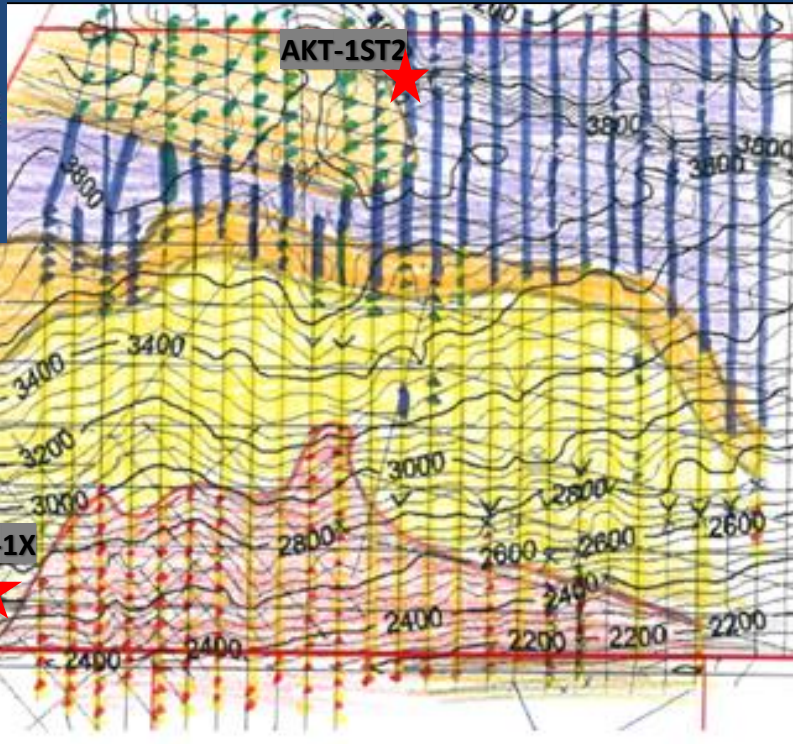
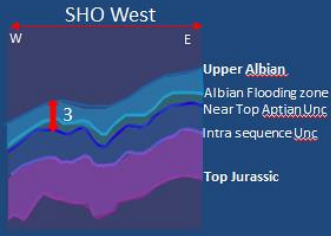
Seismic Reflectivity Analysis



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Seismic Reflectivity Analysis



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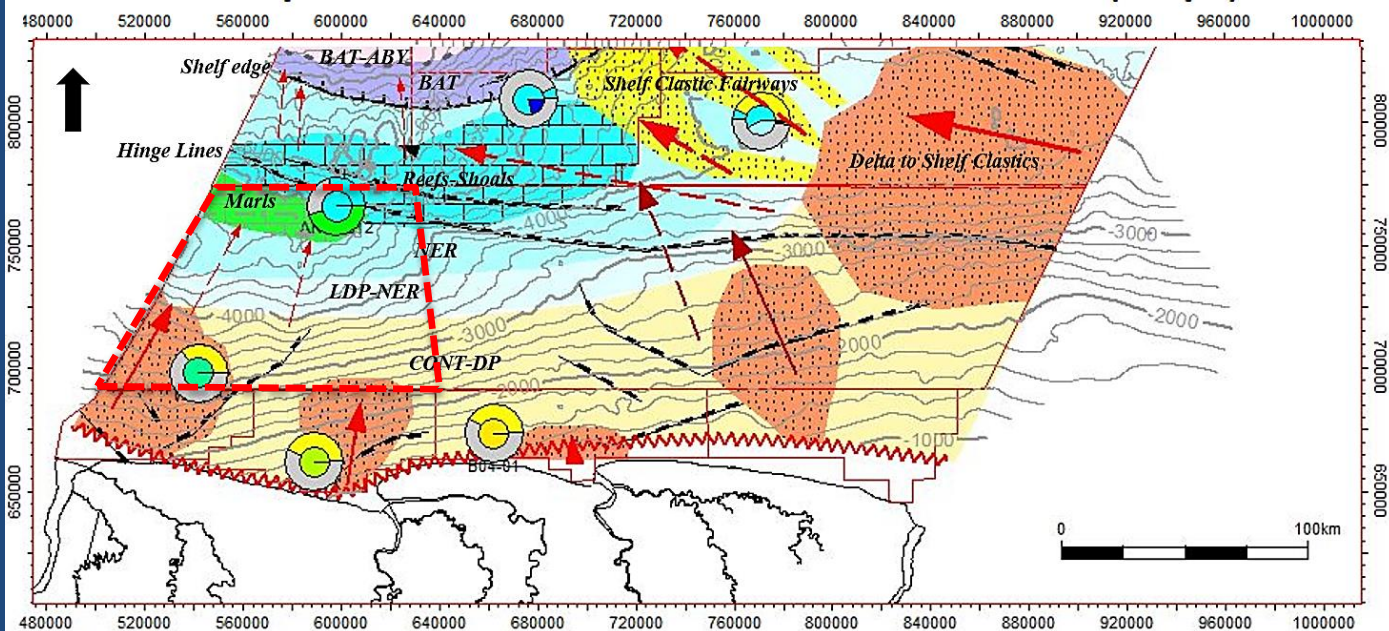


Seismic Reflectivity Analysis:

- ☐ Back Stepping System
- ☐ Increasing Marine influence

Gross Depositional Environment Model

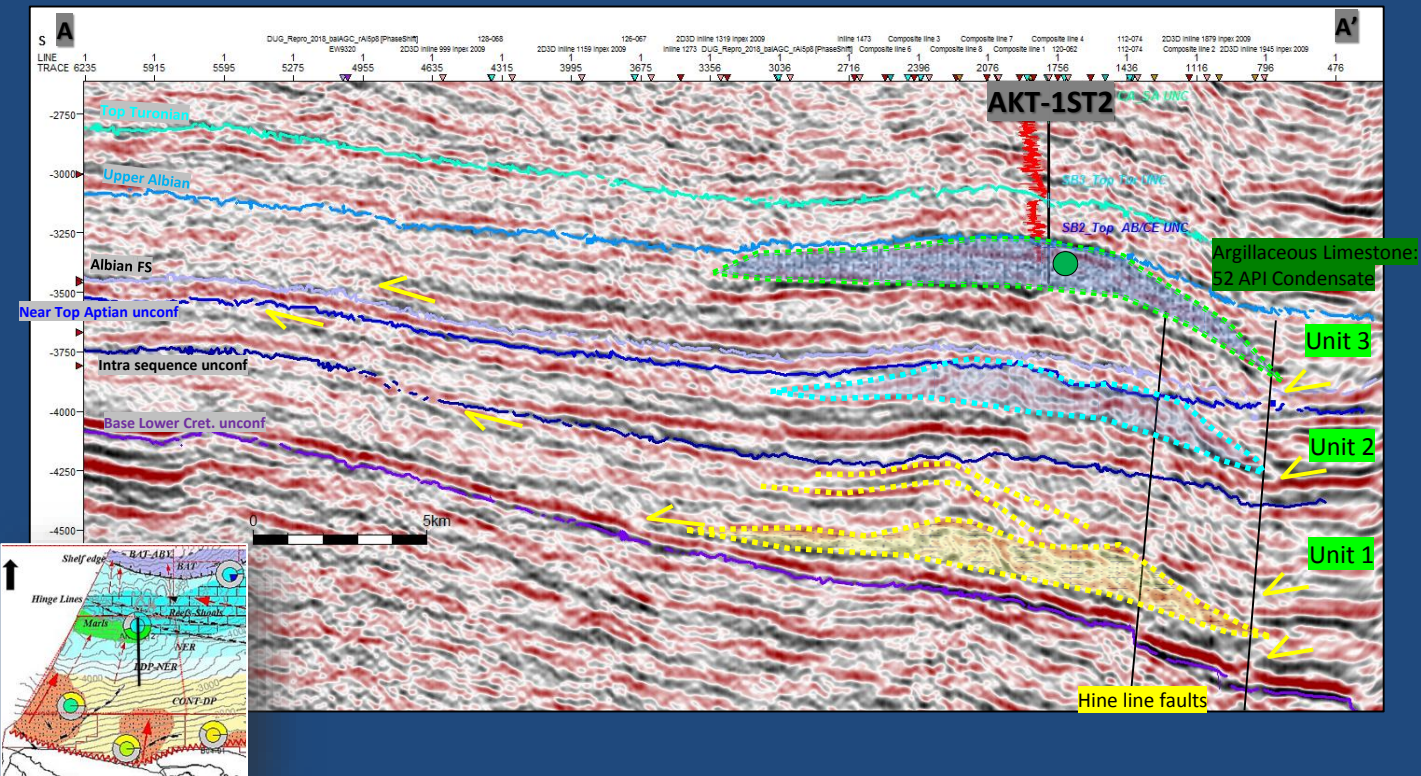
GDE Map of Base L Cret Unc. to Base U Cret Unc. (Seq 2)



Reservoir Potential

- Prominent Seismic observations
- Depositional system
- Reservoir models

Prominent Seismic observations-1



Prominent Seismic observations-3

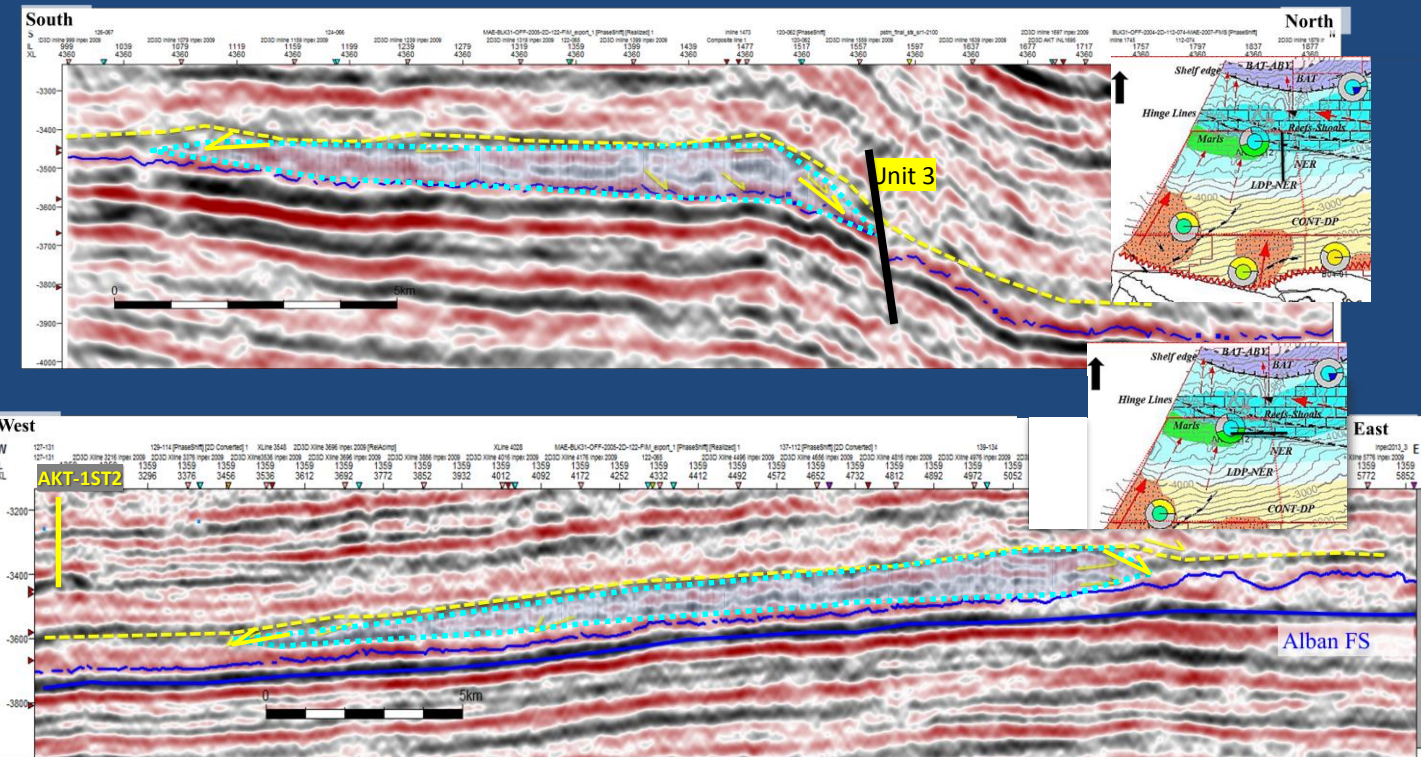
The figure displays two seismic reflection profiles with detailed geological interpretations.

Top Profile (South-North):

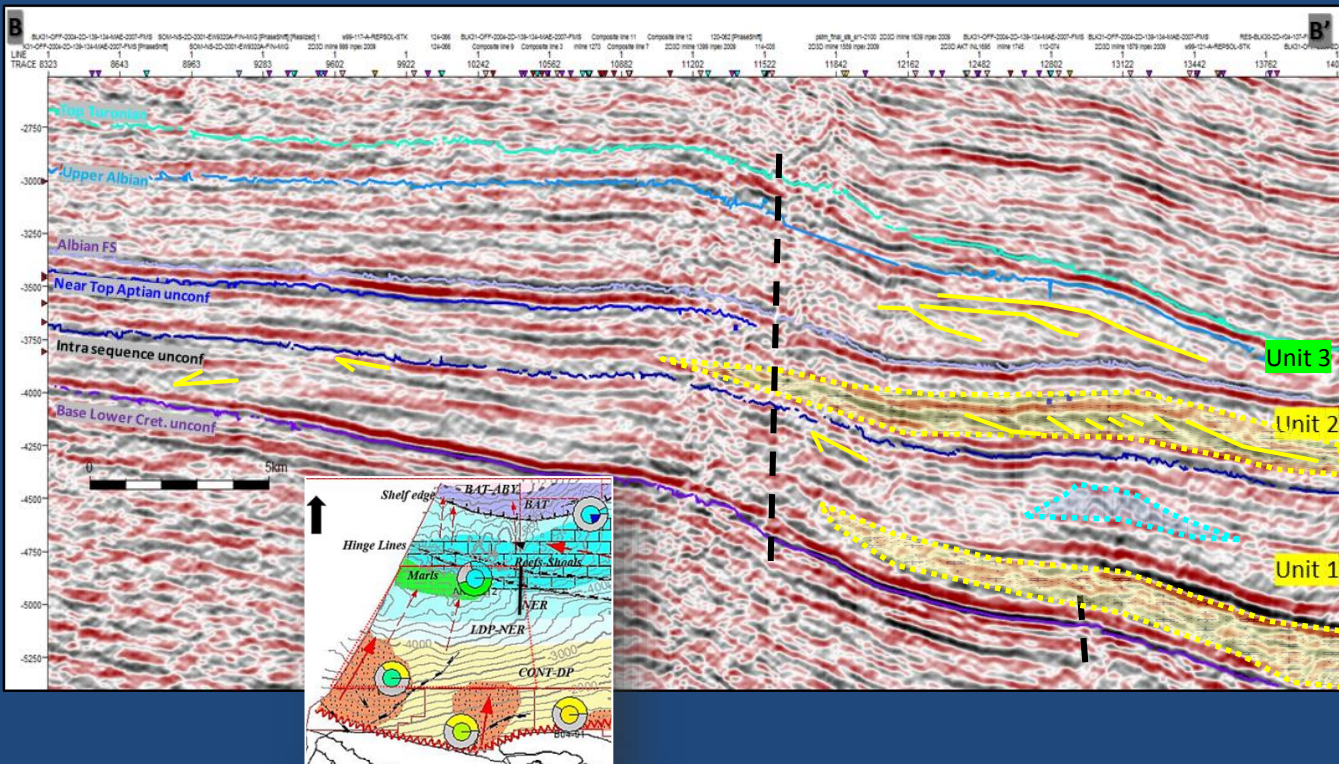
- Orientation:** South (left) to North (right).
- Depth Scale:** -3200 to -4000 meters.
- Distance Scale:** 0 to 5 km.
- Key Features:**
 - Unit 3:** A prominent geological unit highlighted in yellow.
 - Shelf edge:** Indicated by a dashed yellow line.
 - Hinge Lines:** Indicated by dashed blue lines.
 - Marls:** Indicated by a green shaded area.
 - LDP-NER:** Indicated by a red shaded area.
 - CONT-DP:** Indicated by a blue shaded area.
- Geological Interpretation:** A detailed block diagram on the right shows the structural relationships between these units and features, including a fault labeled "BAT-ABH".

Bottom Profile (West-East):

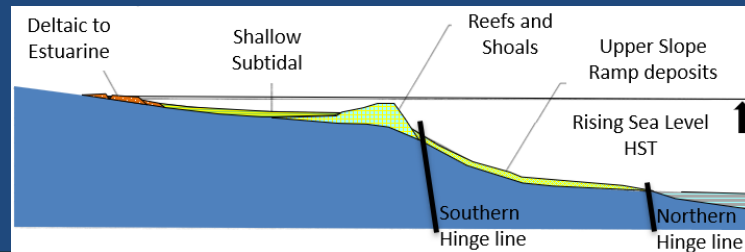
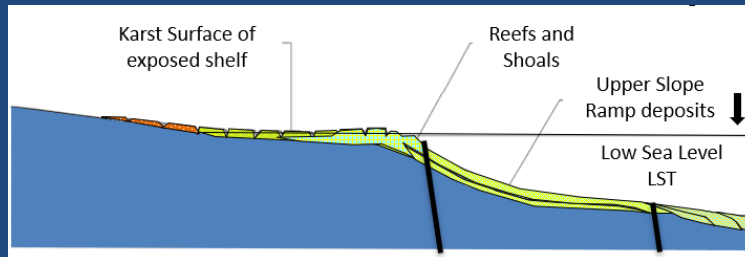
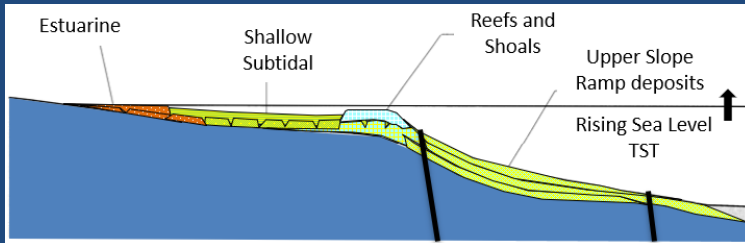
- Orientation:** West (left) to East (right).
- Depth Scale:** -3200 to -3800 meters.
- Distance Scale:** 0 to 5 km.
- Key Features:**
 - AKT-1ST2:** A prominent geological unit highlighted in yellow.
 - Alban FS:** The Albanian Fault, indicated by a dashed blue line.
 - Shelf edge:** Indicated by a dashed yellow line.
 - Hinge Lines:** Indicated by dashed blue lines.
 - Marls:** Indicated by a green shaded area.
 - LDP-NER:** Indicated by a red shaded area.
 - CONT-DP:** Indicated by a blue shaded area.
- Geological Interpretation:** A detailed block diagram on the right shows the structural relationships between these units and features, including a fault labeled "BAT-ABH".



Prominent Seismic observations-3: clastic influx



Modeled Depositional system -1



Unit 3:

- ☐ Albian aged, SL rise all the way to Cenomanian-Turonian MFS
- ☐ Equatorial Atlantic Rifting to drifting
- ☐ Siliciclastic influx reduced

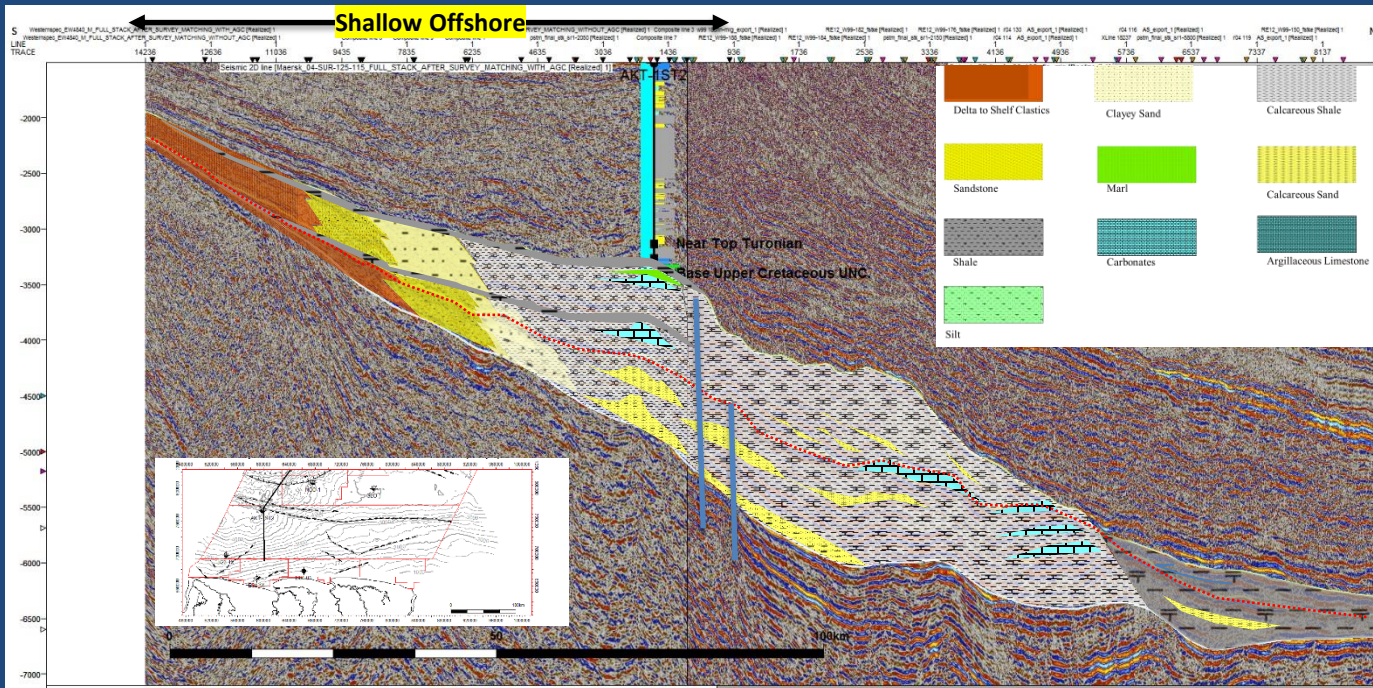
End Unit 2:

- ☐ Aptian aged, Eustatic SL fall on top
- ☐ Active Equatorial Atlantic Rifting

Unit 1-2:

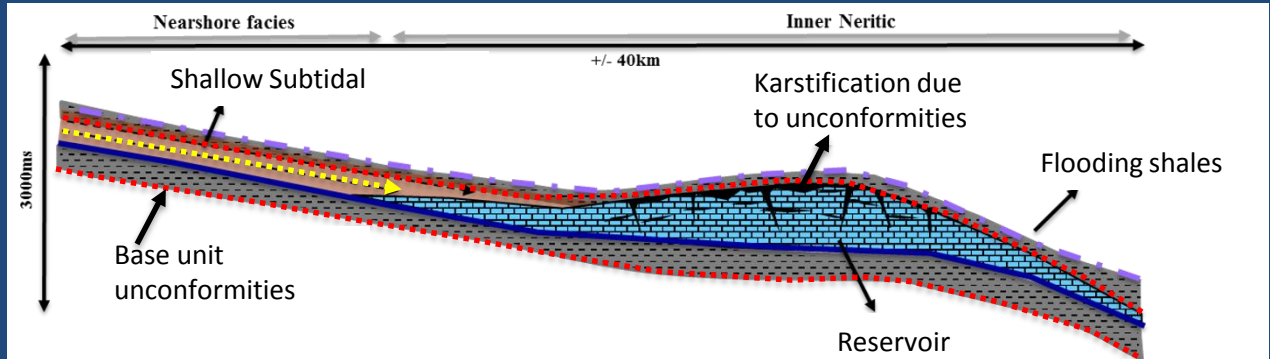
- ☐ Hinge line already present (paleo-high)
- ☐ Ongoing SL Rise to Barremian
- ☐ Siliciclastic influx relative higher

Modeled Depositional system -2

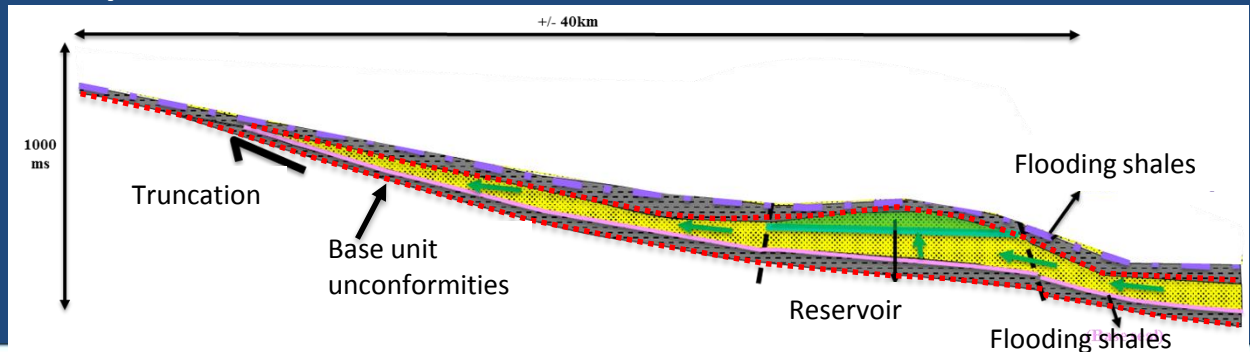


Potential Reservoir models

Concept 1: Potential Karstified Carbonates in Unit 1, 2 and 3

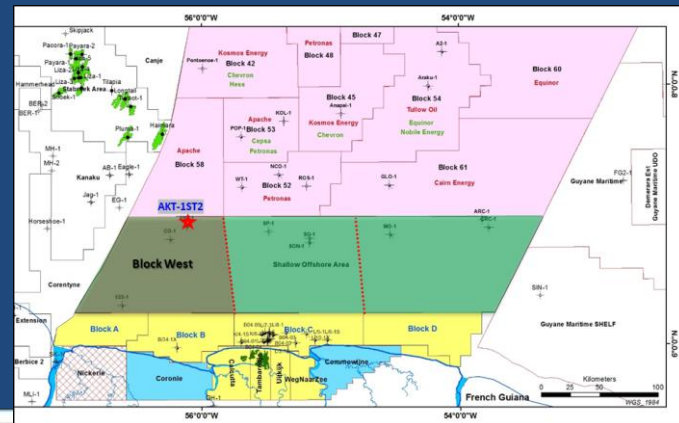


Concept 2: Potential Clastic Shoals in unit 1 and 2



Conclusions

- 52 degree API condensate in the over pressured Albion unit 3 AKT-1ST2:
 - Research towards finding potential reservoirs in the Lower Cretaceous SHO Block West
- Evolution of paleo-highs related to Hinge lines support carbonate growth
- Lower Cretaceous Interval interpreted as an overall transgressive back stepping system
 - 3 units
 - Bounded unconformities and flooding surfaces
- Reservoir potential in:
 - **Karstified Carbonates**
 - **Clastic Shoals**



**Thank you
for your attention!**

**And we hope that this study has set
stage for opening up a new
Hydrocarbon Play**

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