Opportunity CATM

Block LB 32 Liberia

The 'Jupiter Fan'

PETROQUEST
LIBERIA DEEP WATER LLC

LIBERTY
PETROLEUM CORPORATION

07th May 2026

Deep Water Central Atlantic Transform Margin (CATM): A Proven Multi-Billion Barrel Oil 'Hunting Ground!'

Four Global Projects: All in Good Standing

Each Project is held in a separate Liberty owned affiliate (PetroQuest…)

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Project 1: PetroQuest Liberia Deep Water (70% Operator): LB-32 PSC
Capital Required: USD 10 million (Paid initial Sign-on-bonus next PSC Negotiations)
Latest News: TE sign MOU into surrounding blocks LB30/31 under RL002 Q1'26

Project 2: PetroQuest Africa 1 Somalia (100% Operator): Block 131 PSC
Capital Required: USD 30 million (PSC Awarded 2024)

Project 3: PetroQuest Seychelles (57.5% Owner): Areas 1&2 PA
Capital Required: USD 5 million (PSC awarded)
Latest News: Q4 2025 PQS received a government approved 3 Year Permit

Project 4: PetroQuest Australia (100% Operator): Five Permits PA
Capital Required: USD 35 million (Blocks Awarded) (Grant of Native Title)
Latest News: Q1 2026 Georgina Energy will deepen Hussar-2 well in Officer Basin

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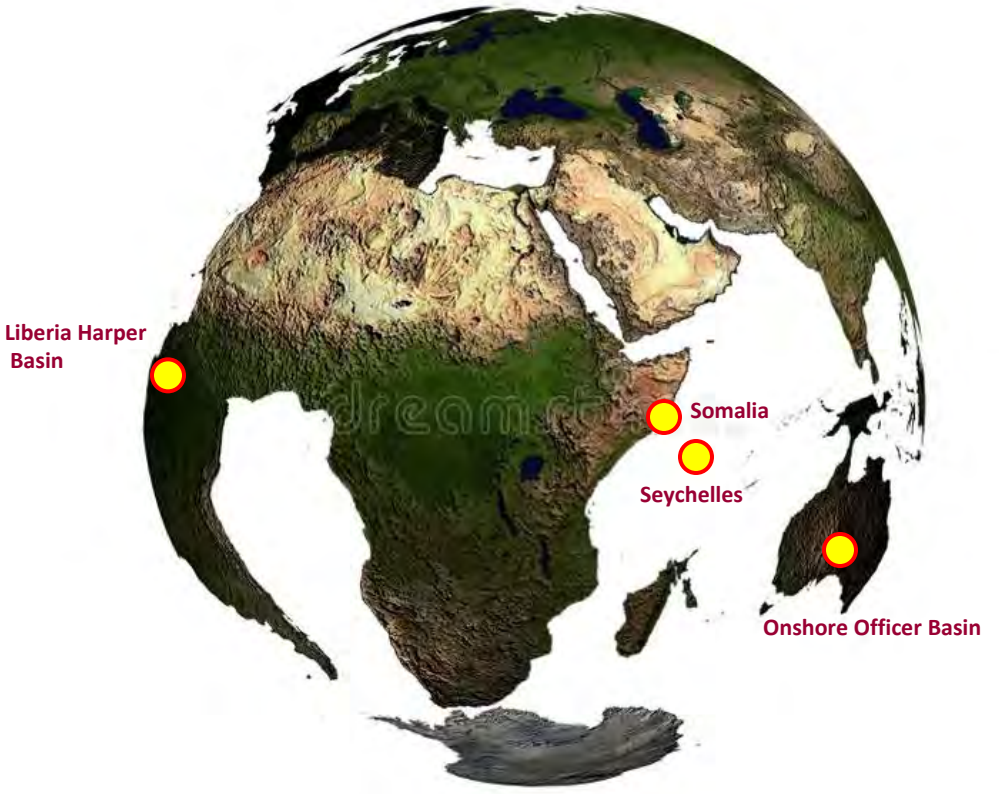
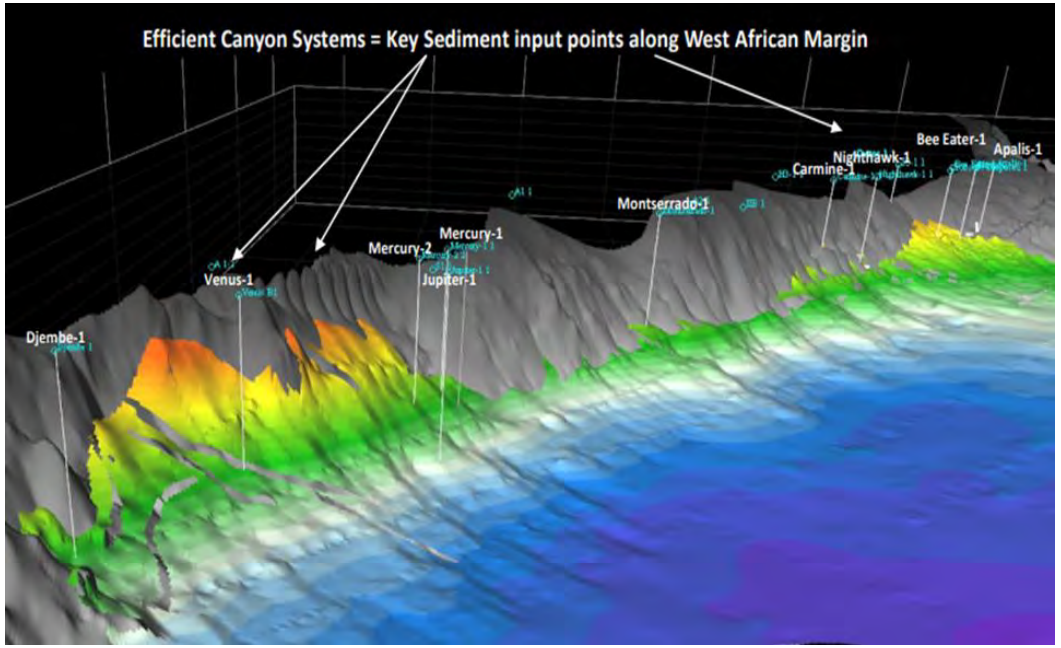


Talk Outline
The Jupiter Prospect



- ***Location***
- *Country Background*
- ***Petroleum Geology***
- *Central Atlantic Transform Margin & Hydrocarbons*
- ***Well Results & Dry Hole Analyses***
- *Oil Discovery Wells*
- *Dry Holes*
- ***Petroleum System***
- *Source*
- *Reservoirs Presence & Effectiveness*
- *Seals Presence & Effectiveness*
- *Maturity Migration & Timing*
- *Traps (Stratigraphic)*
- ***Prospect Generation Harper Basin***
- *Jupiter & Zeus Prospects*
- ***Volumetrics, STOIP & Recoverable Reserves***
- *Screening Volumetrics & USGS Resource Estimates*
- ***Risking, Gcos and Risk Mitigation***
- *SF vs BFF*
- ***Block Acquisition Strategy***
- *Liberia Block 32 (Jupiter/Zeus))*
- ***Recommended Work Program***
- *SAR Slick Analyses, Modern Hybrid 3D Seismic Acquisition (Geostreamer) Rock Physics/rEEI*
- ***Next Steps & Acknowledgements***

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Investor Teaser 1 : Block LB 32 & The Jupiter Fan (PQLDW)

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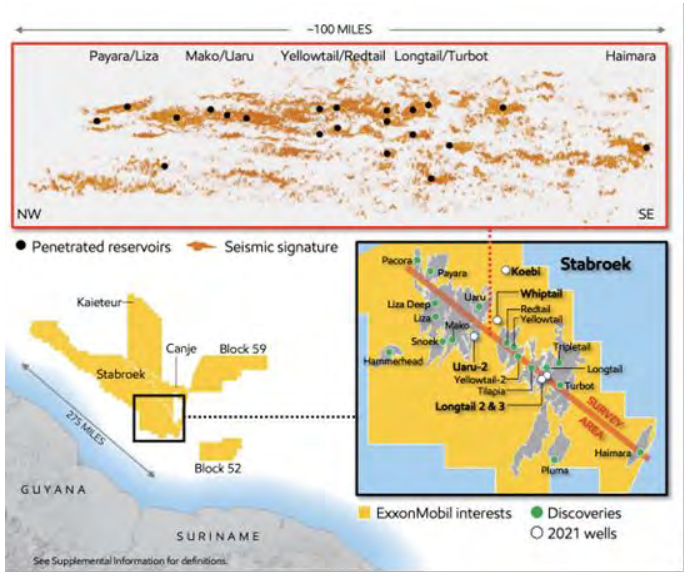
- **Want to find another '100 mile' (12 billion Barrel) 'Golden Lane', like offshore Guyana? And be the ground floor investor in that success?**
- **Offshore Liberia has identical geology to Guyana (Conjugate Margin) and has untested Basin Floor Fan (BBF) Plays of the exact age and depositional style and likely fluid fill as the producing oil fields; Liza, Payara, Yellowtail, Uaru and soon to be Hammerhead!**
- **These Liberian BFFs lie within the oil window, immediately above two of the world's richest oil source rocks, in plays, that based on global metrics have a 1:3 chance of success of finding over one billion barrels!**
- **Drilling along the Liberian margin in the period 2009-2014 has effectively derisked the up-dip slope stratigraphic fan plays with 38–40-degree API oil recovered to surface in multiple wells. The majors are rushing in with almost 30 mm USD spent in sign on bonuses by Total Energies and Oranto Petroleum in September 2025!**
- **Mark Sloan and Liberty Petroleum Corporation under the SPV PetroQuest Liberia Deep Water (PQLDW) has succeeded in securing Block 32 Offshore Liberia via a binding LOE, a bock which hosts the large Jupiter Fan (3.6 Bbls OOIP complete with 3D seismic support) and is now looking for finance, via an IPO or RTO, to negotiate a PSC and interpret the existing 3D data, with a view to executing a rapid farm-out to an IOC or NOC major upon the interpretation of the same.**



Offshore Guyana Golden Mile

Liberia Future Golden Mile??

38 API Oil sampled from Liberian Narnia-1 well 2012!!

Location & Petroleum Geology

Central Atlantic Transform Margin (CATM): Country Background

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Figure 3. Major transform systems along the Sierra Leone, Liberia, and Côte d'Ivoire coast, west Africa. Intersection of fault zones and the continental shelf shown as red line. Modified from Bennett and Rusk (2002).

The term Liberian Basin includes both the Liberia and Sierra Leone Basins. It however does not include the Harper Basin. which will be treated differently in this presentation.

Note the large numbers of rivers! Similar to Guyana?

Republic of Liberia

Physiography, Geopolitics and Oil & Gas

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- Many Rivers draining '***Granitic Terrain'***
- EEZ over 110,000 km2
- Population 4,694,608 (2017 Census)
- 85% of population is Christian
- ***Crown Law Applies***
- ***English is the official language***
- Civil War ended in 2003 (21 years ago)
- 26th President is Joseph Boakai 2024 –
- World Bio-Diversity Hotspot
- Natural Resources Iron Ore and Timber
- ***Offshore areas prospective for oil & gas***
- Two major basins Liberian and Harper
- ***Liberia Petroleum Regulatory Authority***

Petroleum Geology

Geological Map of Liberia

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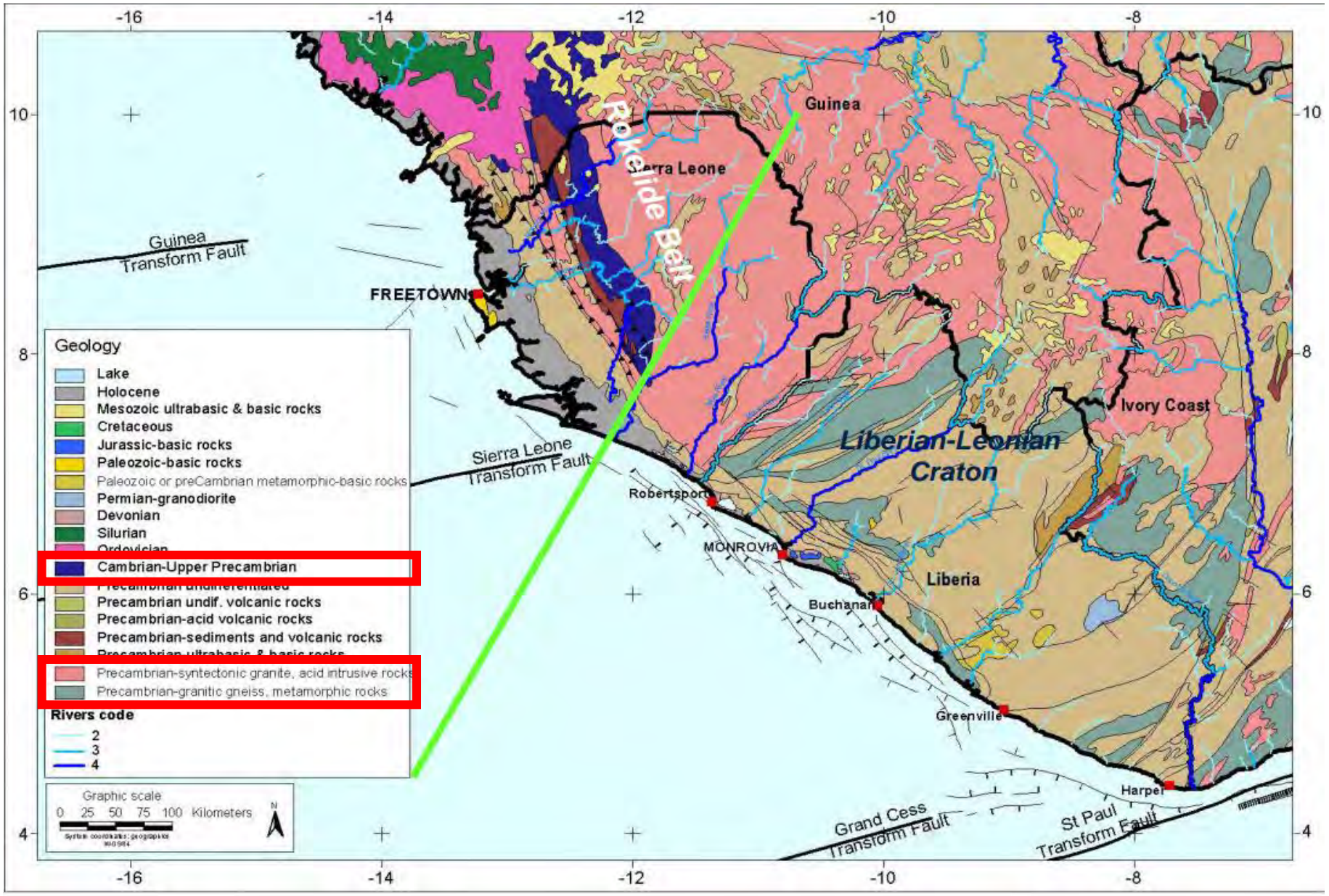
Mainly Granitic hinterland of the Archean/Mesoproterozoic ***West African Craton***

Lots of rivers draining granitic highlands …similar to Guyana!

A series of en-echelon transform margin basins set up offshore

These basins are associated with the evolution of the Atlantic margin through rift, drift to passive margin.



Geological Map of Sierra Leone.

Source to Sink

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Mainly Granitic hinterland of the Archean/ Mesoproterozoic ***West African Craton***

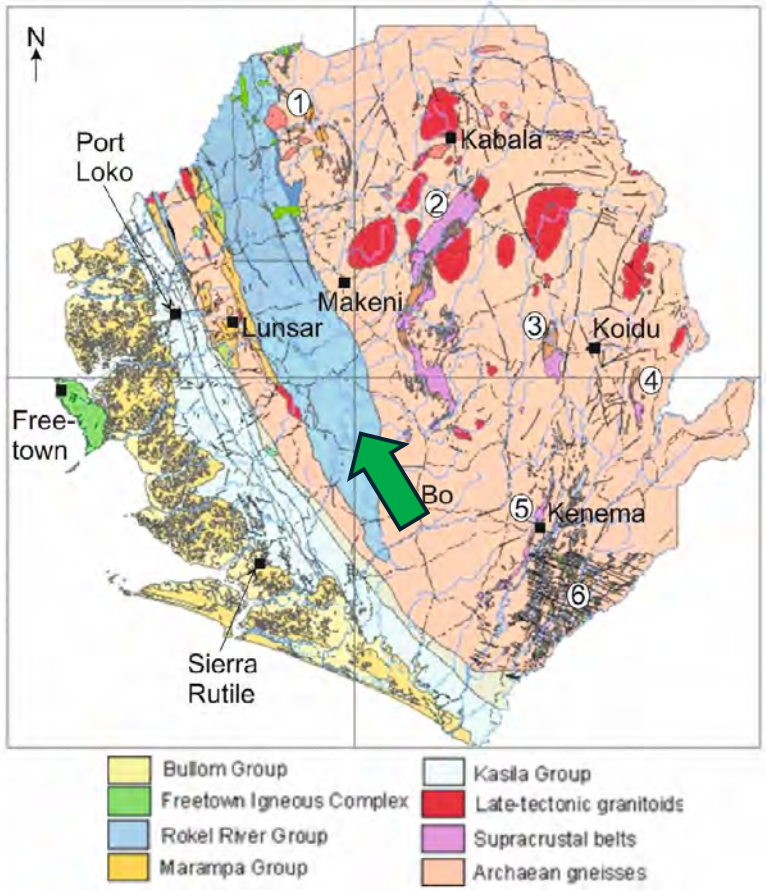
Rokel River Group present which is dominated by Neoproterozoic sandstones.

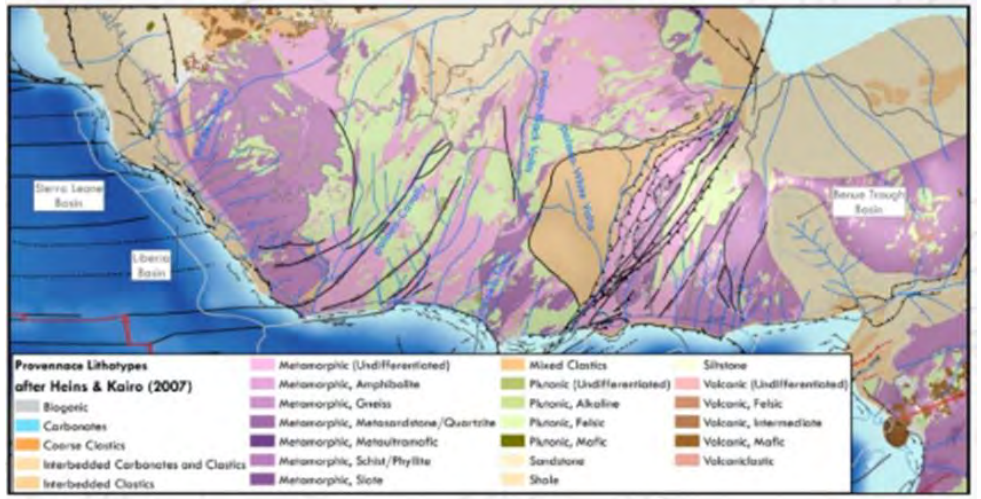
Lots of rivers draining granitic highlands …similar to Guyana & Liberia!

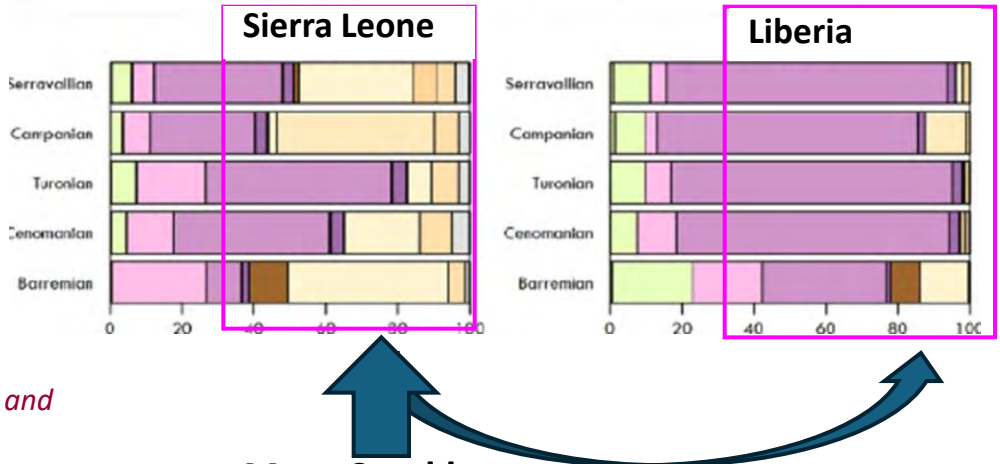
A series of en-echelon transform margin basins set up offshore

These basins associated with the evolution of the Atlantic margin through rift, drift to passive margin.

Slightly better source to sink risk in the northern part of the Liberian Basin due to source to sink effects of Rokel River Gro







Rokel River Group mainly sandstone facies of marine and glacial origin. High net to gross sand intervals

More Sand less Feldspars

Central Atlantic (CATM) Transform Margin

The Target: Proto-Atlantic Rift and Drift Basins

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Period 1 Central Atlantic Rift

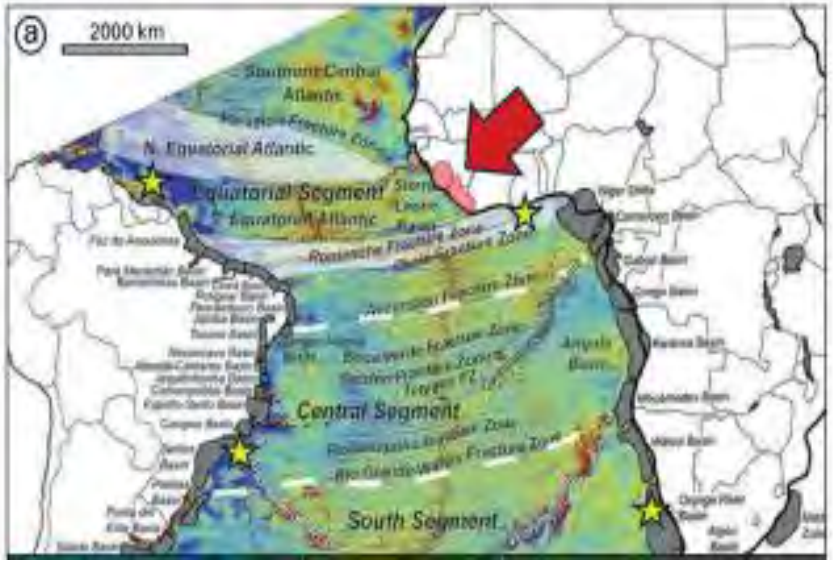
- Development of failed Takutu Graben
- Development of Central Atlantic Ridge
- Rifting & Syn-fill deposition
- Deposition of ***OAE1*** Source Rock

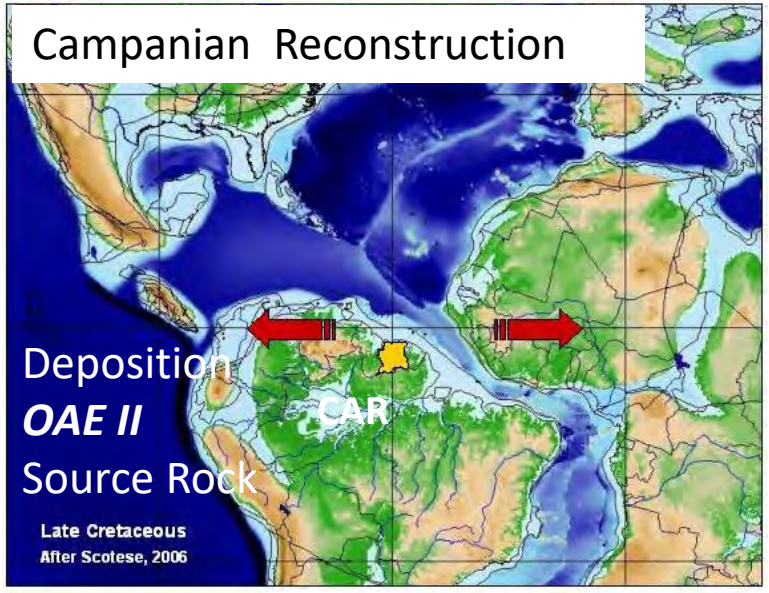
Period 2 Latest Rift- Early Drift

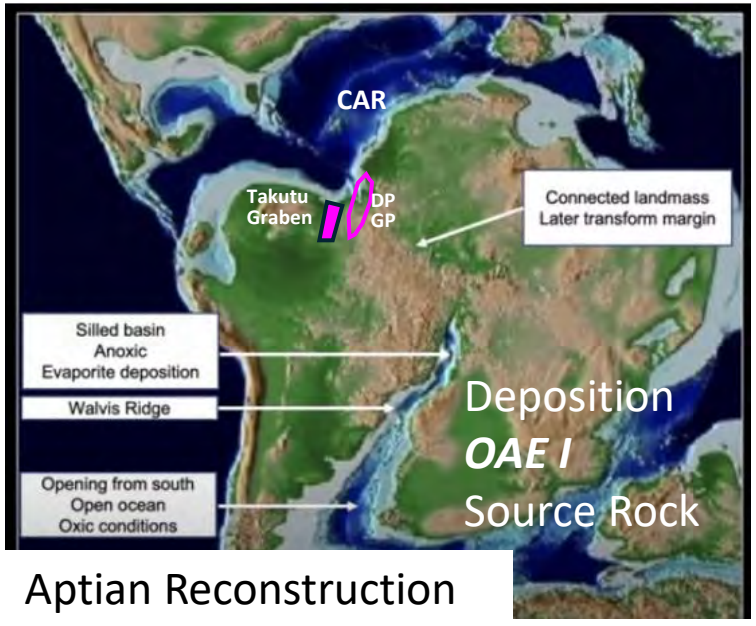
- Uplift of Guinea and Demerara Plateaux
- Deposition of ***OAE2*** (ACT) Source Rock
- Opening of the Southern Atlantic

Period 3 Passive Margin

- Subsidence along the Guyana-Suriname Margin
- Tilting of South America
- Unroofing of Liberian & Sierra Leone hinterland
- Main fill phase of Liberian and Harper Basins







Aptian Reconstruction

Oil Proneness: Central Atlantic Transform Margin (Billions of Barrels)

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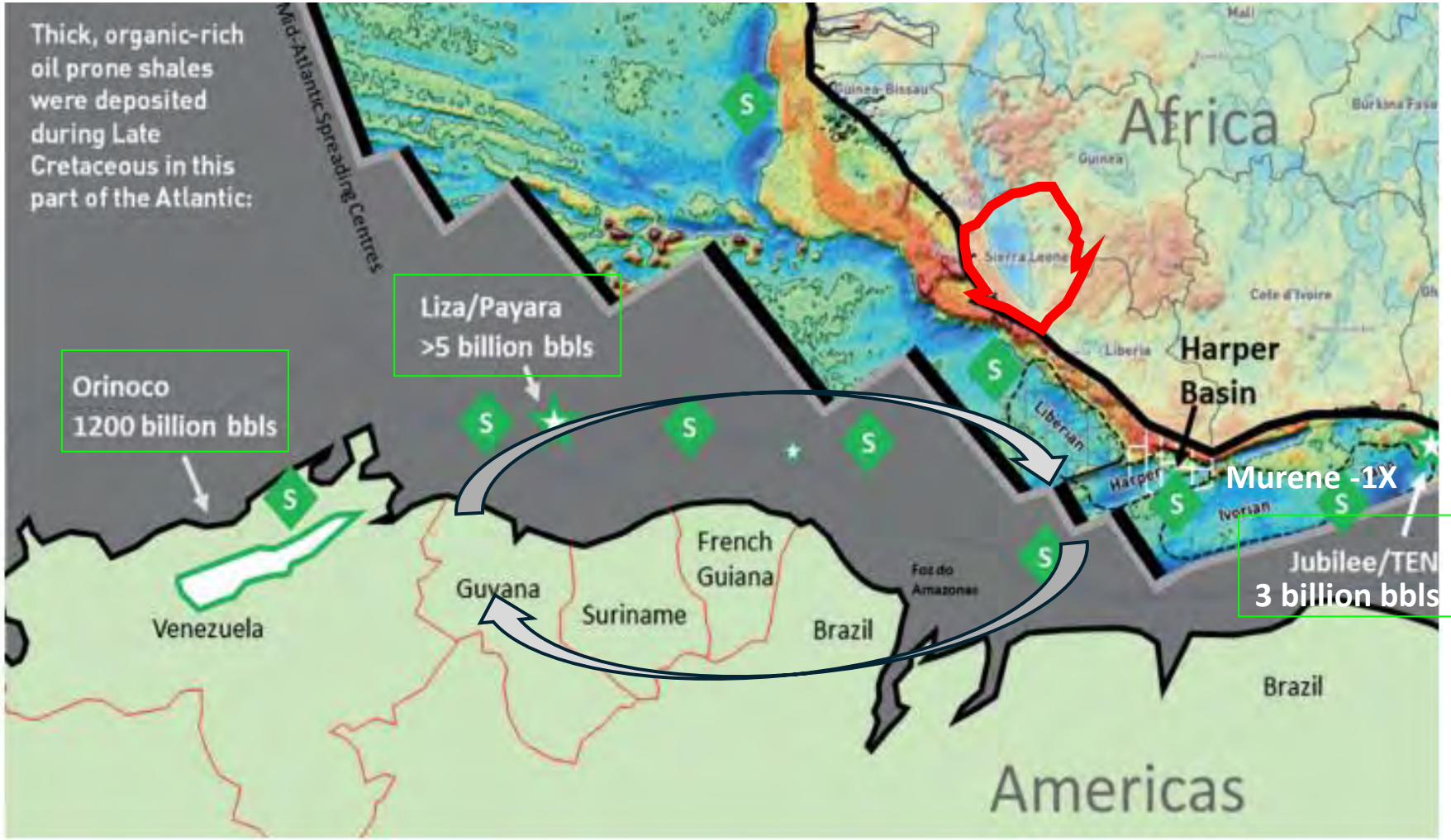
- Oil production offshore Ghana
- Oil production offshore Senegal
- Oil Production offshore Cote D'Ivoire
- Oil Production Offshore Guyana
- Key is the presence of rich and effusive source rocks, OAE I & OAE II
- Widespread reservoirs & seal pairs



Liberian Basin Hosts World Class Source Rocks (CATM)

OAE1 & OAE2 (Aptian – Turonian)

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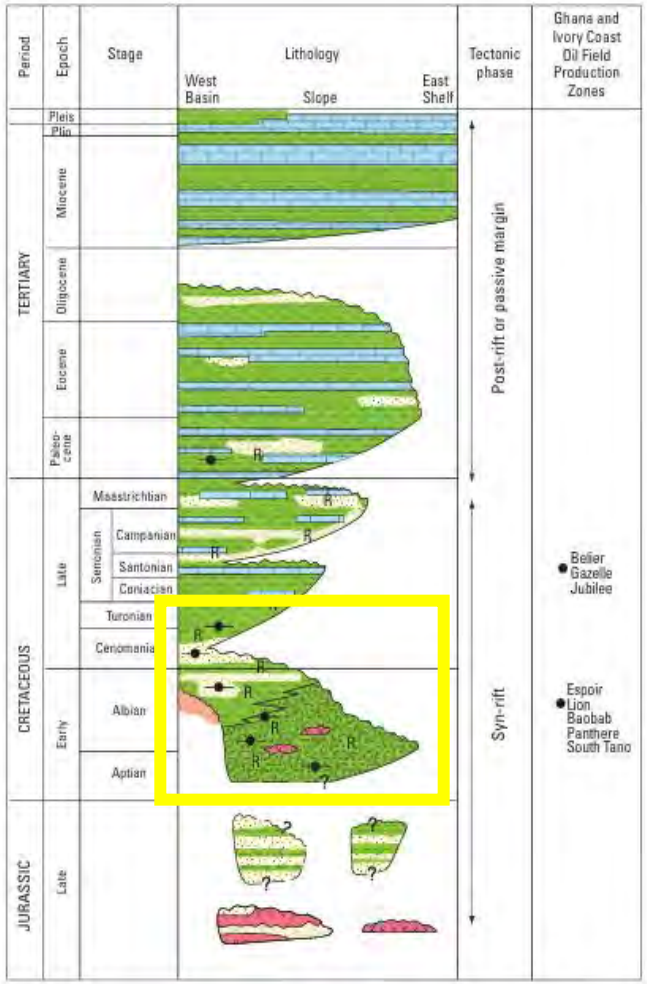
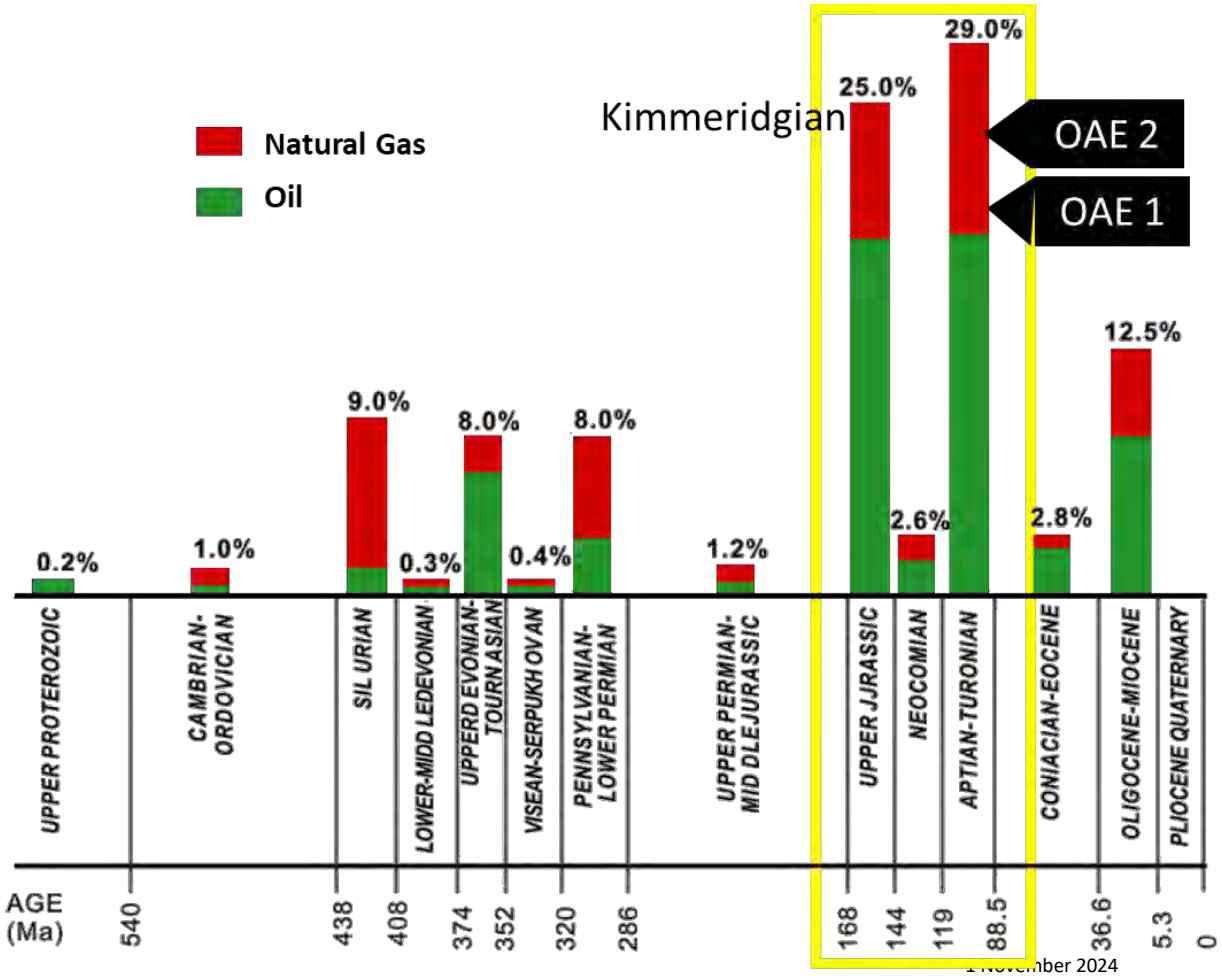
Source Rocks - OAE (Oceanic Anoxic Events)

- Globally, there are two main Cretaceous source rock generative events known as, OAE1 and OAE2
- OAE1 (Aptian) lasted for 1-1.3 Million years and OAE2 (Cenomanian) lasted for 0.8-1.0 Million years
- Both OAE1 and OAE 2 source rocks are known to be present and are actively transforming offshore Liberia and Sierra Leone, based on source rock penetrations in drilled wells.





After Soua & Chihi 2014

Key Source Rocks

Stratigraphic Chart : Offshore Liberian Basin (Oil Prone Region)

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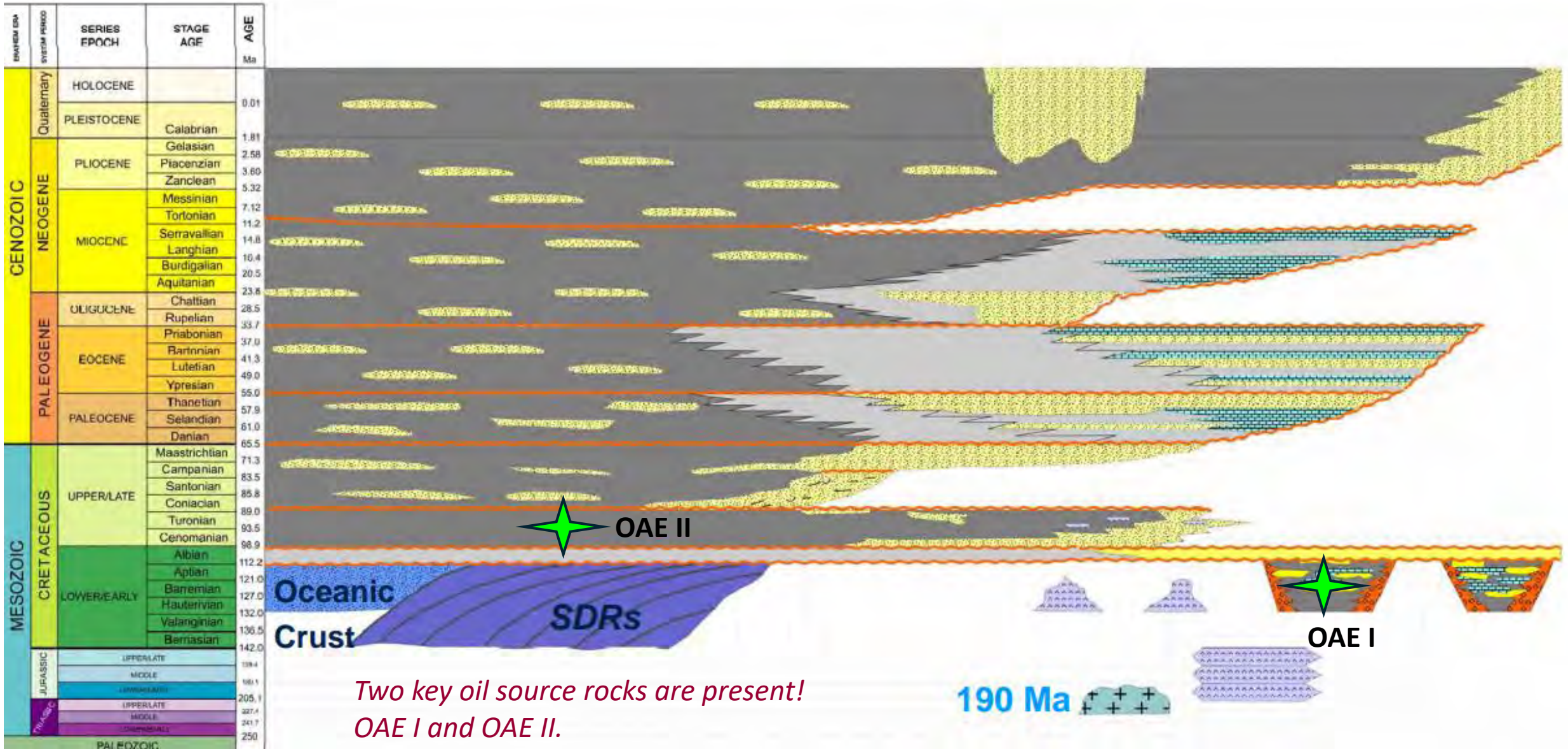

Two key oil source rocks are present!
OAE I and OAE II.

Sequence Stratigraphic Development (CATM)

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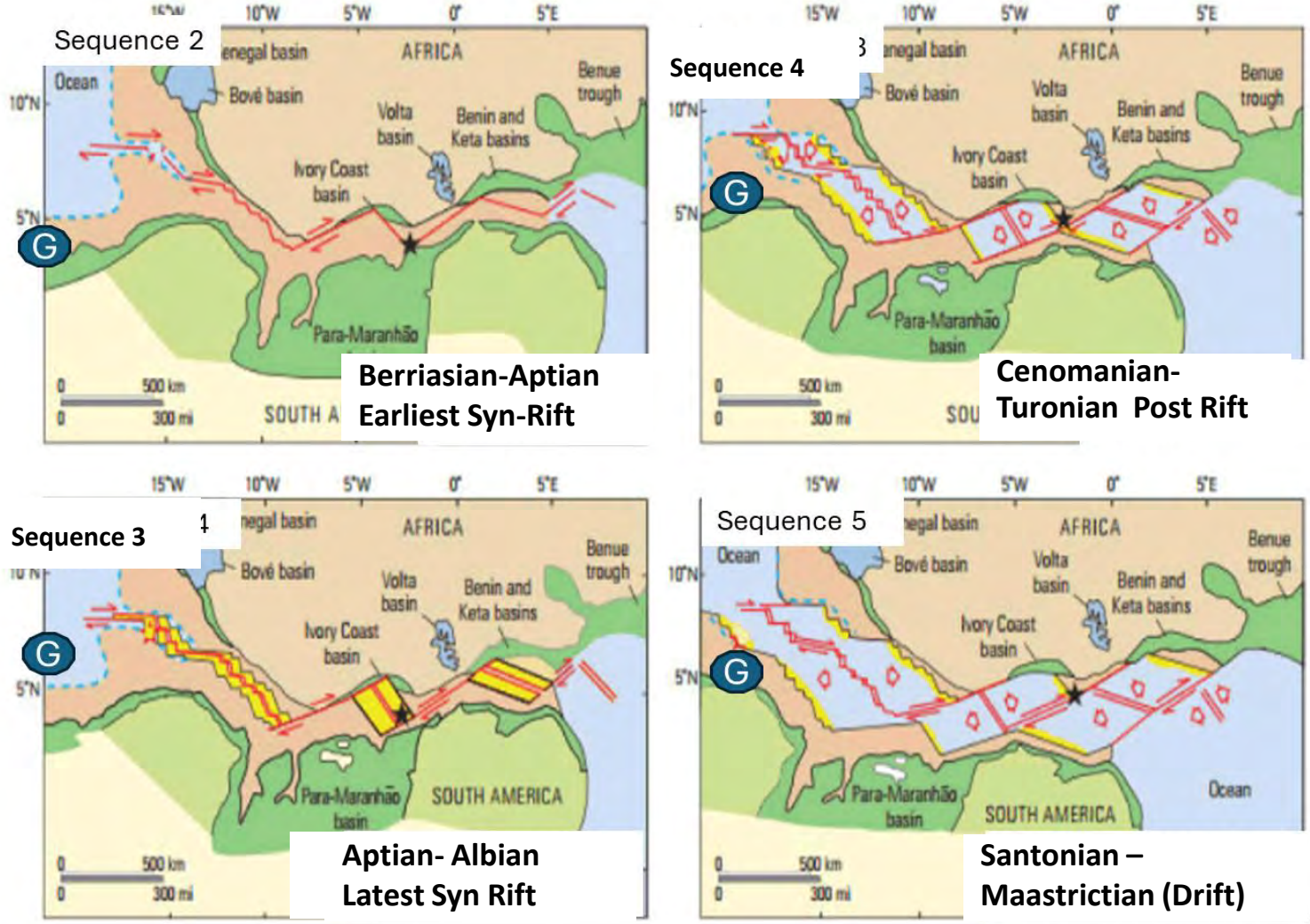
- SQ2: Early syn-rift deposition of Lacustrine source rocks (***OAE I***) and fluvial sands that constitute a robust **Lwr Cretaceous Oil Play (A)**.
- SQ3: Early Post Rift deposition of marine source rocks. This happens during the earliest marine incursions with the main Turonian source rock (***OAE II***) being deposited widely across both the shelfal and deepwater areas.
- SQ4: Early Passive Margin Inboard deposition of shelfal marine deposits and in both deepwater slope and basin floor fans (outboard). This is when the Liza type fans were deposited within third order cycles during the Conacian, Santonian & Maastrictian. **This is the Upper Cretaceous Oil Play (B)**
- SQ5: Late Passive Margin deposition of sands and carbonates on the shelf and deepwater muds during the Paleocene –Oligocene. **This is the Tertiary Oil Play (C)**



Genesis of the Liberian Margin (Rift – Drift- Passive Margin)

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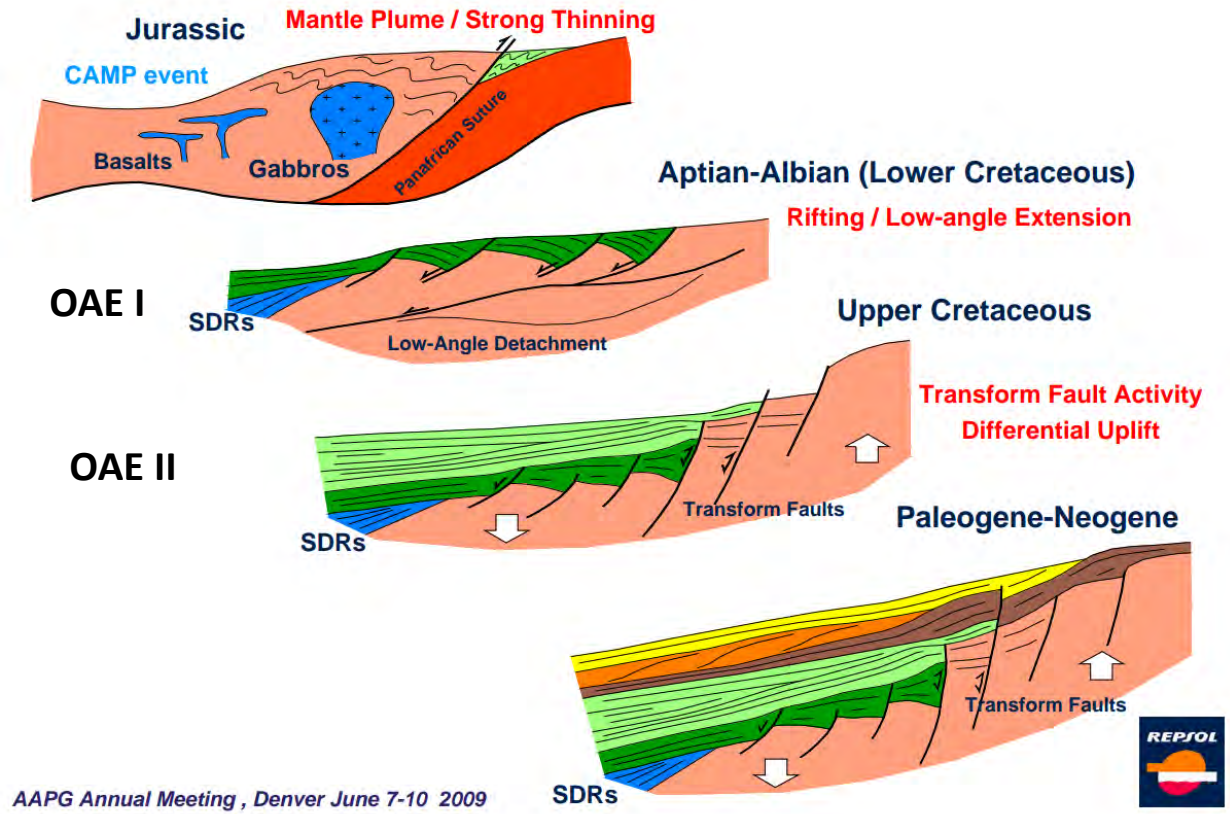

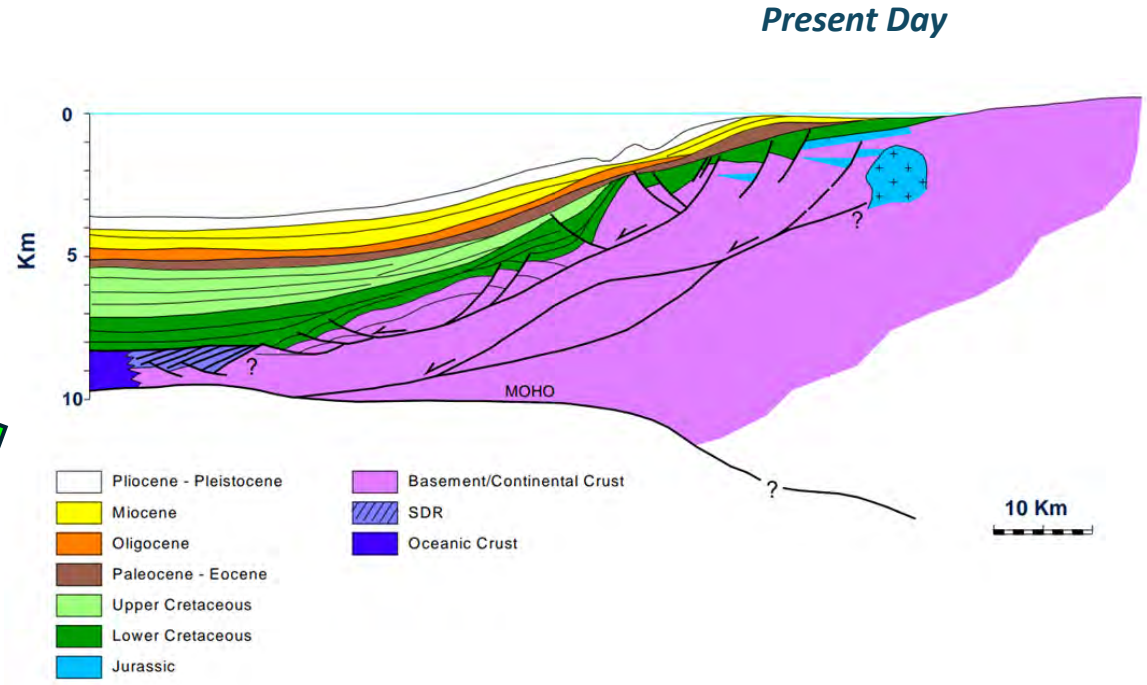

AAPG Annual Meeting , Denver June 7-10 2009

Liberian Basin Play Opener Venus-B1 (2009)

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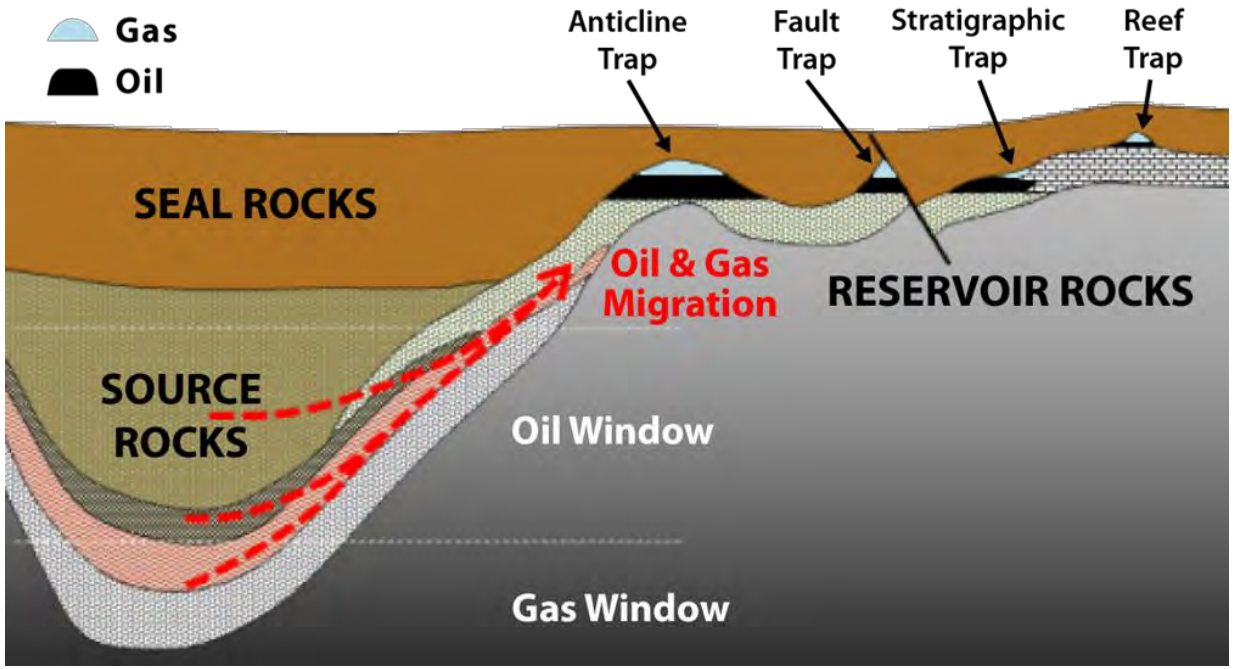

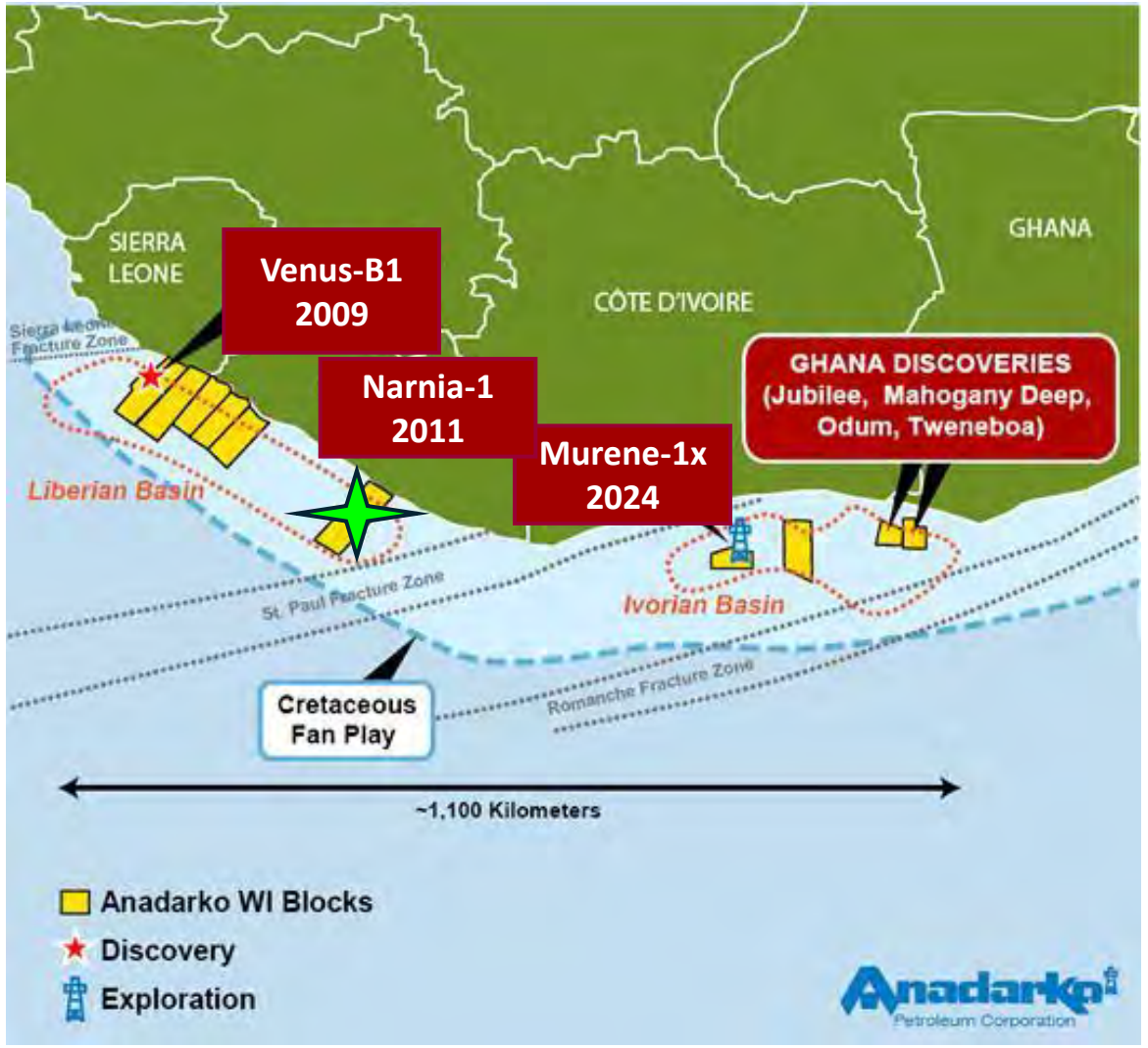

Two Petroleum Systems Offshore CATM

1) Aptian–Albian ***OAE I***
2) Cenomanian – Turonian ***OAE II***

Well Results Liberian Basin

Seven Sub-Commercial Oil Discoveries Offshore Liberian Basin

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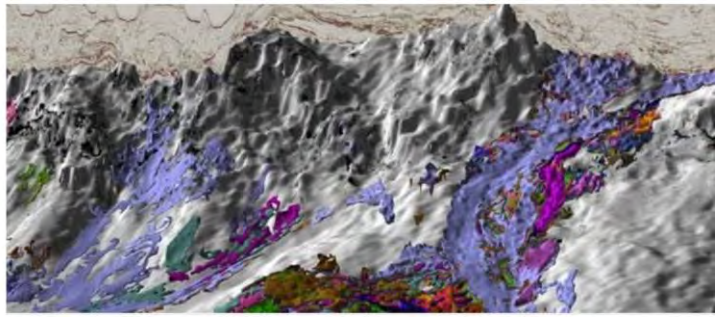
1. Modern Wells 2010-2016 drilled channel and slope fans on the continental Shelf (Oil Found)
2. Live oil found in the late K deep marine channel and slope fan facies sandstones
3. Live oil also found in early K, shallow marine, delta front and mouth bar facies sandstones
4. Detached basin-floor fans evident on the seismic, out-board of the channel and slope fan discoveries that remain untested!

Well name	Date	Status
Venus-B1	2009	Oil Discovery Late K
Mercury-1	2010	Oil Discovery Late K
Montserrado-1	2011	Oil Discovery Early K
Jupiter-1	2012	Oil Discovery Late K
Narnia-1	2012	Oil Discovery Early/Late K
Bee-Eater-1 (Tight)	2013	Oil Discovery Early/Late K
Savannah-1x	2013	Oil Discovery Late K
End of Drilling Activity		
2025-2028	***Deep Water BFF Plays***	***Oil with Gas flush risk!***



High Risk (1:6) slope fans feeding lower risk (1:3) BFF Seismic Image Liberia! ***Published by TGS 2017***

Existing Oil Discoveries Liberian Basin 2009-2013 Campaign

Sierra Leone (Only)

Venus-B1(Anadarko) **2009** SL 6/7
Seeking oil in late Cretaceous Slope Fan reservoirs
Found 15 m of high-quality oil saturated reservoir in Santonian ssts.
Oil Pay and Non-Commercial Oil Discovery

Mercury-1 (Anadarko) **2010** SL-07B-10
Seeking oil in Slope Fan Facies Campanian & Santonian reservoirs
Found 35 m of 34 API Oil in Santonian aged ssts and 21 m of 24 API Oil in a shallower objective (Campanian ssts).
Oil Pay and Non-Commercial Oil discovery

Jupiter-1 (Anadarko) **2012** SL-07B-11
Seeking oil in Santonian reservoirs
Found 30 m of high-quality oil in Campanian aged sandstones
Oil Pay and Non-Commercial Oil Discovery

Savannah-1x (Lukoil) **2013** SL-05-11
Seeking oil in late Cretaceous reservoirs
Found live oil of high-quality oil in Turonian aged sandstones
Oil Pay and Non-Commercial Oil Discovery

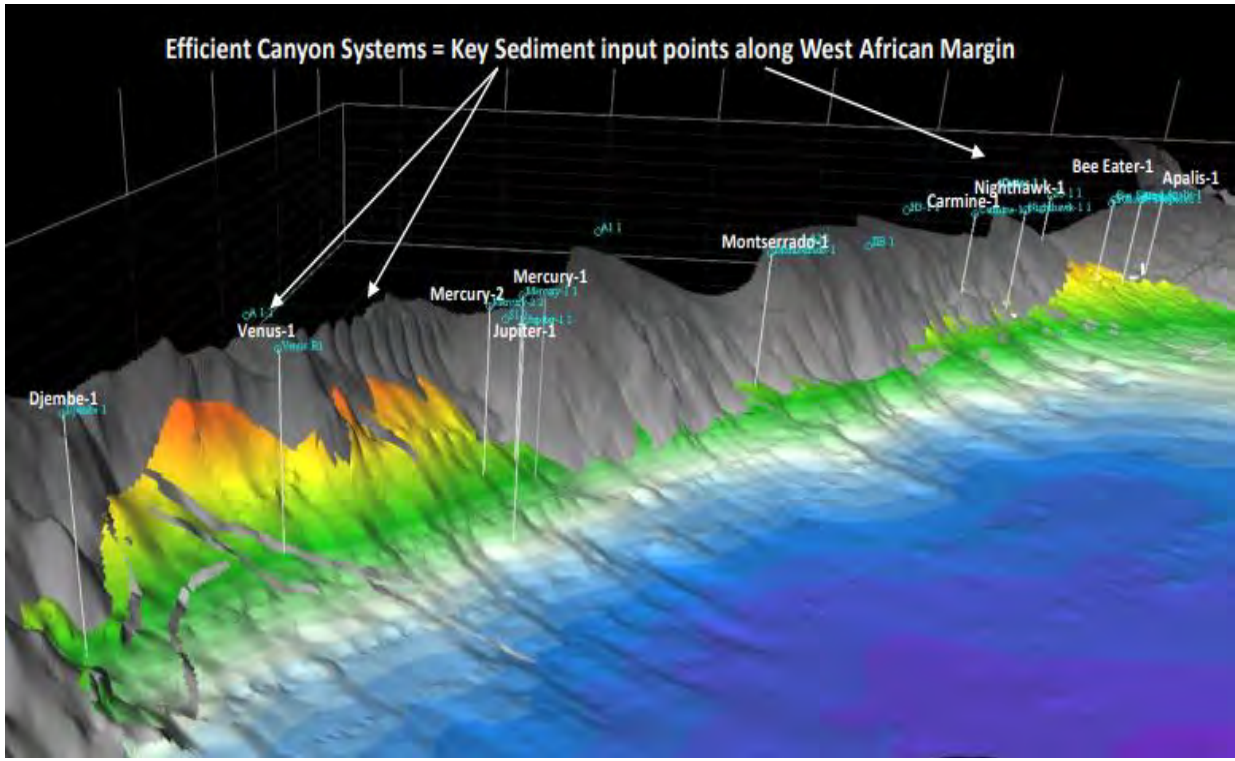


Table of Wells & Well Results Offshore Sierra Leone

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Two Dry Wells in Late Cretaceous Fan Play

Name	Year	Operator	Well Status
A-1 1982	1982	Mobil	Oil Shows
A-1 1985	1985	Amoco	Oil Shows
Venus B-1	2009	Anadarko	Discovery
Mercury-1	2010	Anadarko	Discovery
Mercury-2	2012	Anadarko	Appraisal
Jupiter-1	2012	Anadarko	Discovery
Djembe-1	2012	Talisman	Water wet
Savannah-1X	2013	Lukoil	Discovery

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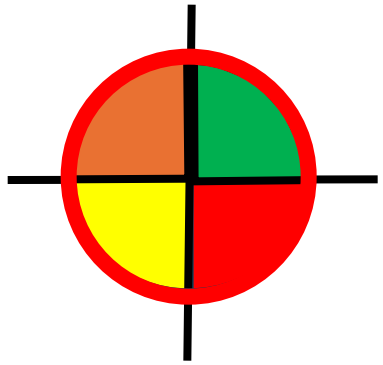
SEAL

Present and Effective

Ambiguous

Not Present and Ineffective



Venus-B1

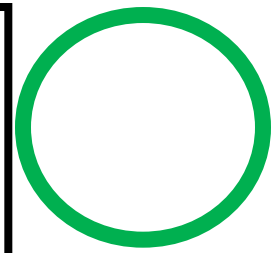
Santonian Live Oil Discovery!
Stratigraphic Trap

TRAP

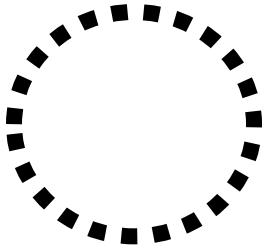
Present and Effective

Ambiguous

Not Present and Ineffective



VALID TEST



STRATIGRAPHIC WELL ONLY

RESERVOIR

Present and Effective

Ambiguous

Not Present and Ineffective

CHARGE

Present and Effective

Ambiguous

Not Present and Ineffective

DISCOVERY

VALID TEST

DRY VALID TRAP TEST

DRY FAILED TRAP TEST
Stratigraphic Trap Fail

DRY OFF STRUCTURE TEST

Venus-B1 (2009) Oil Discovery

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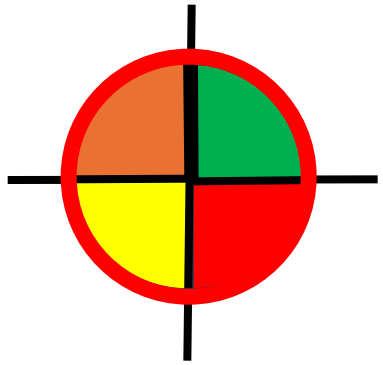
SEAL

Present and Effective

Ambiguous

Not Present and Ineffective



Mercury-1

Santonian Live Oil
Discovery!
Stratigraphic Trap

TRAP

Present and Effective

Ambiguous

Not Present and Ineffective

VALID TEST

STRATIGRAPHIC WELL ONLY

RESERVOIR

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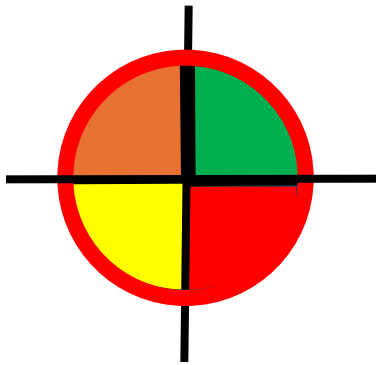

Mercury-1

Campanian Live Oil
Discovery
Stratigraphic Trap

CHARGE

Present and Effective

Ambiguous

Not Present and Ineffective

DISCOVERY

VALID TEST

DRY VALID TRAP TEST

DRY FAILED TRAP TEST
Stratigraphic Trap Fail

DRY OFF STRUCTURE TEST

Mercury-1 (2010) Oil Discovery

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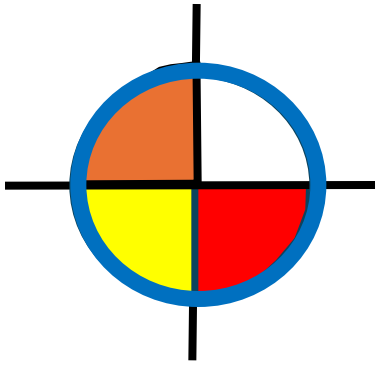

Montserrado-1

Santonian Trap Fail

TRAP

Present and Effective

Ambiguous

Not Present and Ineffective

VALID TEST

STRATIGRAPHIC WELL ONLY

RESERVOIR

Present and Effective

Ambiguous

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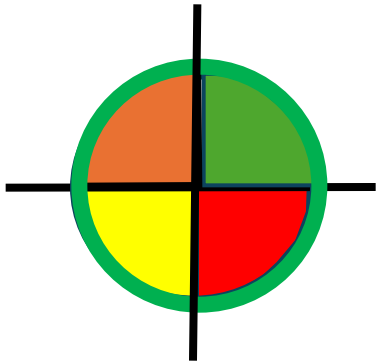

Montserrado-1

Aptian Trap Present with oil!

CHARGE

Present and Effective

Ambiguous

Not Present and Ineffective

DISCOVERY

VALID TEST

DRY VALID TRAP TEST

DRY FAILED TRAP TEST
Stratigraphic Trap Fail

DRY OFF STRUCTURE TEST

Montserrado-1 (2010) Discovery

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LIBERIA DEEP WATER LLC

SEAL

Present and Effective

Ambiguous

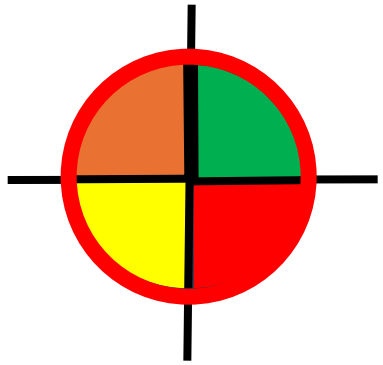
Not Present and Ineffective

RESERVOIR

Present and Effective

Ambiguous

Not Present and Ineffective



Jupiter-1

Santonian Live Oil Discovery!
Stratigraphic Trap

TRAP

Present and Effective

Ambiguous

Not Present and Ineffective

CHARGE

Present and Effective

Ambiguous

Not Present and Ineffective

VALID TEST

STRATIGRAPHIC WELL ONLY

DISCOVERY

VALID TEST

DRY VALID TRAP TEST

DRY FAILED TRAP TEST
Stratigraphic Trap Fail

DRY OFF STRUCTURE TEST

Jupiter-1 (2012) Oil Discovery

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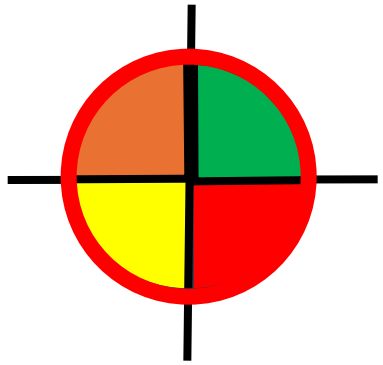
Not Present and Ineffective



Narnia-1

Turonian Oil Discovery
Stratigraphic Trap

TRAP

Present and Effective

Ambiguous

Not Present and Ineffective

VALID TEST

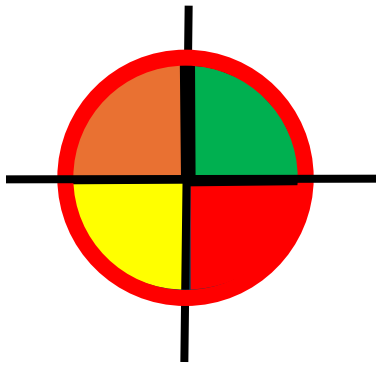
STRATIGRAPHIC WELL ONLY

RESERVOIR

Present and Effective

Ambiguous

Not Present and Ineffective



Narnia-1

Aptian Oil Discovery
Stratigraphic Trap

CHARGE

Present and Effective

Ambiguous

Not Present and Ineffective

DISCOVERY

VALID TEST

DRY VALID TRAP TEST

DRY FAILED TRAP TEST
Stratigraphic Trap Fail

DRY OFF STRUCTURE TEST

Narnia-1 (2012) Oil Discovery

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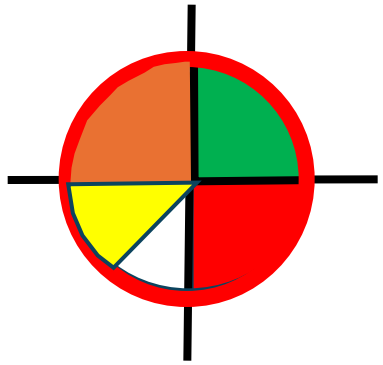
SEAL

Present and Effective

Ambiguous

Not Present and Ineffective

RESERVOIR



Bee-Eater-1

Turonian Oil Discovery!

Stratigraphic Trap

TRAP

Present and Effective

Ambiguous

Not Present and Ineffective

CHARGE

VALID TEST

STRATIGRAPHIC WELL ONLY

DISCOVERY

VALID TEST

DRY VALID TRAP TEST

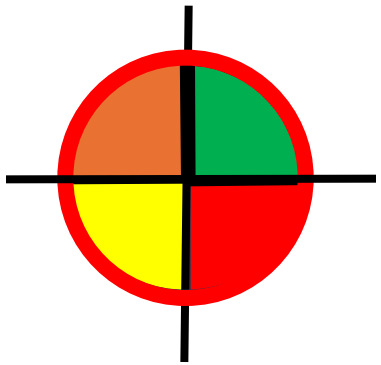
DRY FAILED TRAP TEST
Stratigraphic Trap Fail

DRY OFF STRUCTURE TEST

Present and Effective

Ambiguous
Ambiguous

Not Present and Ineffective



Bee-Eater-1

Aptian Oil Discovery

Discovery

Stratigraphic Trap

Present and Effective

Ambiguous

Not Present and Ineffective

Bee-Eater-1 (2013) Oil Discovery (Tight)

PETROQUEST
LIBERIA DEEP WATER LLC

SEAL

Present and Effective

Ambiguous

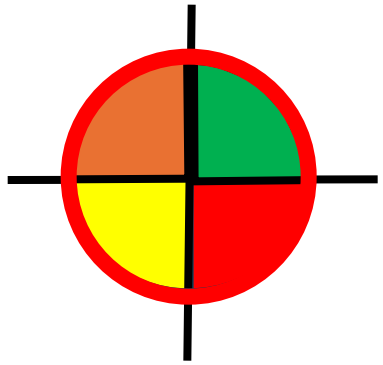
Not Present and Ineffective

RESERVOIR

Present and Effective

Ambiguous

Not Present and Ineffective



Savannah-1x

Turonian Live Oil Discovery!

Stratigraphic Trap

TRAP

Present and Effective

Ambiguous

Not Present and Ineffective

CHARGE

Present and Effective

Ambiguous

Not Present and Ineffective

VALID TEST

STRATIGRAPHIC WELL ONLY

DISCOVERY

VALID TEST

DRY VALID TRAP TEST

DRY FAILED TRAP TEST
Stratigraphic Trap Fail

DRY OFF STRUCTURE TEST

Savannah-1x (2013) Oil Discovery

Dry Hole Analyses

Legacy Dry Wells Liberian Basin (2009-2016 Failure)- Future?

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1. Early Wells 1970's-80's drilled on Continental Shelf in Shallow water Oil shows (Failure)
2. Modern Wells 2009-2016 drilled channel and slope fans on the continental Shelf (Oil Found)
3. Future Exploration 2025-2028 drills Basin Floor Fans down depositional dip from existing oil discoveries

Chevron Wells

Well name	Date	Status
Apalis-1	2011	Dry P/A Oil Shows
Mercury-2	2012	P/A Oil Shows
Carmine Deep-1	2012	P/A Oil shows?
Nighthawk-1	2012	Dry P/A Oil Shows?
Dejembe-1	2013	Dry P/A – Oil Shows
Goshtern-1	2014	Dry P/A ?
Timbo-1	2014	Dry/P/A?
Iroko-1	2014	Dry/P/A?
Mesurado-1	2016	Dry P/A – Oil Shows
End of Drilling Activity		
2025-2028	***Deep Water BFF Plays***	***Oil with Gas flush risk!***

25 APRIL 2014

Front Page Africa (Monrovia)

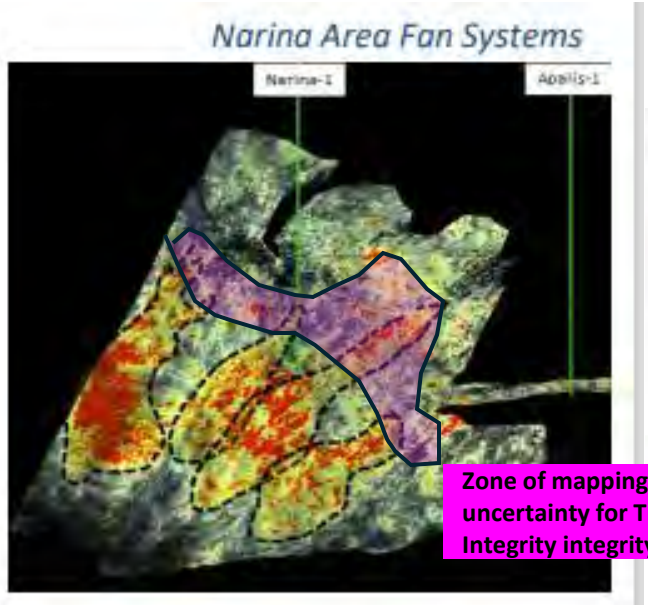
By Wade C. L. Williams Monrovia — Chevron Liberia on Thursday took Liberian journalists on a tour of its third oil-drilling rig The West Tellus. Quizzed on the outcome of previous drilling carried out by the company, it's Liberia country Representative was very careful in making any disclosure of the company's previous drills.
"We're in a very, very competitive world so we do not release our well results. I believe that's company confidential information; we are in competition with the likes of African Petroleum, Anadarko and Exxon Mobil so we do not like to share our results," Karl Cottrel, Chevron Liberia Country Manager

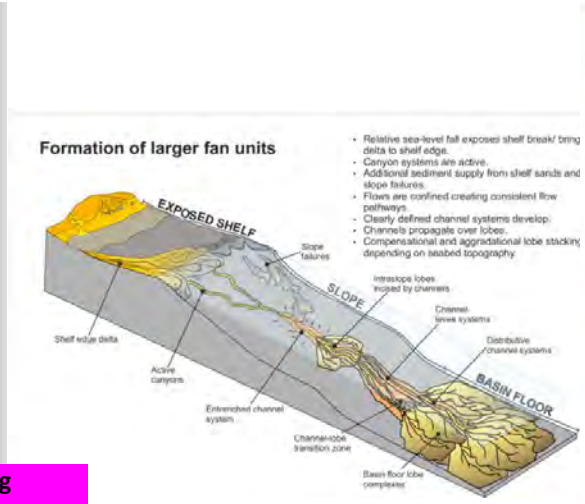
Dry Hole Analyses

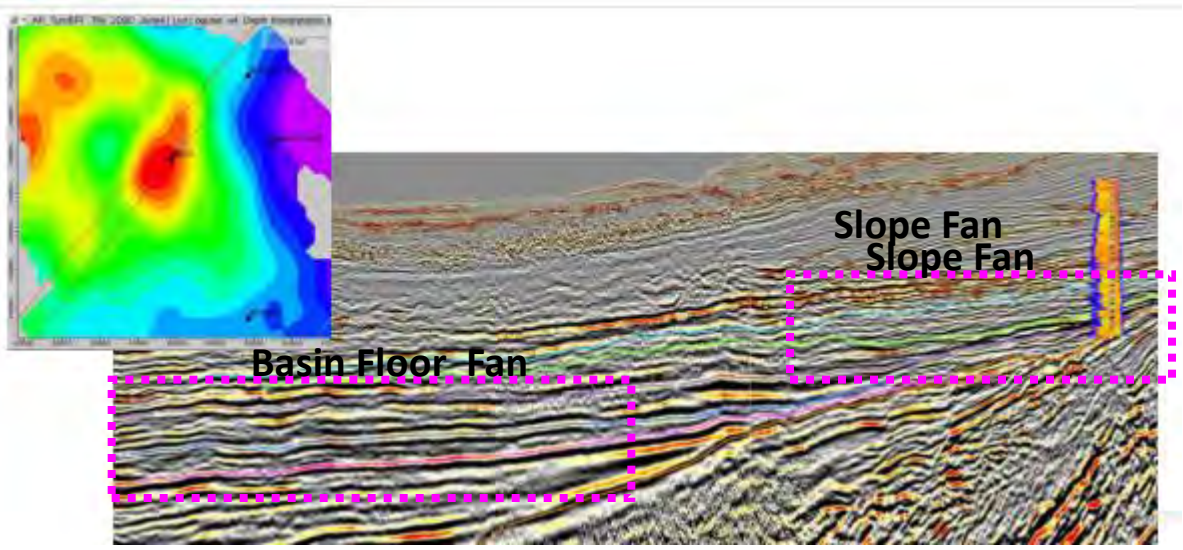
Key Risk 1: Trap Integrity (Liberian Basin)

Trap Integrity is the key risk for the Liberian Basin. Oil has been discovered (thus far) in stratigraphic traps, mapped on 3D seismic data. Because of real limits in seismic resolution, combined with thin-bed tunning effects, it is not always possible to define or establish the correct trap geometry, especially where the trap terminates in the up-dip direction against the paleo-continental slope.

1) Although huge progress has been made in broad-band 3D seismic data quality there are still limits to seismic resolution and the correct identification of Trap geometry
2) If we can't readily map the up-dip termination of the channel or slope fan container then we don't know whether there is closure and seismic attributes rarely provide clarity.
3) There is often a great deal of confusion as to where to place this risk, is it in seal (lateral seal) or is it in Trap?
4) Offshore Liberia seal distribution and effectiveness is not a significant risk as seals if present will be effective.
5) Furthermore, 90% of drilled wells have oil shows (even those on the shelf) so we can conclude source/charge and migration are not the major issues, oil is everywhere in the K
6) Therefore, we place the main stratigraphic trap failure at the feet of failed trap integrity.
7) So simply put, for those stratigraphic prospects which were tested but dry, the key failure is that there was effectively no trap or the trap geometry had been incorrectly mapped.
8) Geophysical attributes such as AVO analyses has been used offshore Liberian Basin to position wells and infer trap integrity through direct hydrocarbon detection- ***No panacea!***







Dry Hole Analyses

Key Risk 2 Reservoir Effectiveness

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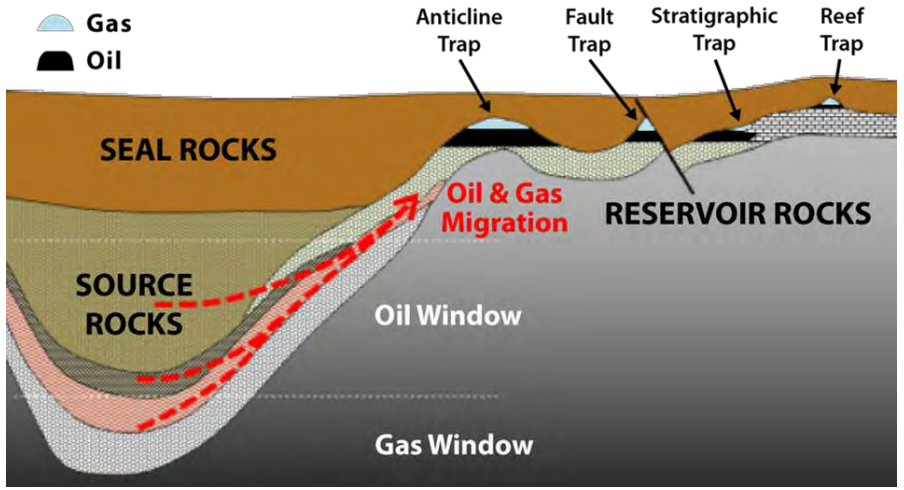
- The Liberian Basin Late Cretaceous *Slope Fan* reservoirs have a pernicious '***Achilles Heel***' vis a vis reservoir quality & effectiveness
- An argument to chase the Late K slope fans for novel billion-barrel oil fields cannot be sustained due to highly variable poro-perms
- A robust risk mitigation strategy for '*Reservoir Effectiveness*' is to forego the *Slope Fan* play in favour of the *Basin Floor Fan* (BFF) Play
- Robust global analogues, infer that Late Cretaceous (**K**) BFF have more effective reservoir properties vis a vis porosity & permeability
- Highly effective K BFF reservoirs are low risk targets across the CATM with recent B bbl discoveries offshore *Guyana/Cote D'Ivoire*
- Late K BFFs can be readily identified on 3D seismic data as they normally are comprised of high-quality reservoirs that display a large acoustic impedance contrast at the top and base/lateral seal boundary, making their trap geometry clear and distinct.
- Earliest Tertiary aged *Basin Floor Fans* are likewise robust exploration targets on account of their inferred *higher poro-perm* due to the reduced depth of burial and cementation.
- Cretaceous Basin Floor Fan plays (Aptian – Lwr Tertiary) typically have a distinct *AVO* response (*Class II/III*) that is strongly linked to their high porosity and permeability, making *their fluid response* visible in some special cases.

The Cretaceous Petroleum System

Source Rocks Presence & Quality



Biomarker Analyses GCMS Data - CATM (Guyana- West Africa)

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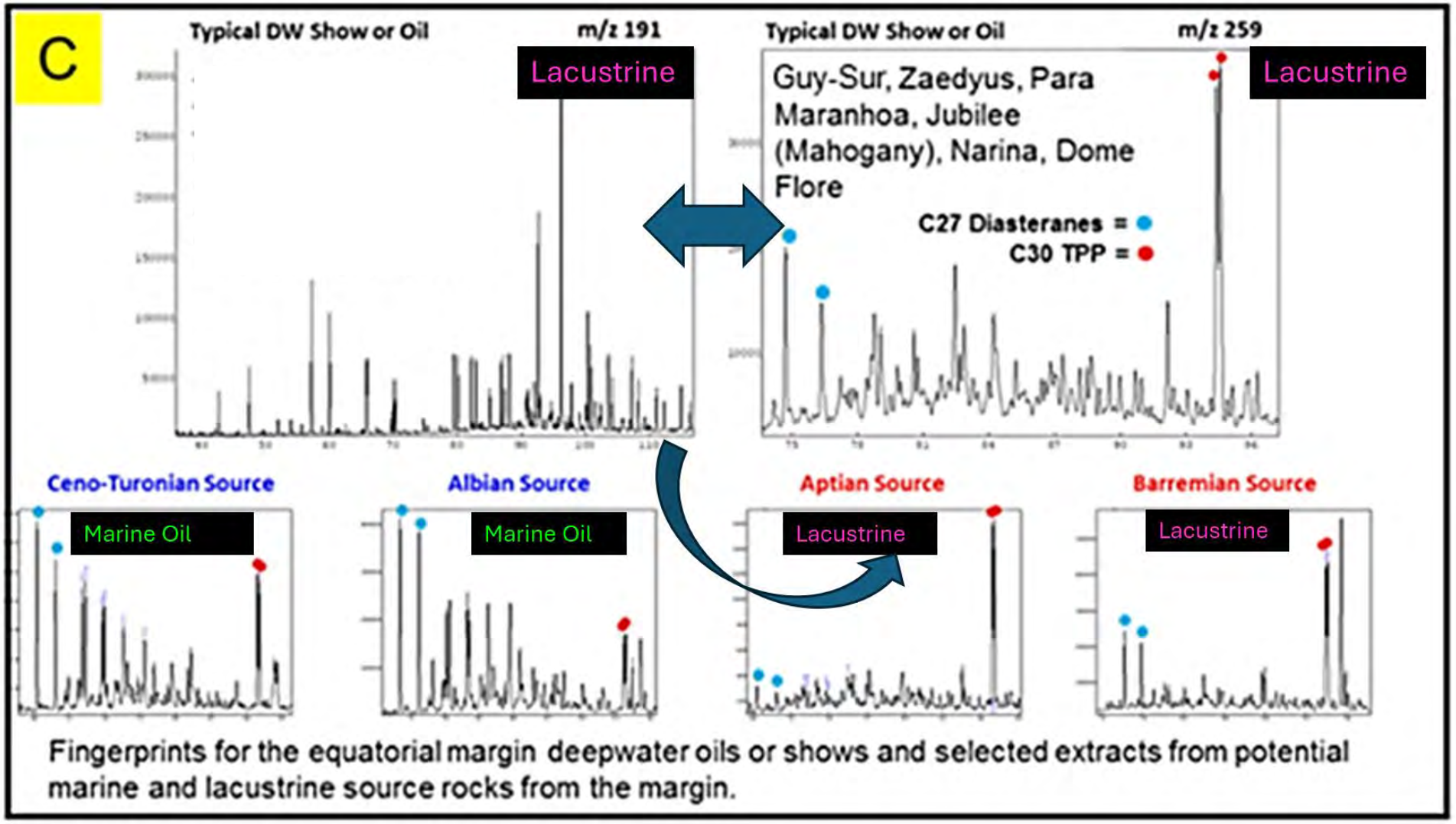
Turonian OAE II
Marine

Aptian OAE I
Lacustrine



Fingerprints for the equatorial margin deepwater oils or shows and selected extracts from potential marine and lacustrine source rocks from the margin.

Source Rock Evolution (CATM) Rift (Lacustrine) to Drift (Marine)

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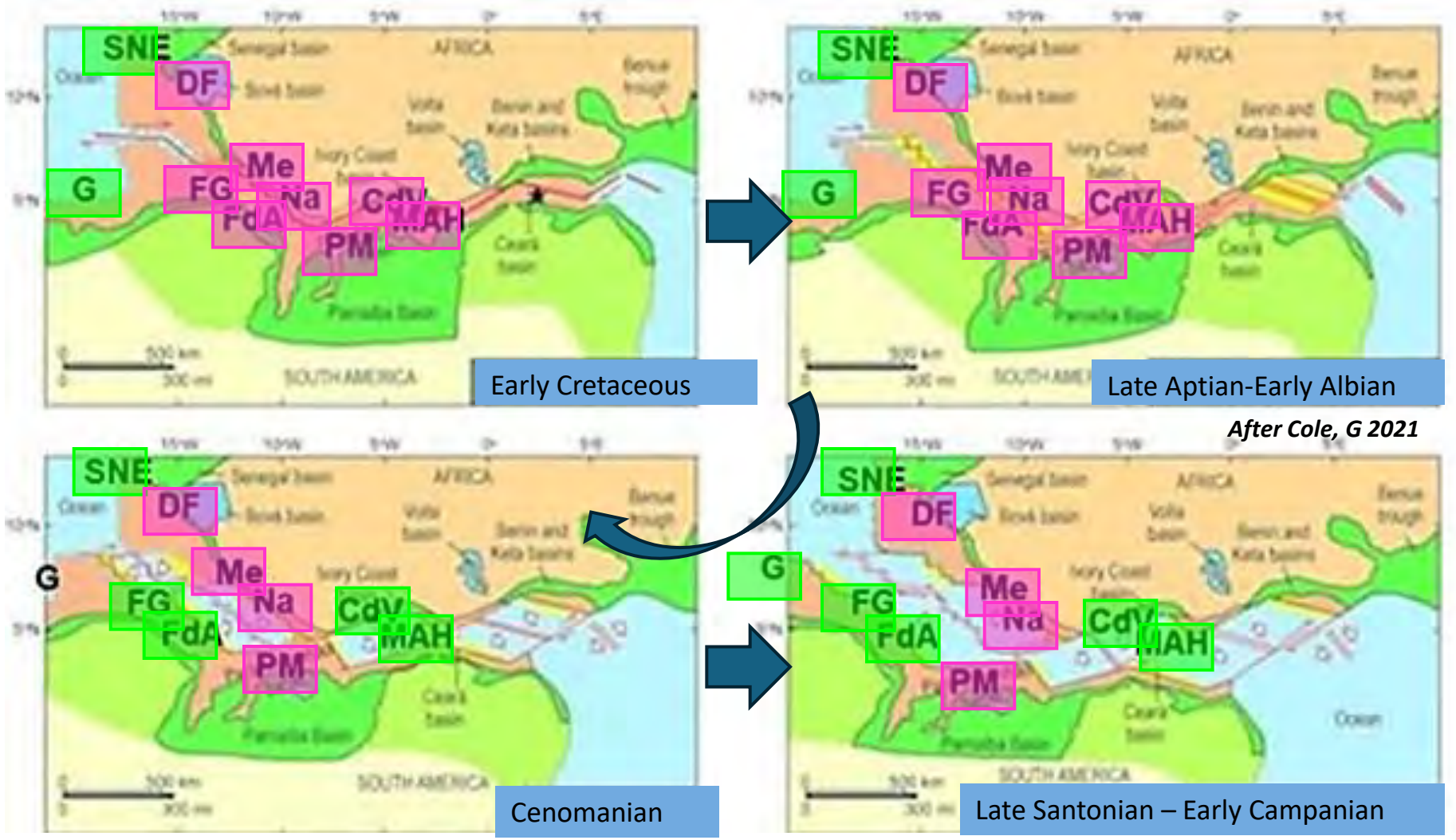
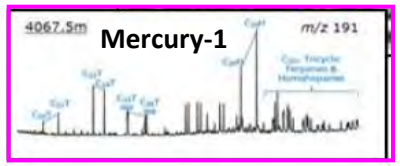


OAE I vs OAE II (CATM)

Jubillee Well (Ghana)

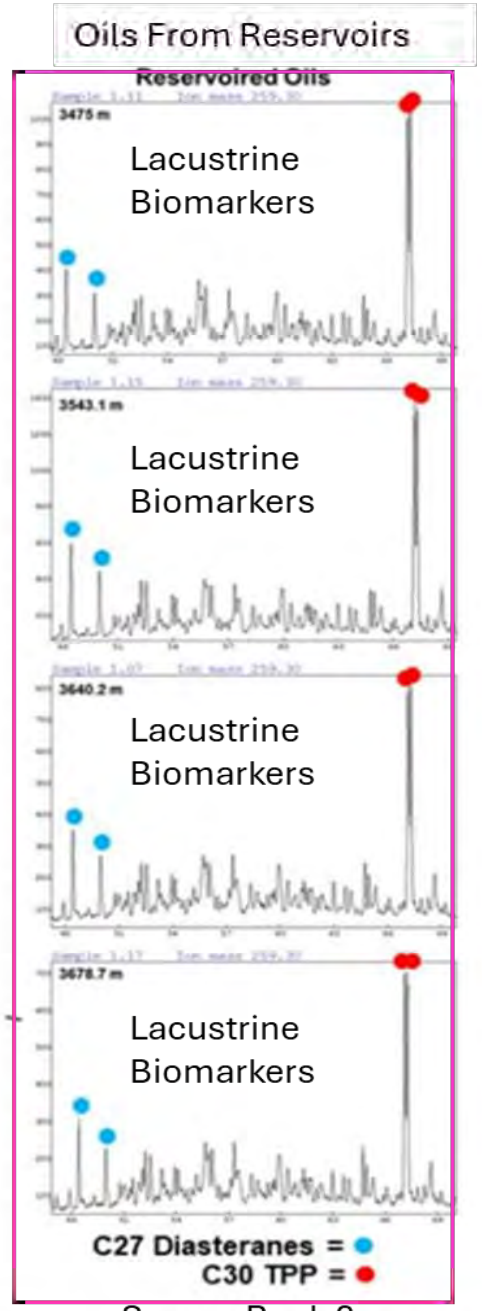
- Oil Reservoired within sands of the **Central Atlantic Transform Margin** Play (***CATM***) (Africa) is typically sourced from ***OAE I*** Source Rock (Lacustrine)
- Whilst 'Shows' in wells tend to be ***OAE II*** Marine Source Rock.
- Turonian Source Rock Extracts tend ***OAE II*** (Marine Source)
- **SNE-1** (Sangomar) Oil is ***OAE II*** (Marine Source)
- **Jubilee Oil-Field** is ***OAE I*** (Lacustrine Source).
- **Mercury-1** (Liberian Basin) Oil is ***OAE I*** (Lacustrine Source).

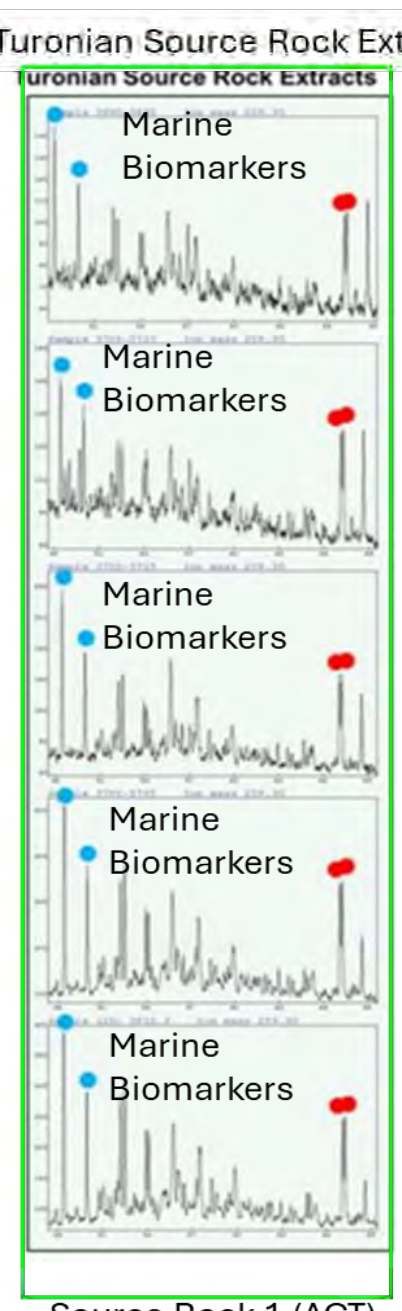


Oil in Mercury-1 has Lacustrine Biomarkers

Source rocks	Source type	Total Organic Carbon %	Hydrogen Index
Cenomanian–Turonian	Marine Type II shales	Up to 11%	482-795 mg/gTOC
Aptian–early Cenomanian	Type II and III lacustrine shales	5%	~560 mg/gTOC

er Cole, G 2021





Above oils overlie the Turonian source extracts from 3680 to 3812

Source Rock Geochemistry Offshore Liberian Basin

Mature Source Rock Evaluated via SWC's in Bee-Eater-1

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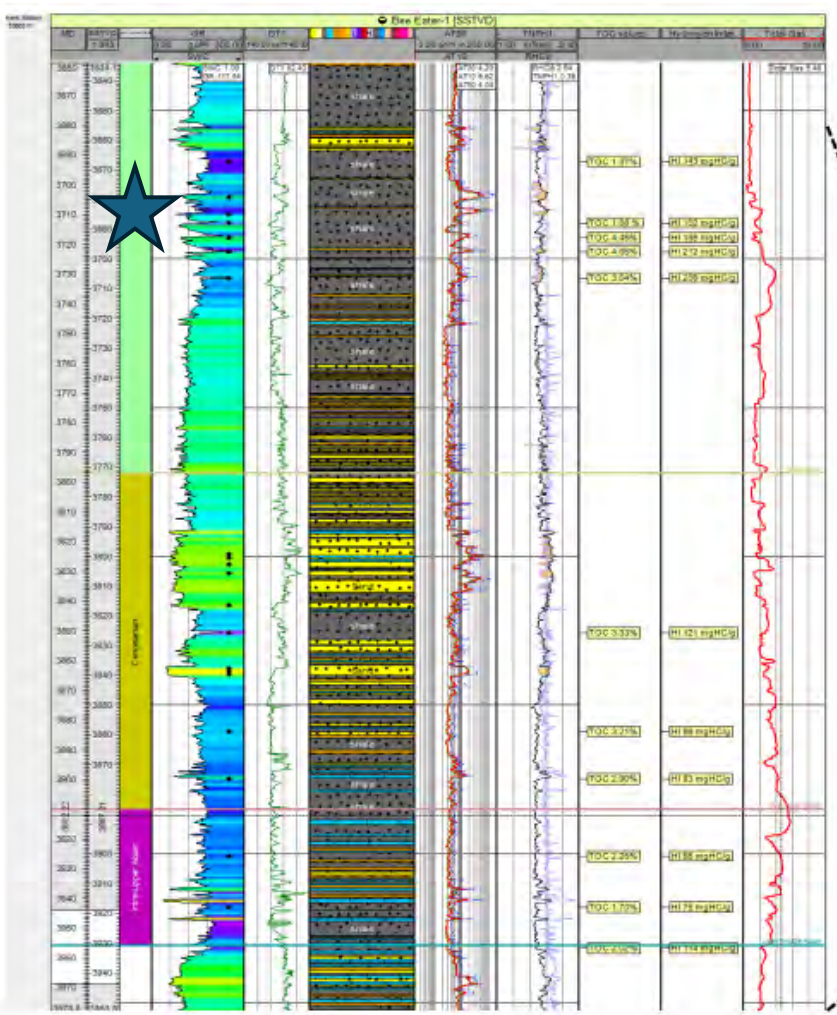
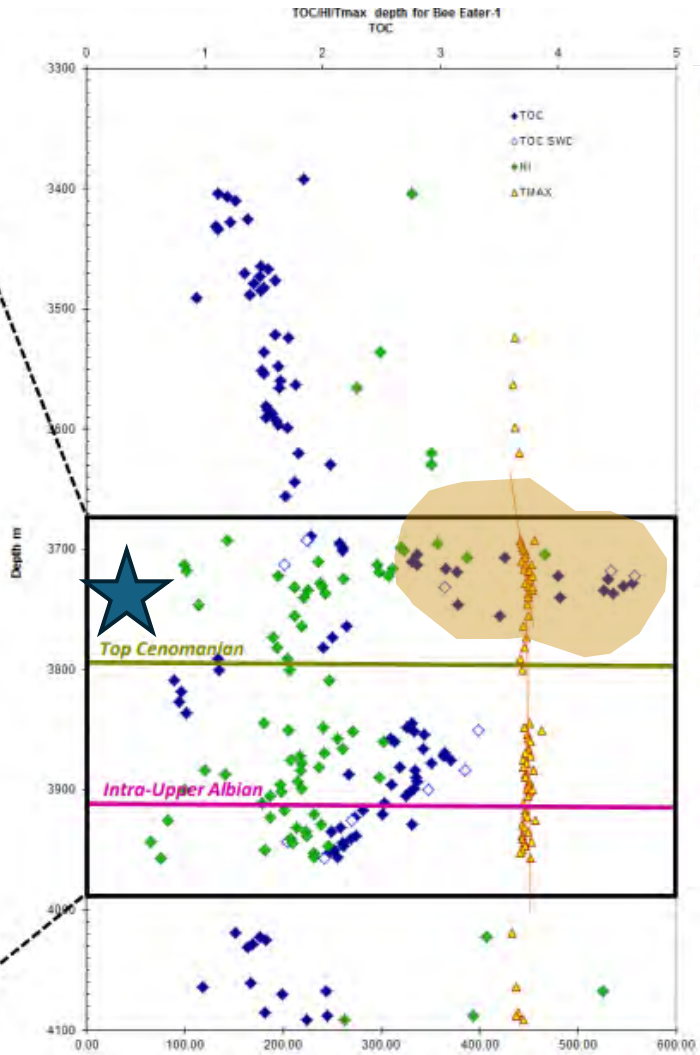
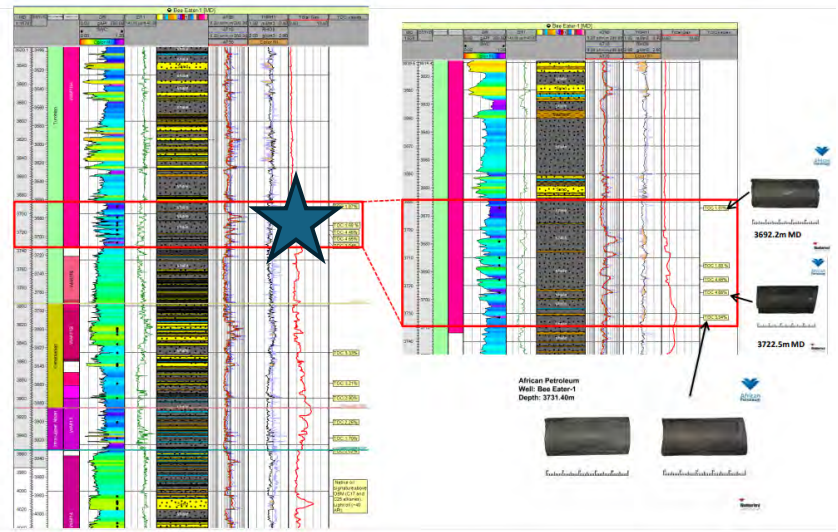
LIBERIA DEEP WATER LLC







Very high TOCs across the entire Cretaceous section in Bee-Eater-1 and also a physical sample of the mature source rock collected via SWC's (Tmax estimated at 460 degrees C)

Geochemical Characterization of Rocks and Fluids from Liberia and Sierra Leone Offshore.

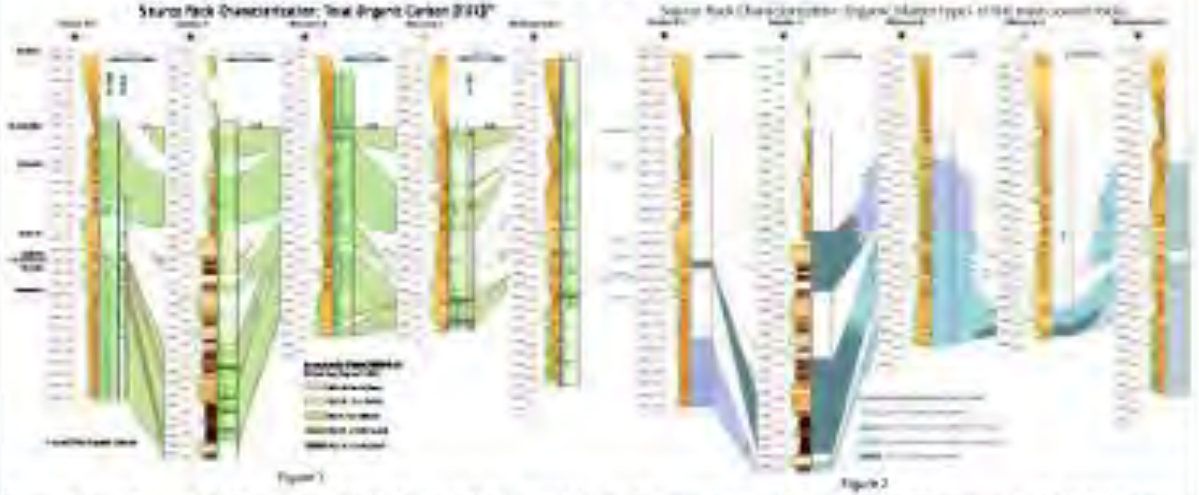
Tocco R.[1], Martínez Portí S.[1], Franques J.[2] and Franco A.[1]
[1]Repsol Exploration, Madrid, Spain; [2]Repsol Exploration, Houston, USA

oceanic-continental transition. A rapid sedimentation with important lithological contrasts and important water depth variations through time are characteristics of this margin. Volcanic intrusions and sub-aerial activity are known to have occurred during the basin evolution. Sierra Leone and Liberia basins are limited by the Sublima and Liberia plateaus. The Sublima plateau is the result of the intersection of the Sierra Leone TF and the African continental margin. The Liberia plateau is a basement high forming at the intersection of the North Atlantic and South Atlantic transform systems with the continental margin.

Objectives

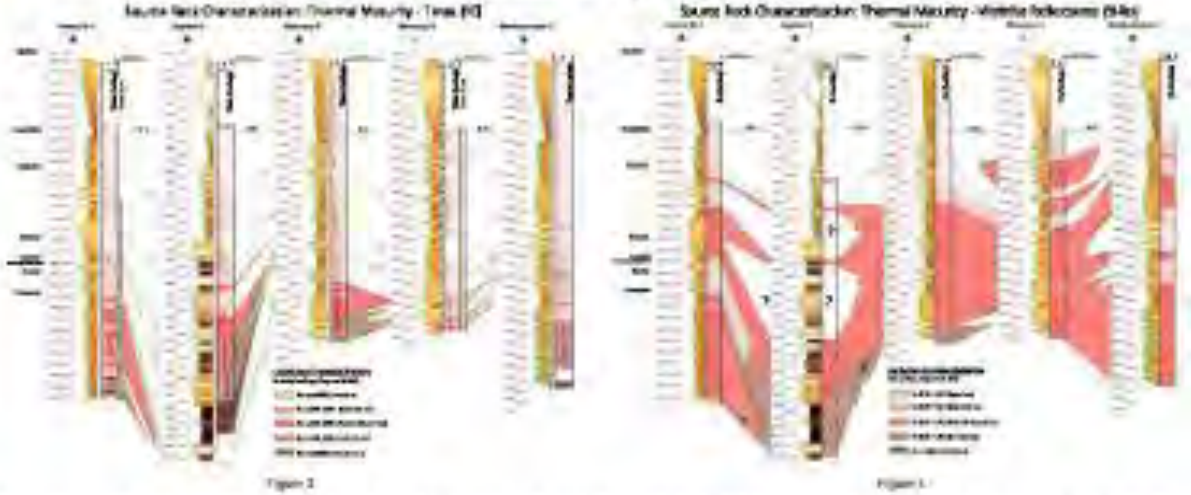
The objective of this study was to carry out the geochemical characterization of rocks, and fluids (oil and gas samples) from wells Montserrado-1 (Liberia) and Jupiter-1, Mercury-1, Mercury-2, Venus-1B (Sierra Leone). The geochemical evaluation of rock samples included Total Organic Carbon (TOC), Pyrolysis Rock-Eval, Visual Kerogen Analysis, Vitrinite Reflectance (Ro%) and Thermal Alteration Index (TAI). Gas samples were analyzed by Gas Chromatography and Isotopic Analysis, and oils/organic extracts were analyzed by Gas Chromatography (GC) and Gas Chromatography–Mass Spectrometry (GC-MS).

Rocks: TOC and Organic Matter Type



Campanian and Coniacian to Albian units show the best petroleum potential, based on organic matter richness (TOC). Effective source Rock thickness may increase towards the northwestern part of the studied area (wells Venus-1, Jupiter-1 and Mercury-2), based on TOC data (Figure 1). As Hydrogen Index (HI) is affected by maturity, the HI showed in the cross section represents the remaining mgHC/gTOC associated to the rocks. Turonian to Albian source rock quality (Type II Kerogen, marine) increases toward the northwestern part of the studied area (wells Venus-1 and Jupiter-1).

Rocks: Thermal Maturity (Tmax and %Ro)



Thermal maturity of Cenomanian to Albian rocks (mainly inferred from Vitrinite Reflectance-%Ro, Figure 4) increases towards the northwestern part of the studied area (wells Venus-1 and Jupiter-1). These sequences present an equivalent maturity to Peak Oil Generation to Late Mature.

https://www.searchanddiscovery.com/documents/2019/11203tocco/ndx_tocco.pdf

REPSOL Source Rock Study 2019

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Liquid Hydrocarbons: Well Mercury-1

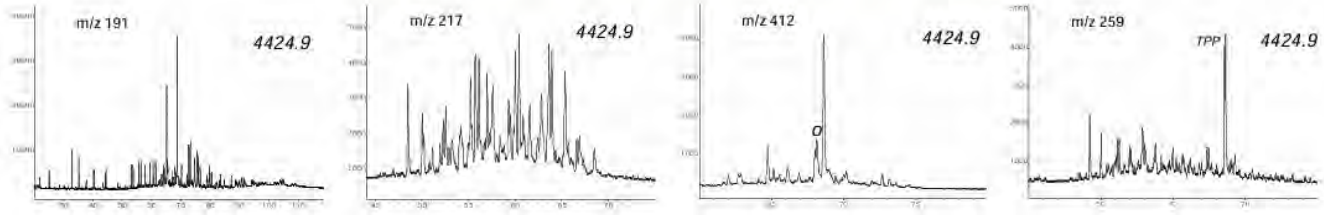

Figure 5 Figure 6

m/z 191 and m/z 217 chromatograms (Figure 5) indicate marine organic matter contributions for the source rock that generated the Mercury oils. Relative high concentration of diasteranes and low C29 nor-Hopane/C30 Hopane indicate fluids derived from clay-rich source rocks. The Mercury oils are characterised by the presence of the source and geological age specific marker oleanane (m/z 412, Figure 6). Oleanane are best preserved in deltaic rocks influenced by marine waters during early diagenesis. The oleanane/(oleanane+C30-Hop) ratio indicates probably Late Cretaceous source rock for these crude oils. Tetracyclic Polyprenoids (TPP) are highly specific for lacustrine organic matter input. Apparently, the Mercury oils have appreciable content of TPP (m/z 259, Figure 6). It is necessary to confirm the presence of TPP in these oils using GCMS/MS analysis (414->259). These results could indicate influx of freshwater algae in nearshore marine source rock settings or, input from nearshore shalow marine algae with chemistry similar to that found in lacustrine settings (Peters et al., 2005).

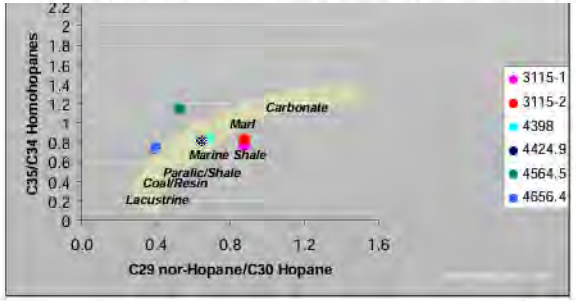

Figure 7

Shaly source rock lithology is indicated by the relatively low C29 nor-Hopane/C30 Hopane which is clearly below unity. The oils are characterized by a C35/C34 Homohopanes ratio < 1 (except oil 4564.5), which again indicates to shaly source lithology (Figure 7).

Crude Oils	Rc from 20S/20R	Ctemp (°C)	Rc from Ctemp
3115-1 (API° 23.2)	0.77	130	0.93
3115-2 (API° 23.2)	0.78	134	0.97
4398 (API° 45.3)	0.73	131	0.95
4424.9 (API° 33.4)	0.77	128	0.91
4564.5 (API° 35.3)	0.80	124	0.86
4656.4 (API° 36.2)	0.85	120	0.82

Figure 8

Ctemp (°C): maximum temperature of hydrocarbon expulsion (Mango, 1997).
Rc from Ctemp: vitrinite reflectance from maximum temperature of hydrocarbon expulsion.
Rc from 20S/20R: vitrinite reflectance inferred from sterane distribution.

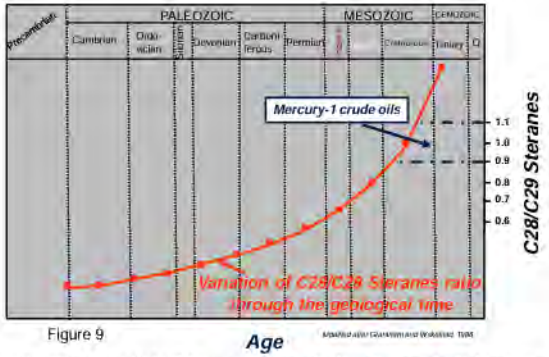

Figure 9

Mercury oils are associated to a mature shaly source rock (marine shale) probably of Late Cretaceous age .

The light hydrocarbon based maturity (Rc: 0,82-0,97) is higher than the value that is based on the sterane Isomerisation (Rc: 0,73-0,85). However, expulsion temperatures over 130°C are typical for condensates samples and the Mercury oils are originally light oils (33-36°API).

It is possible that differences between light-hydrocarbon and biomarker parameters reflect mixing of light and heavy hydrocarbon components of differing thermal maturities (Peters et al., 2005). These differences could be the result of a less mature and more mature source rock have expelled hydrocarbons that observed in the Well Mercury-1. A possibility is that one source rock which is characterised by a continuously increasing maturity could have generated the Mercury oils.

Gases: Wells Venus-1, Mercury-1 and Mercury-2

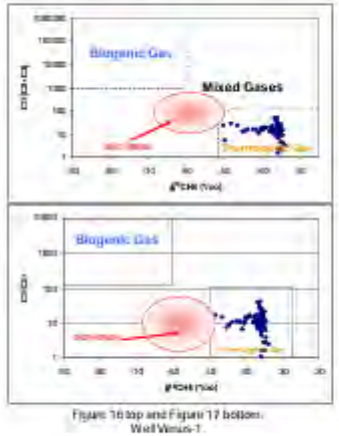

Figure 16 top and Figure 17 bottom
Well Venus-1

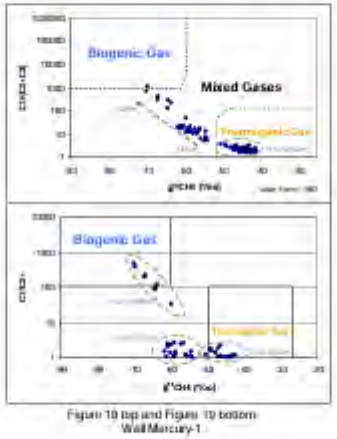

Figure 18 top and Figure 19 bottom
Well Mercury-1

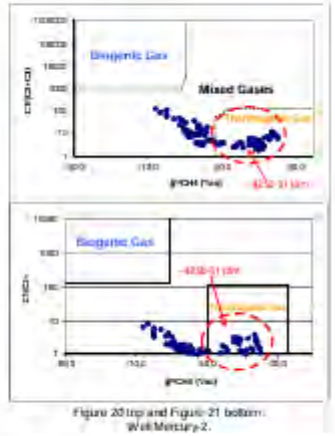

Figure 20 top and Figure 21 bottom
Well Mercury-2

Thermogenic gas was identified in the deeper part of the Well Venus-1B (4050-5630m) (Figures 16 and 17), at 4180-4850m in the Well Mercury-1 (Figures 18 and 19), below ~4250m in the Well Mercury-2 (Figures 20 and 21).

Gases: Wells Jupiter-1 and Montserrado-1

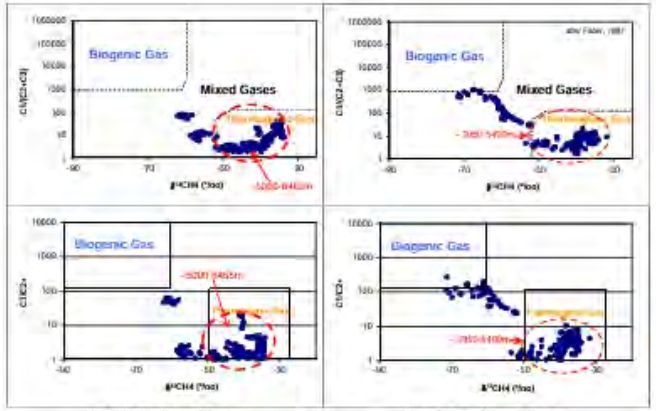

Figure 22 top and Figure 23 bottom
Well Jupiter-1

Figure 24 top and Figure 25 bottom
Well Montserrado-1

Thermogenic gas was identified below ~5000m in the Well Jupiter-1 (Figures 22 and 23). Important thermogenic contributions in the total hydrocarbon gas from the middle-deeper part (~3800m) of the Well Montserrado-1 were observed (Figures 24 and 25). The thermogenic component is mainly oil-condensate associated gas.

REPSOL Source Rock Study 2019 - Summary

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LIBERIA DEEP WATER LLC

ABSTRACT

The study area is a portion of the South Atlantic passive margin, implying a complex thermal history (rifting), located at the oceanic continental transition. A rapid sedimentation with important lithological contrasts and important water depth variations through time are characteristics of this margin. Volcanic intrusions and sub-aerial activity are known to have occurred during the basin evolution. Sierra Leone and Liberia basins are limited by the Sublima and Liberia plateaus. The Sublima Plateau is the result of the intersection of the Sierra Leone TF and the African continental margin. The Liberia Plateau is a basement high formed at the intersection of the North Atlantic and South Atlantic transform systems with the continental margin. The objective of this study was to carry out the geochemical characterization of rocks, and fluids (oil and gas samples) from the wells Montserrado-1 (Liberia) and Jupiter-1, Mercury-1, Mercury-2, Venus-1B wells (Sierra Leone). The geochemical evaluation of rock samples included Total Organic Carbon (TOC), Pyrolysis Rock-Eval, Visual Kerogen Analysis, Vitrinite Reflectance (Ro%), Thermal Alteration Index (TAI), and Pyrolysis-GC. Gas samples were analyzed by Gas Chromatography and Isotopic Analysis, and oils/organic extracts were analyzed by Gas Chromatography (GC) and Gas Chromatography–Mass Spectrometry (GC-MS). Campanian and Coniacian to Albian units show the best petroleum potential based on organic matter richness (TOC). Turonian to Albian source rock quality (Type II Kerogen, marine) increases toward the northwestern part of the studied area (in Venus-1 and Jupiter-1 wells). Maturity of Cenomanian to Albian rocks increases towards the northwest. These sequences present a maturity that ranges between the peak oil generation to late mature. Thermogenic gas was identified in the deeper part of the Venus-1B Well (4050-5630 m), at 4590-4850 m in the Mercury-1 Well, below ~440 0m in the Mercury-2 Well, and below ~5000 m in the Jupiter-1 Well. Important thermogenic contributions in the total hydrocarbon gas from

the middle-deeper part of the Montserrado-1 Well were observed (from ~3800 m). The thermogenic component is mainly oil-condensate associated gas. Different biomarker ratios support oil-oil correlations for Mercury-1 oils, indicating one genetically related petroleum system. The source rock that generated these oils is characterized by high marine organic matter contributions. Analyzed organic extracts at 4564 m and 4568 m in the Mercury-2 Well show mixed organic matter with significant mature terrestrial organic matter input. Mercury oils are associated with a mature shaly source rock (marine shale), probably of Late Cretaceous age.

Source rocks	Source type	Total Organic Carbon %	Hydrogen Index
Cenomanian–Turonian	Marine Type II shales	Up to 11%	482-795 mg/gTOC
Aptian–early Cenomanian	Type II and III lacustrine shales	5%	~560 mg/gTOC

https://getech.com/blog/petroleum/challenging-current-thinking-on-deep-water-petroleum-system equatorial-atlantic-margin-sierra-leone-how-integrated-studies-help-to-reduce-exploration-risk/

Conclusions

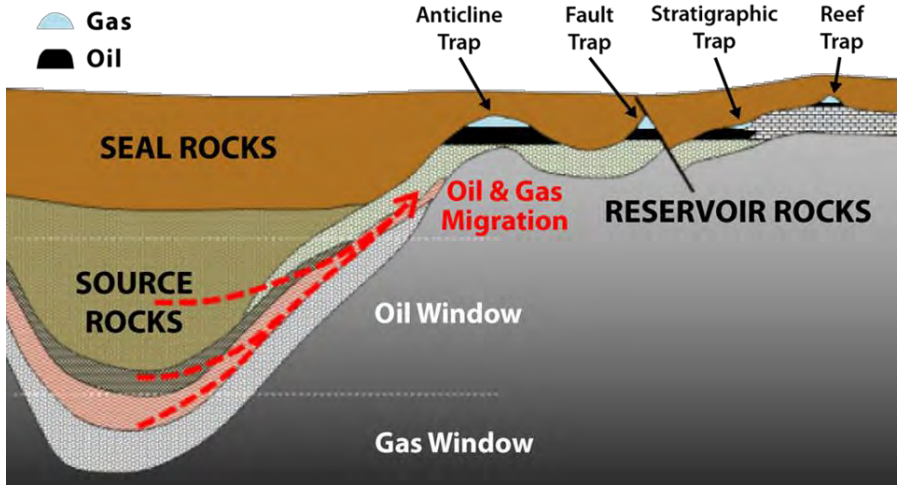
Campanian and Coniacian to Albian units show the best petroleum potential, based on organic matter richness (TOC). Effective source rock thickness may increase towards the northwestern part of the studied area (wells Venus-1, Jupiter-1 and Mercury-2), based on TOC data. Turonian to Albian source rock quality increases toward the northwestern part of the studied area (wells Venus-1 and Jupiter-1). Type II organic matter (marine) increases in this area. Thermal maturity of Cenomanian to Albian rocks (mainly inferred from Vitrinite Reflectance-%Ro) increases towards the northwestern (wells Venus-1 and Jupiter-1).

Different biomarker ratios support oil-oil correlations for Mercury-1 oils indicating one genetically petroleum system. The source rock that generated these oils is characterized by high marine organic matter contributions. Apparently, the Mercury-1 oils have appreciable content of TPP. Tetracyclic Polyprenoids (TPP) are highly specific for lacustrine organic matter input. For future works, it is necessary to confirm the presence of TPP in these oils using GCMS/MS analysis (414->259). Analyzed organic extracts at 4564m and 4568m in the Well Mercury-2 show mixed organic matter with significant mature terrestrial organic matter input. Mercury oils are associated to a mature shaly source rock probably of Late Cretaceous age.

Gas analyses from deeper part of all wells are thermogenic in origin.

The Cretaceous Petroleum System

Reservoir Rocks Presence and Quality



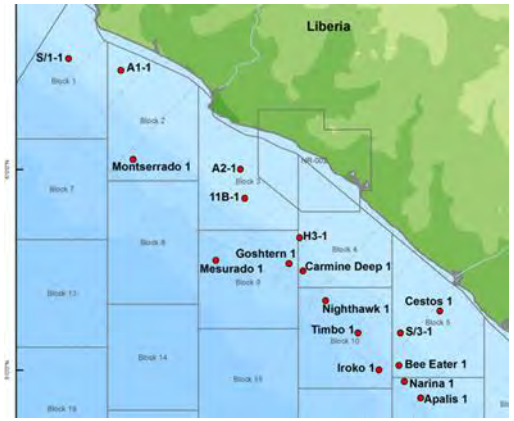
Liberian Basin - Reservoir Presence & Effectiveness

LPRA sponsored Core Lab Report -17 Wells - Liberian Basin

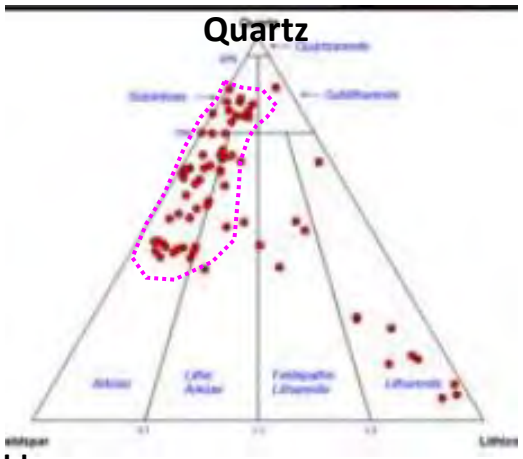
PETROQUEST
LIBERIA DEEP WATER LLC

Reservoir is a key risks for the Liberian Basin and whilst multi-storey stacked reservoirs (80-150 m thick) are nearly always present, in the Campanian, Turonian Santonian and Aptian/Albian *the effectiveness (porosity and permeability) of those reservoirs does widely vary*, depending on: *provenance*, grain size, facies, reworking, depth of burial and diagenesis.

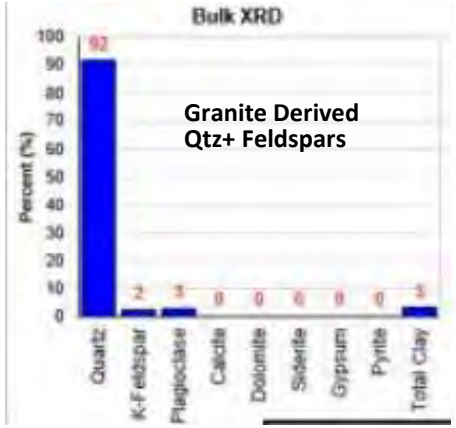
1) The facies of Late Cretaceous Sands is typically deep marine channel or slope fan. Whilst those in the Albian are shallow marine
2) Grain size, typically varies from massive, coarse-grained sands to medium grained sandstones
3) Petrography/Composition, varies from well sorted mature quartz arenites to poorly sorted mature quartz dominated arkoses.
4) Sand provenance is largely from granitic/gneiss dominant terrain for both the early and late K reservoirs.
5) Local reworking of the older early cretaceous sands is clearly evident in the late Cretaceous sands.
6) Reservoir quality decreases with depth of burial via compaction and loss of porosity and permeability
7) Petrographic studies show clear evidence for the deposition of various cements, quartz over-growths and clay mineral diagenesis



Classification



Composition



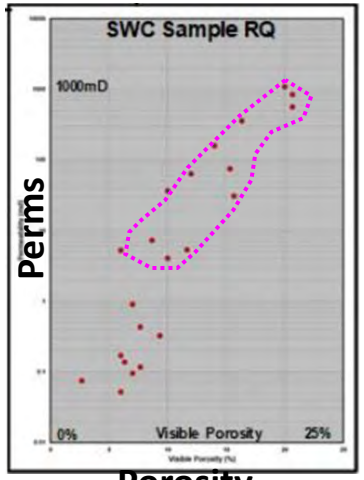
Cementation

4650.2m: Moderately well sorted, laminated muddy sandstone. Strong cementation mainly by quartz overgrowths & clays

Core Analysis Data:
Porosity (%)*: 14.11
Permeability (md)*: 0.003
Gr. Density (g/cc): 2.705

Quart overgrowth and Kaolinite mineralisation leads to cementation and loss of permeability!

Reservoir Properties



Source to Sink Liberian Basin: Late Cretaceous & Lwr Tertiary

Reservoir Provenance and Composition - Offshore Liberia

PETROQUEST LIBERIA DEEP WATER LLC

- For Reservoir Presence and composition, it's important to address the source to sink model for the Liberian Basin. Where source in this case means sedimentary constituents as products of both erosion and transport.
- Source and therefore Reservoir Provenance is the Granitic and Gneiss prone terranes of Precambrian West African Shield which in their current exposed expression are devoid of any remaining Neoproterozoic sedimentary cover which has been un-roofed. The timing of this unroofing is important!
- It's possible that much of that cover was likely removed during the syn and earliest post rift so maybe compositionally richer sandstones lie somewhere in the Cretaceous section.
- Slope fan penetrations offshore Liberian Basin suggest that sandstones are typically sub-Arkose and compositional contain quite a lot of Feldspar
- Such compositions favour the precipitation of both early calcite and quartz cements that have a significant bearing on reservoir effectiveness by the occlusion of primary poro-perm.

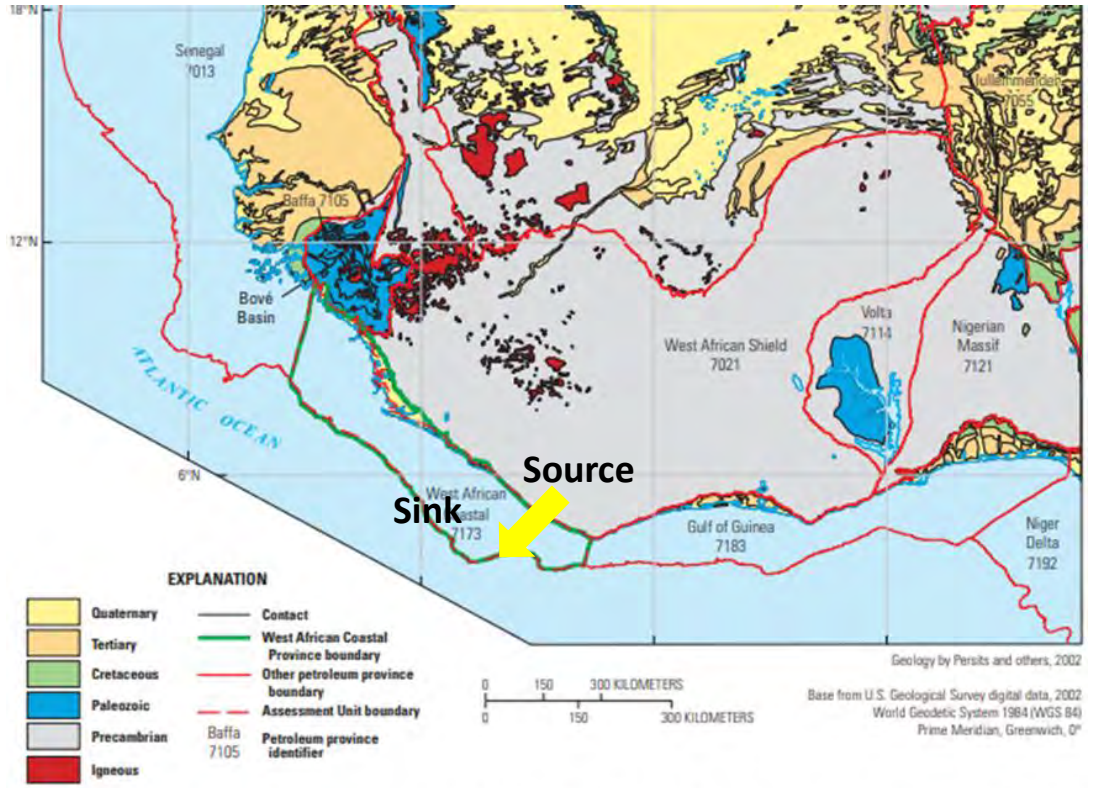
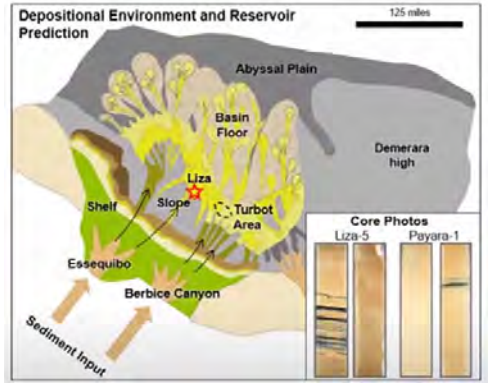


Figure 4. Generalized geology of west Africa (from Persits and others, 2002), showing province boundaries and 13 province names and codes as defined by Klett and others (1997).



Mitigation

BFF Sand Reservoirs offshore Liberia may be very similar to their Guyana counterparts and thus will make excellent reservoirs with 100-400 mD permeability and 16-20 porosity.

Source to Sink Model For Liberian Basin

Source to Sink Liberian Basin: Late Cretaceous & Lwr Tertiary

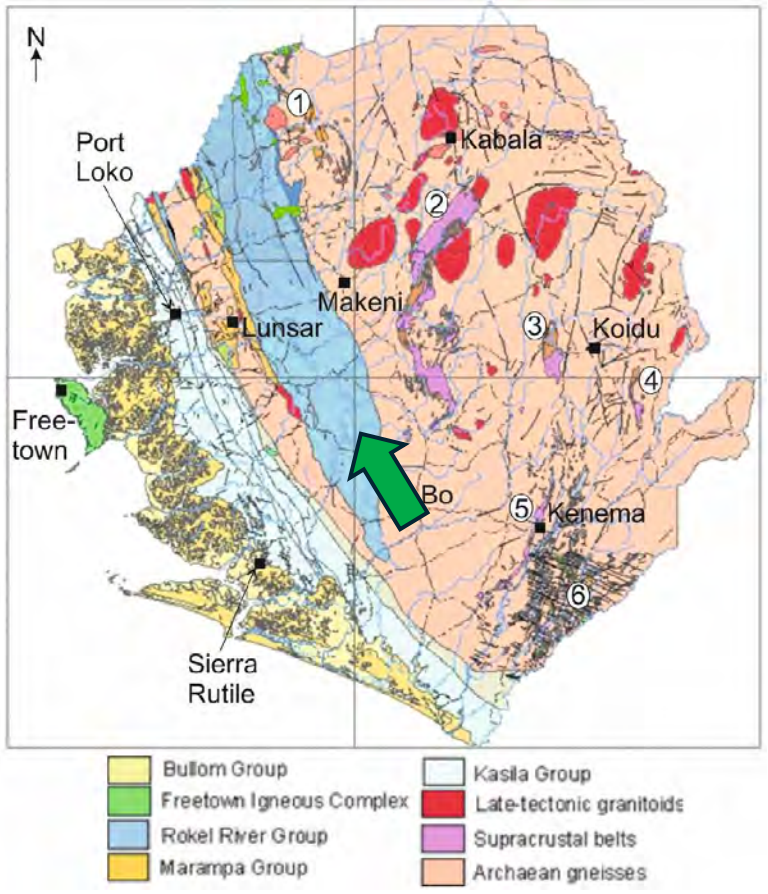
Reservoir Provenance and Composition - Offshore Sierra Leone

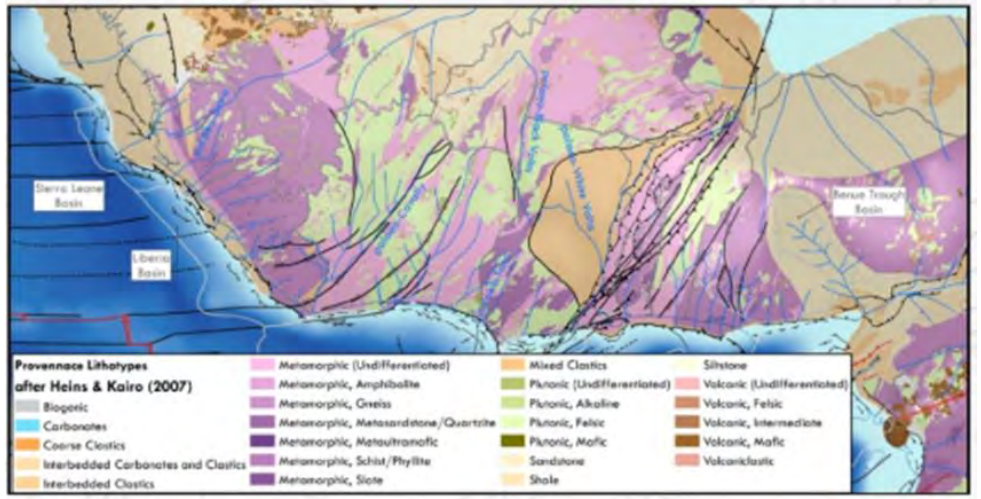
PETROQUEST
LIBERIA DEEP WATER LLC

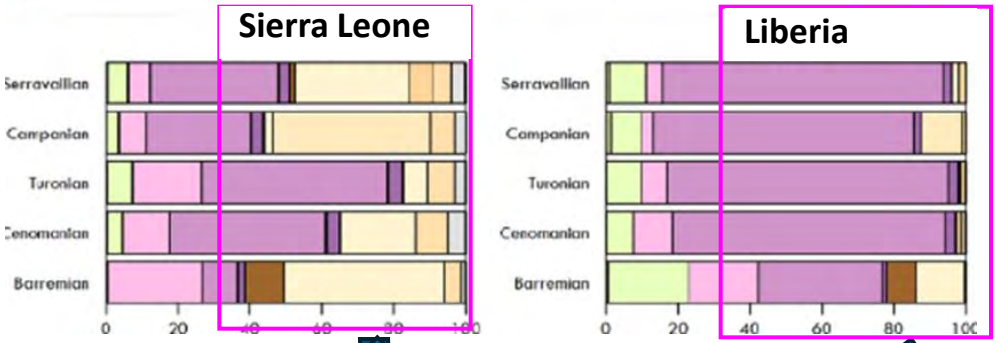
Rokel River Group present which is dominated by Neoproterozoic sandstones.

The Taban Formation in particular consists of coarse grained, well sorted fluvial (high flow regime) reservoirs.

Slightly reduced source to sink risk in the northern part of the Liberian Basin due to the un-roofing of the extensive sandstones of the Rokel River Group.



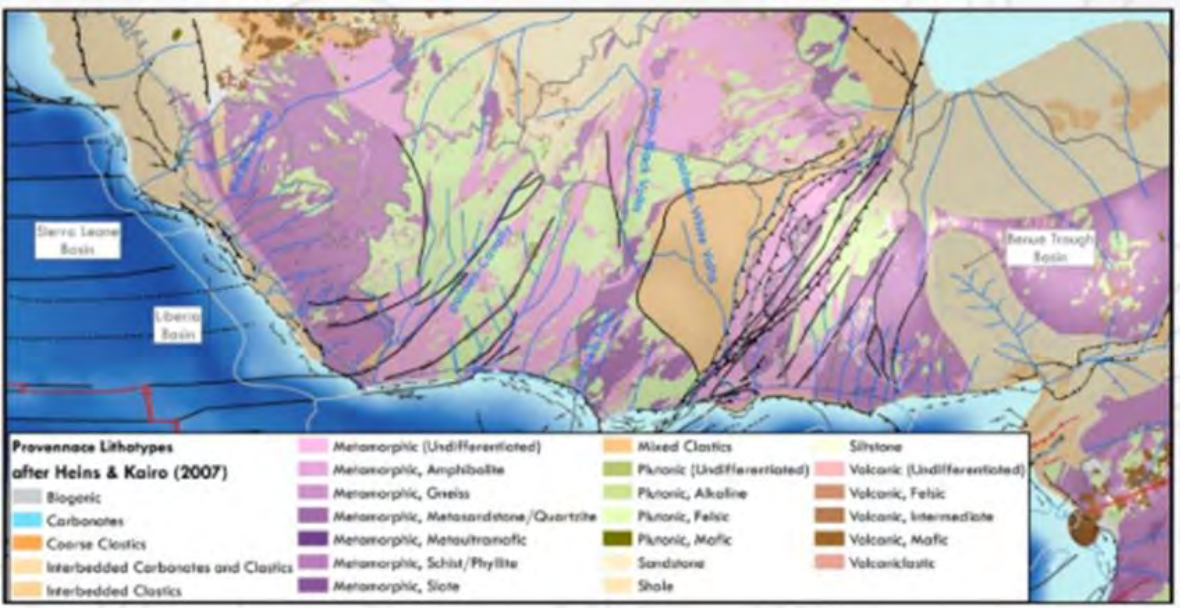


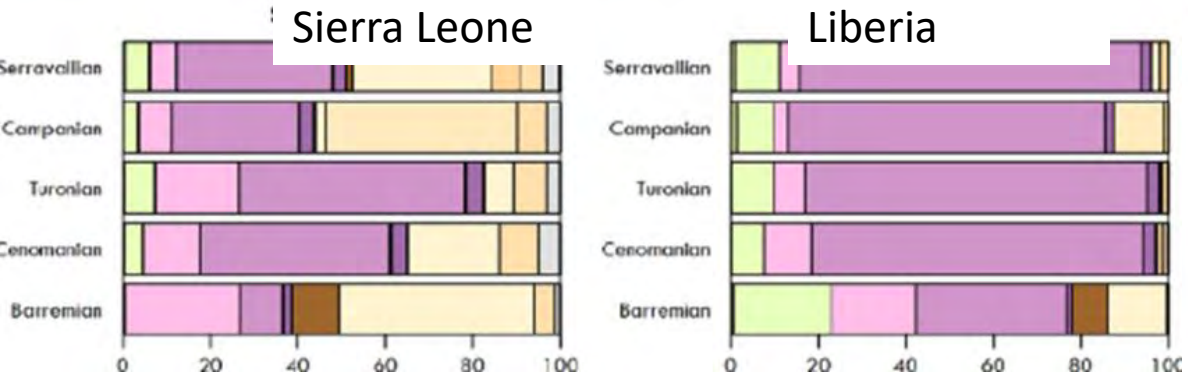


Rokel River Group mainly sandstone facies of marine and glacial origin. High net to gross sand intervals

More Sand less Feldspars

Source to Sink Reservoir Effectiveness Risk & Un-Roofing





More Sst
Neo Proterozoic

Less Sst
Neo Proterozoic

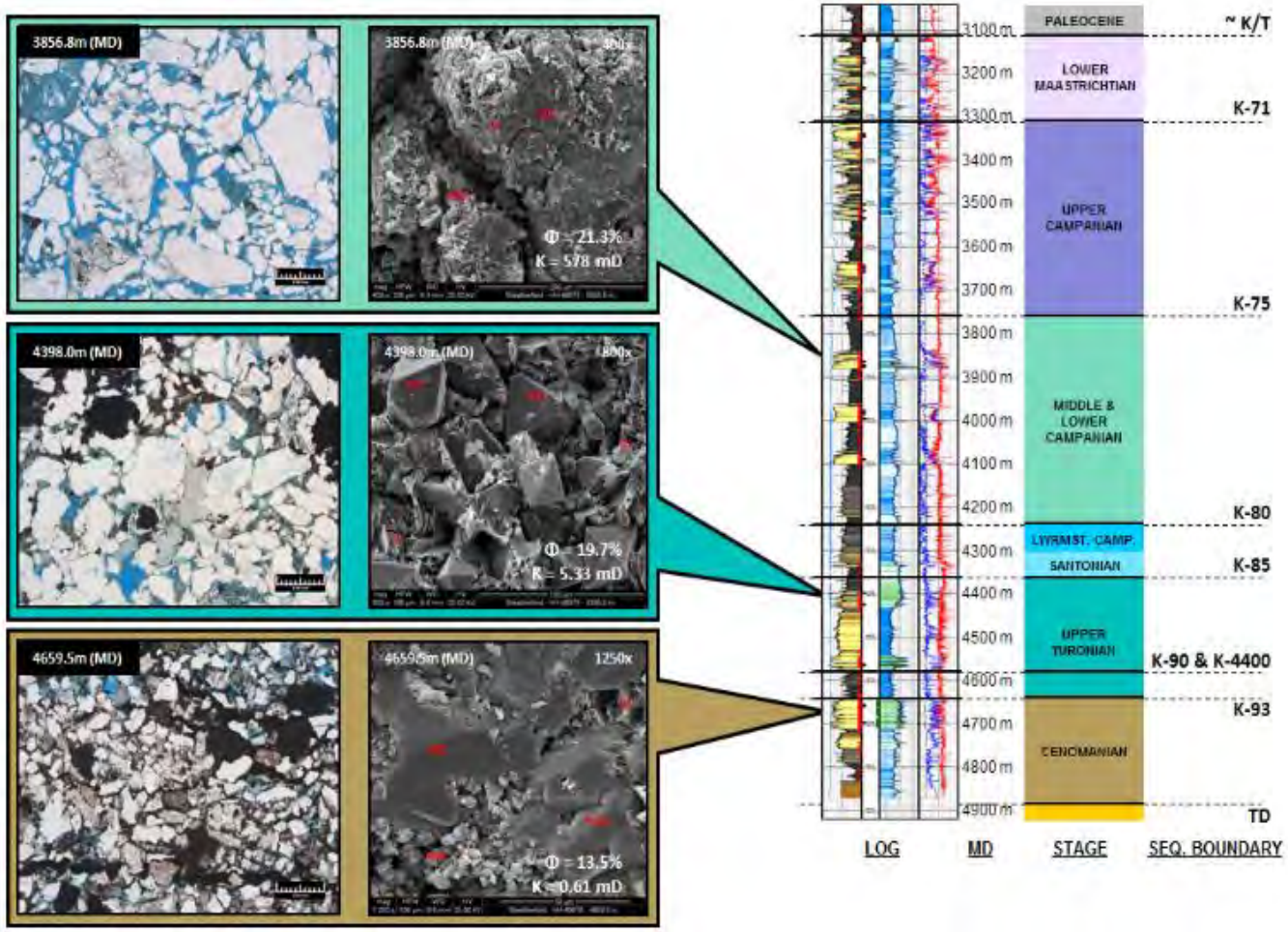


Figure 4: Thin section and SEM photomicrograph of Upper Cretaceous reservoirs with kaolinite offshore Sierra Leone

Great opportunity For Chemostrat Work to assist with Provenance Studies

Source to Sink – Guyana (Granitic, Gneiss & Neoproterozoic Sst)

Roraima Group

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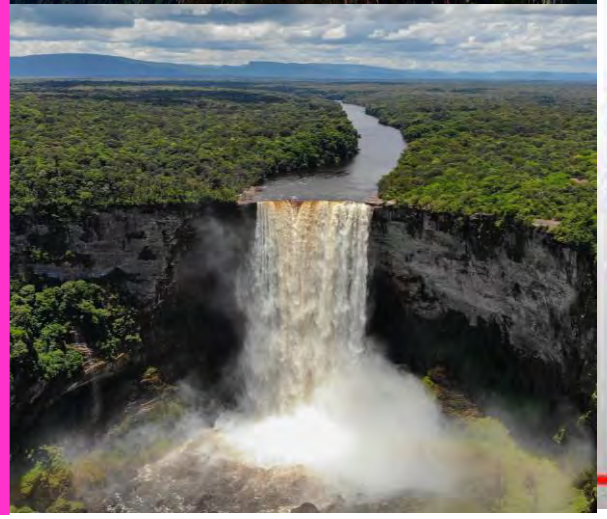

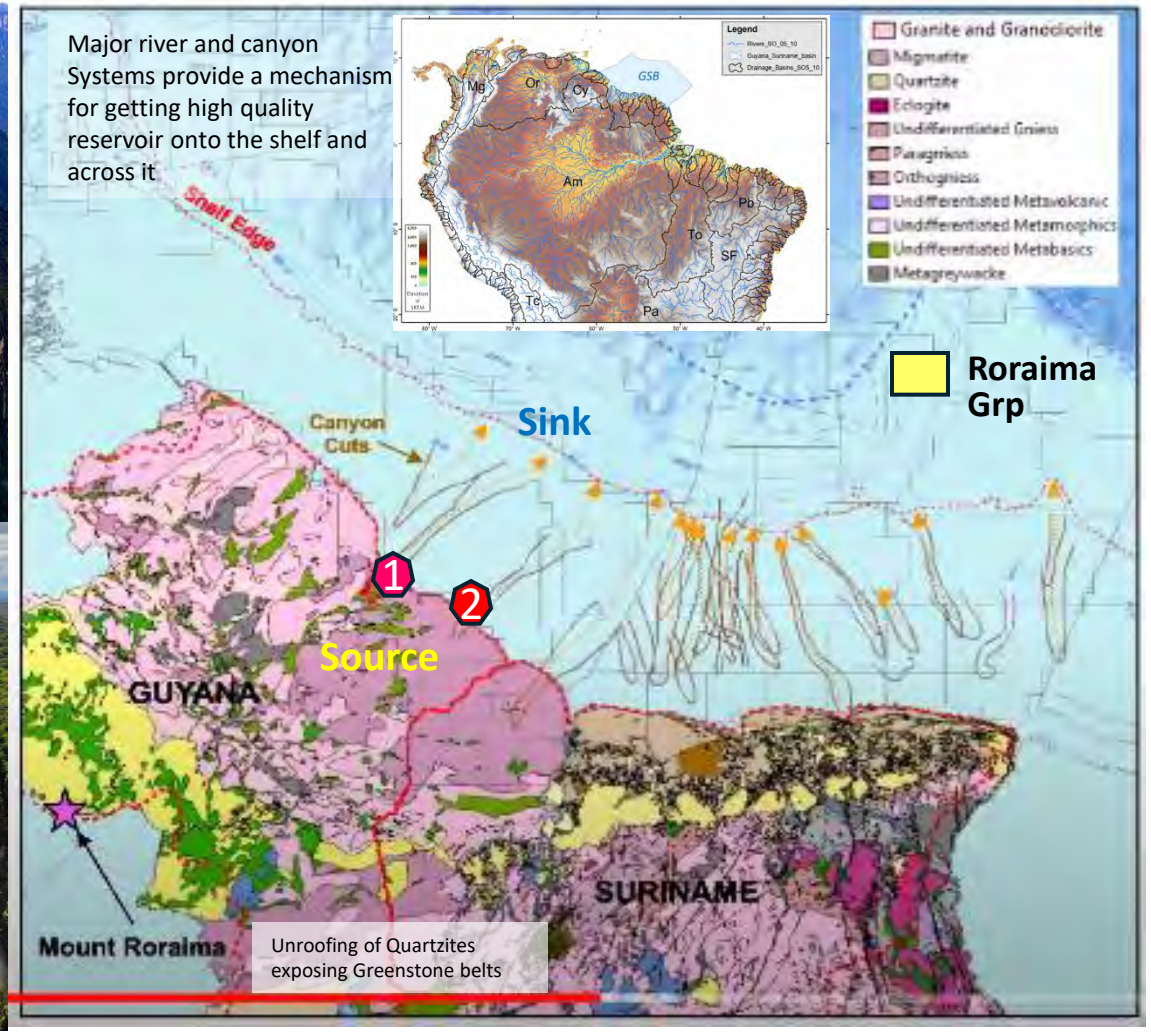

Source to Sink Analogue :Guyana Granitic, Gneiss & Proterozoic Sst

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- The key Cretaceous oil reservoirs offshore Guyana belong to three groups;
- A old, Lower Cretaceous group of mixed fluvial and marginal marine sandstones.
- A high quality Upper Cretaceous Turonian-Santonian sequence of deep water turbidites.
- A younger, poorer quality sequence of Conacian – Maastrictian group of turbidites.
- An un-roofing model of the onshore hinterland explains the differences.
- The older texturally mature reservoirs represent unroofing of Proterozoic sandstones (quartz arenites) and conglomerates of the Roraima Group, whilst the younger;
- Poorer quality reservoirs result from the unroofing of an older igneous (Greenstone) terrane that comprises a mix of shales and igneous material that is poor in quartz compositionally.
- The older (Turonian) quartz rich sediments retain reservoir properties with deep burial below the mud-rock line (BML) and provide excellent reservoirs that are observed within the Liza, Payara and Yellowtail oil fields.
- Whereas the younger reservoirs loose reservoir quality upon deep burial (BML) on account of the presence of clay minerals, leading to texturally and mineralogical less mature reservoirs with lower reservoir quality.
- Changes in the drainage patterns (river capture) provide both temporal and spatial directional changes in sediment input, especially through the two major conduits; namely the Berbice (1) and Essequibo (2) Canyon systems that form failed rift arms of the Atlantic opening.
- Lwr Cretaceous Stabroek Fm sands have not yet been drilled on the paleo-shelf

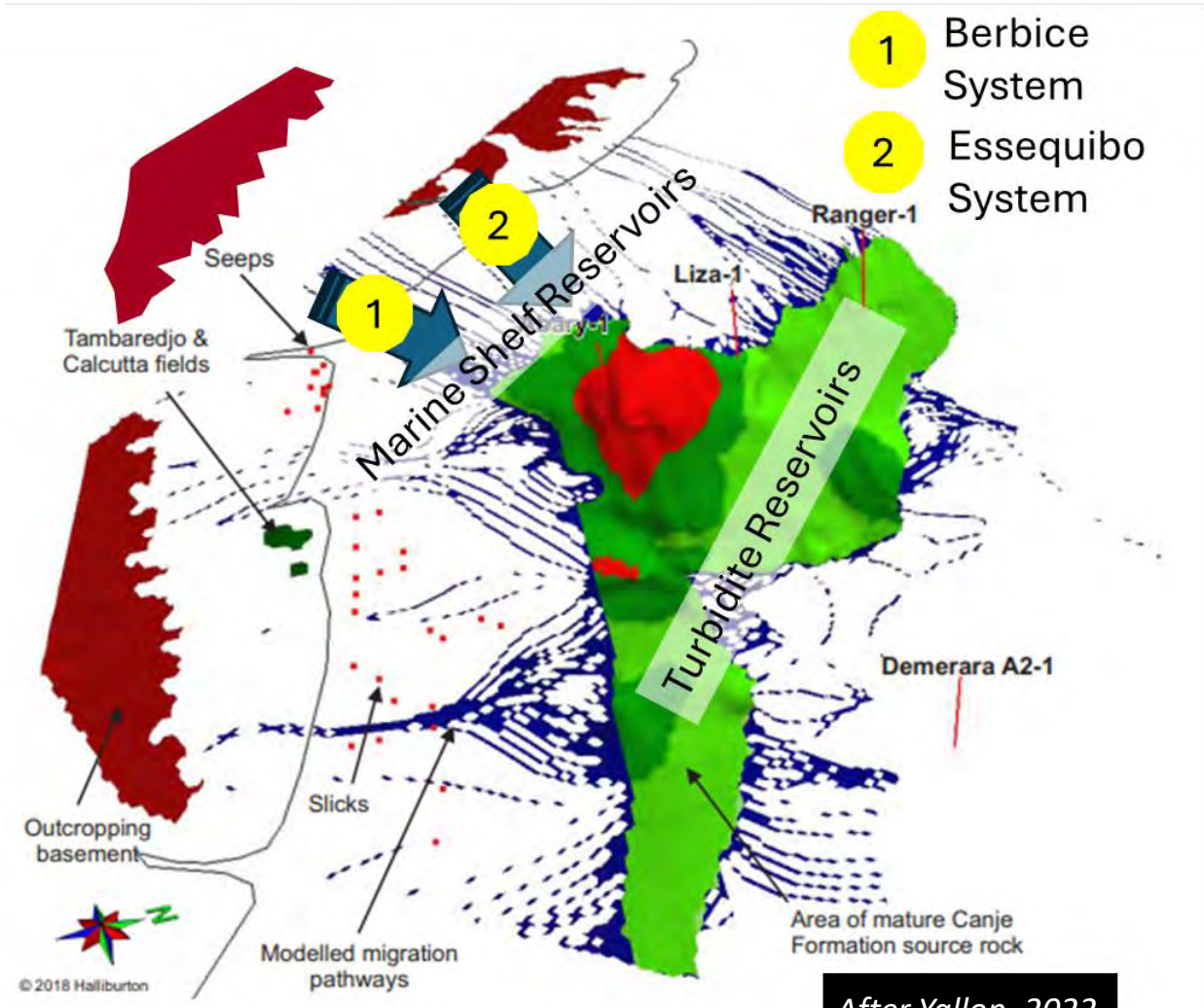

Figure 4 > A kitchen map for the Canje Formation source rock in the Guyana-Suriname Basin.

After Yallop, 2022

Good Quality Upper Cretaceous Reservoirs (Narnia-1)

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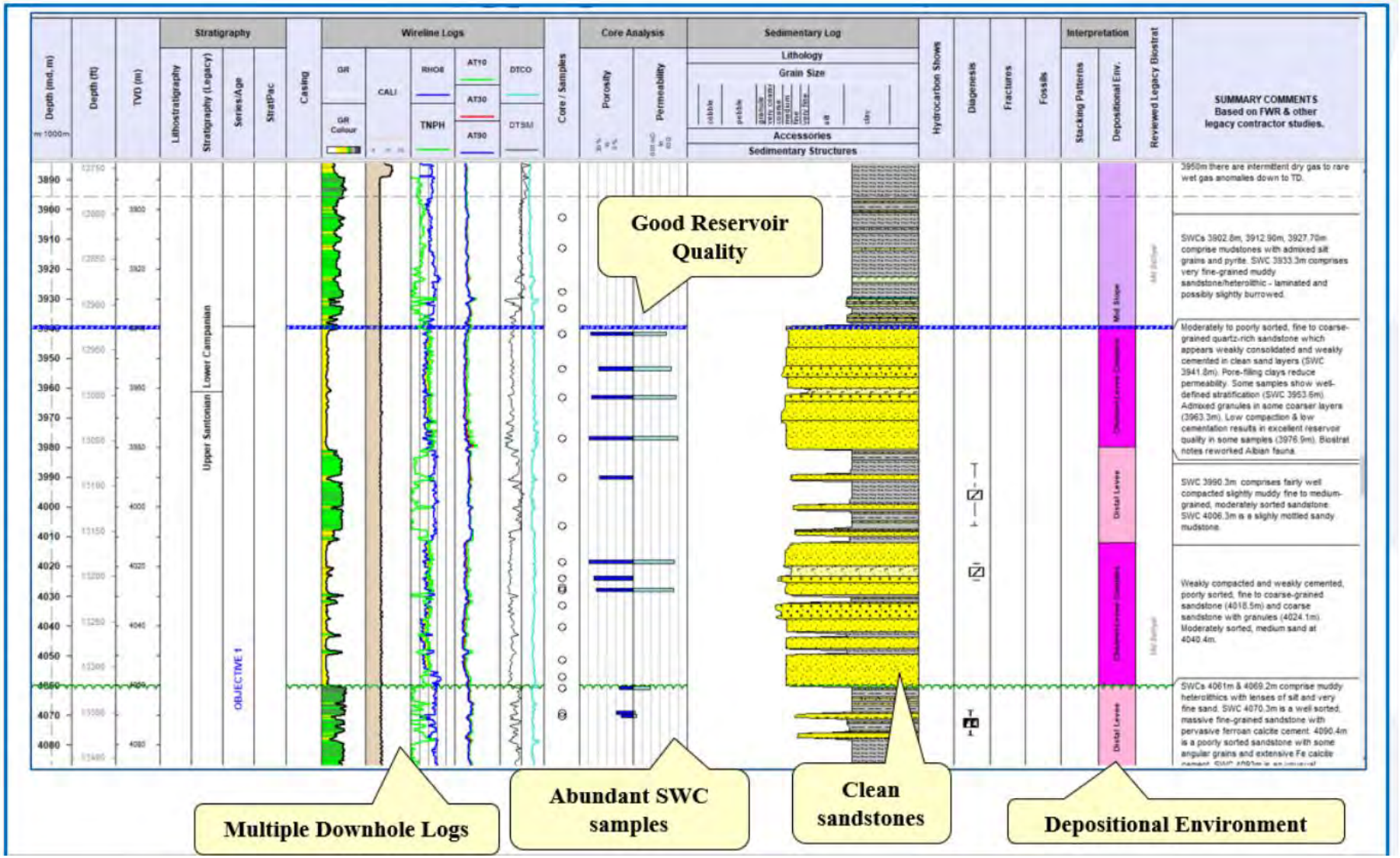
- High Quality Late K reservoirs + 90 m thick.
- Good poro-perms up to 20 % porosity and 100's mD perms
- Some reservoir units are visibly uncemented and unconsolidated.
- Some units are poorly sorted; some are well sorted.
- Good quality sands slightly Quartz arenite slightly Arkose



Good Quality Lwr Cretaceous Reservoirs (Shelfal Well)

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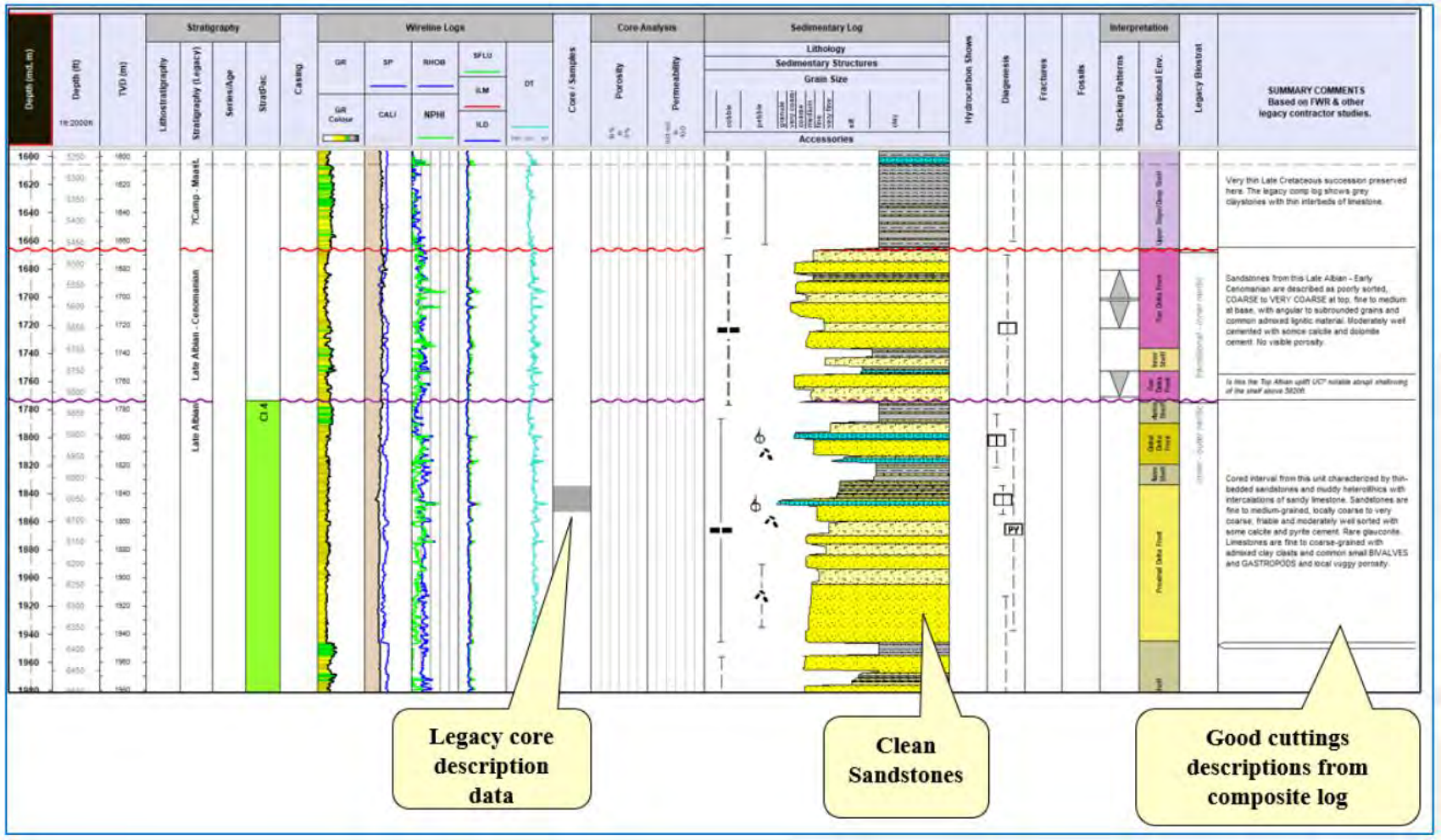
- High Quality early K reservoirs 80- m thick.
- Good visual poro-perms
- Some reservoir units are visibly uncemented and unconsolidated
- Some units are very coarse grained and interpreted as Delta front sands



Poro-Perm Relationships Liberian Basin

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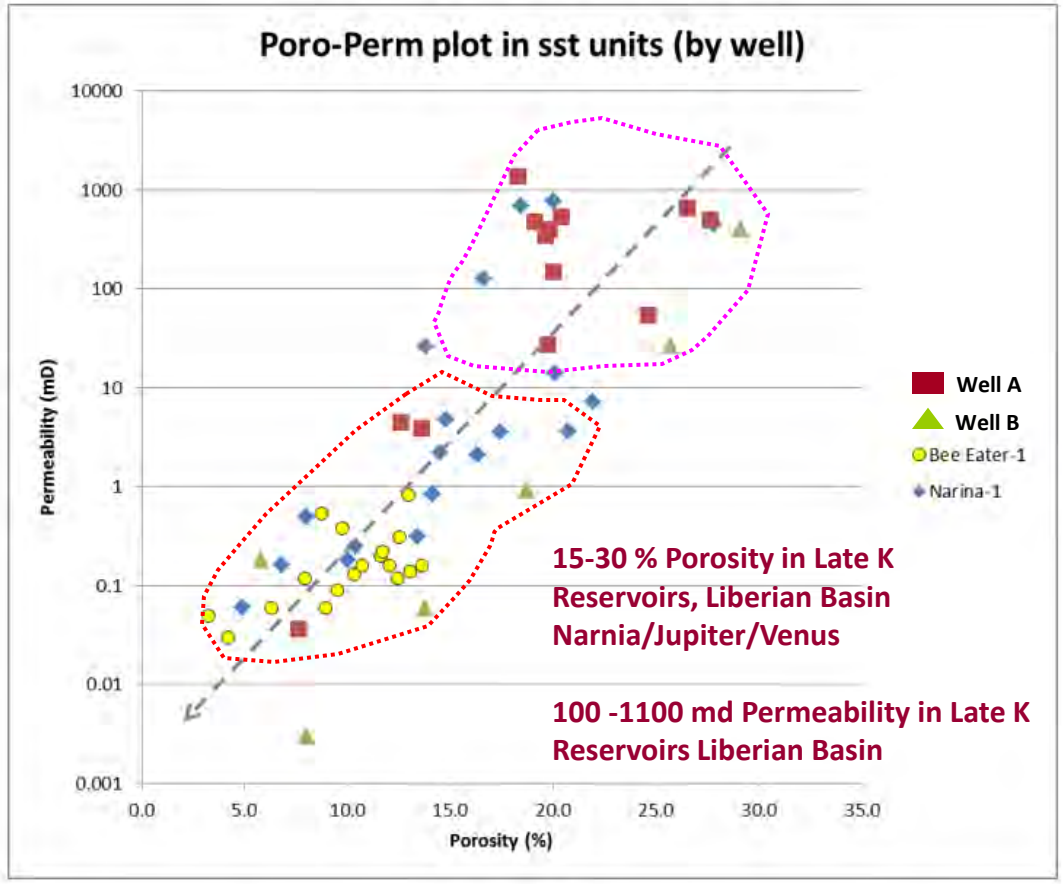
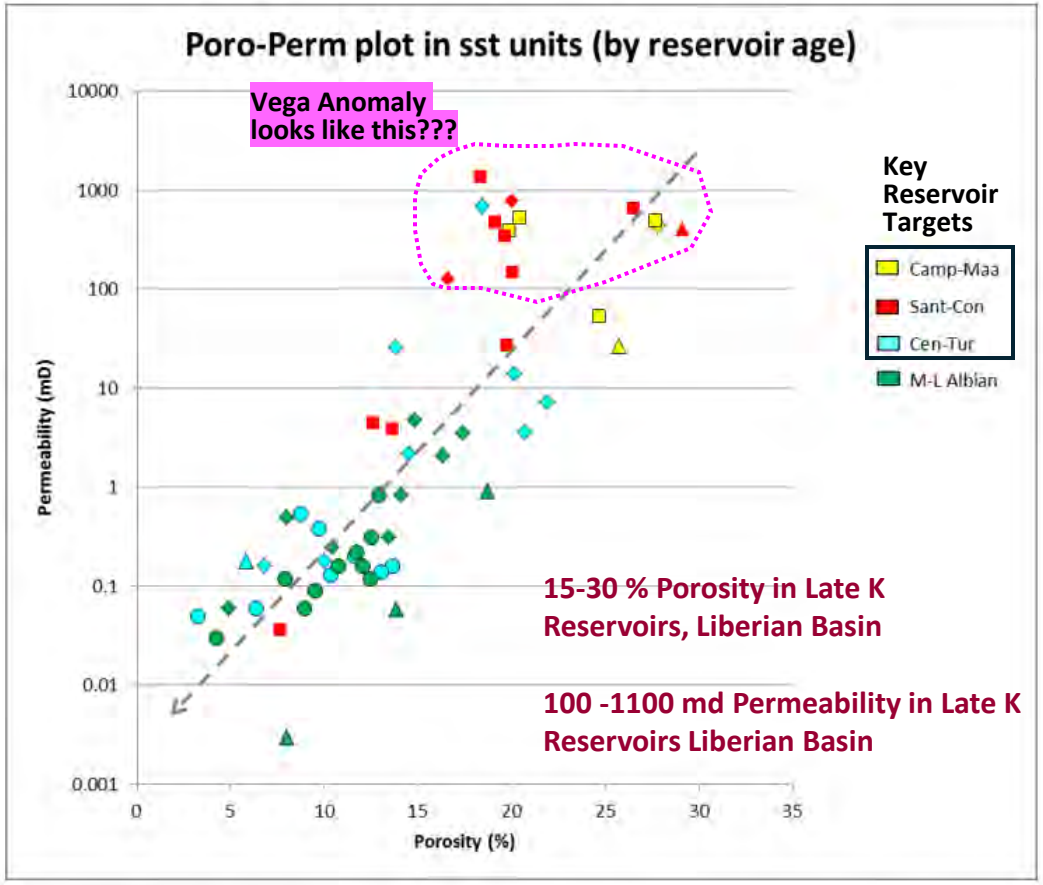


Narnia-1 & Bee-Eater-1 poorer quality than Wells A & B
This is likely related to a mixture of Provenance, Sorting/Reworking



Exploration Future Focus Sands younger than the Turonian
Oil shows were encountered in Tertiary aged Sands in Apalis-1

BFFs' Upper Cretaceous (Reservoir Presence & Quality (Guyana))

Liza-1 Reservoirs Compare favorably to Santonian- Campanian reservoirs

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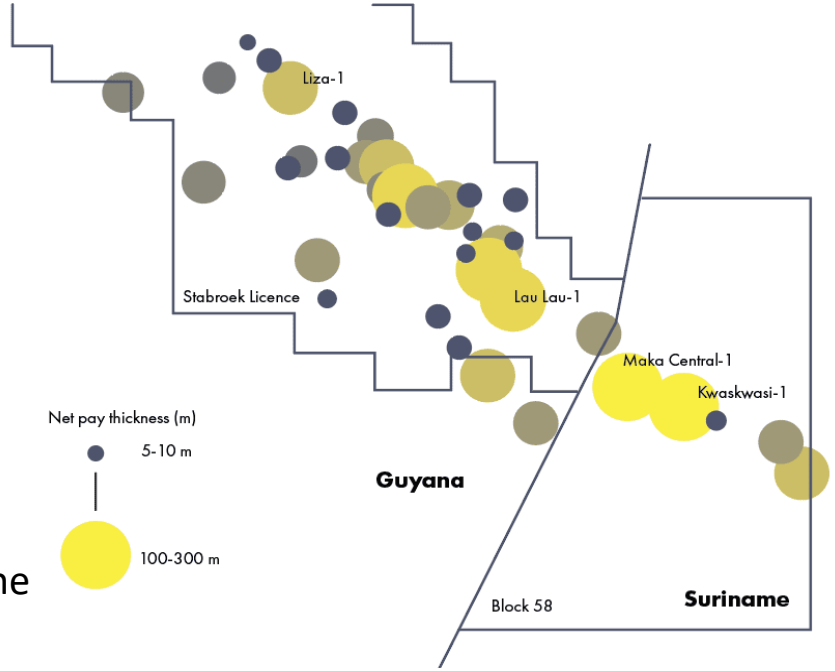
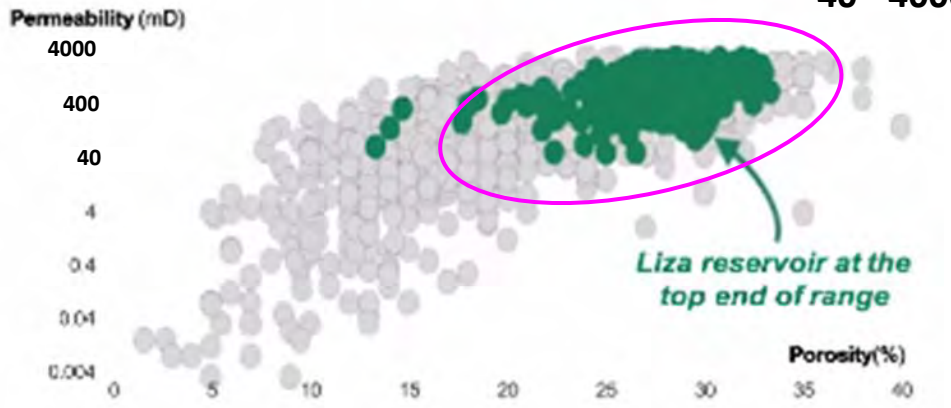
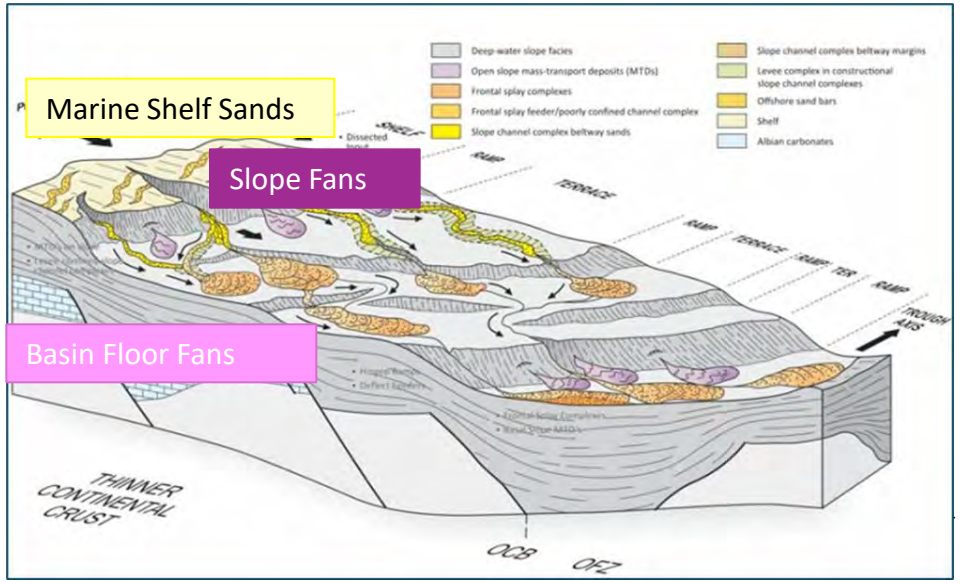
Map showing net pay thickness in the Upper Cretaceous intervals (undifferentiated). Lateral variations in thickness may relate to compensational stacking of channel-lobe complexes immediately outboard of the canyon systems, in the vicinity of the paleo regional slope.



20-25% Porosity
40 - 4000 mD



Late K Fan Poro-Perm X-plot



- The Upper Cretaceous Reservoirs of the Stabroek Block (Guyana) and Block 58 (Suriname) are the key exploration targets.
- Outboard of the Cretaceous shelf-break these reservoirs comprise detached basin floor fans that were widely deposited during the Berbice clastic input. Individual flows are vertically stacked in channel and supra-fan complexes
- Net pay thicknesses are typically between 80-200 m and the most productive reservoirs are Turonian–Santonian in age.
- Reservoir quality is typically good to very good with sands having average porosities between 15-32% and average permeabilities in 40-2000 millidarcy range. Sands are texturally mature and compositional rich in quartz.

Porosity & Permeability Floor : Below Mud-line, Offshore Liberia

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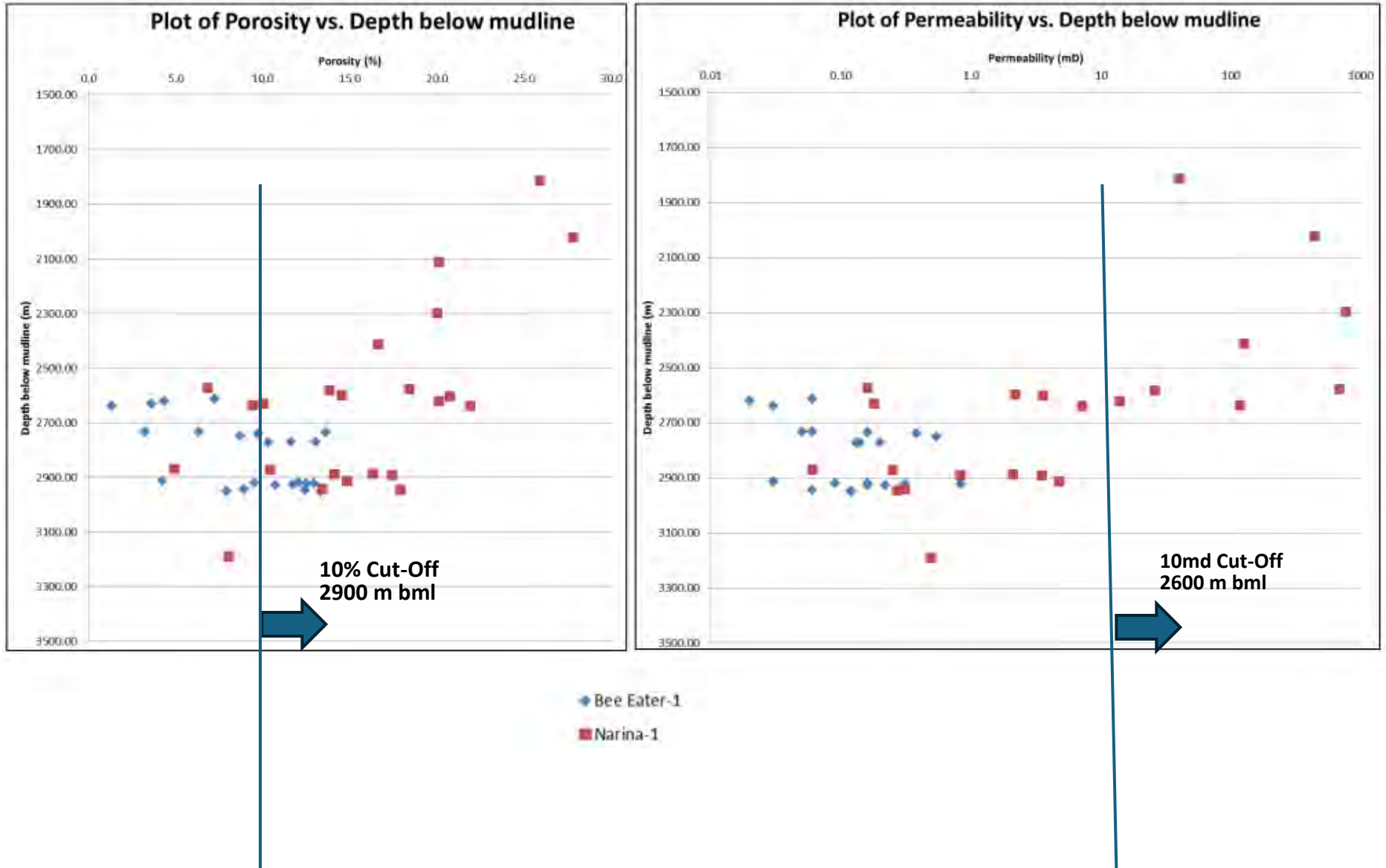
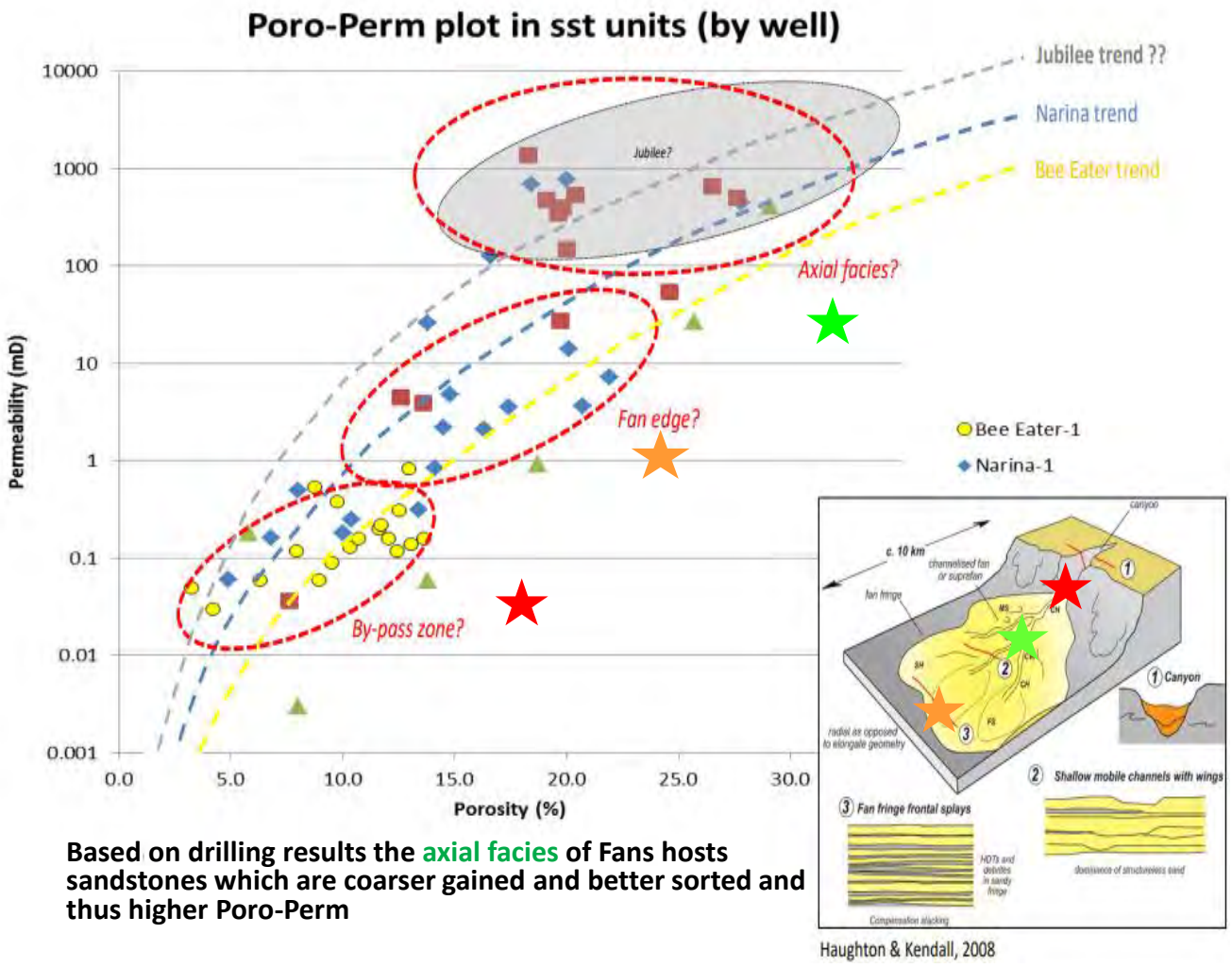


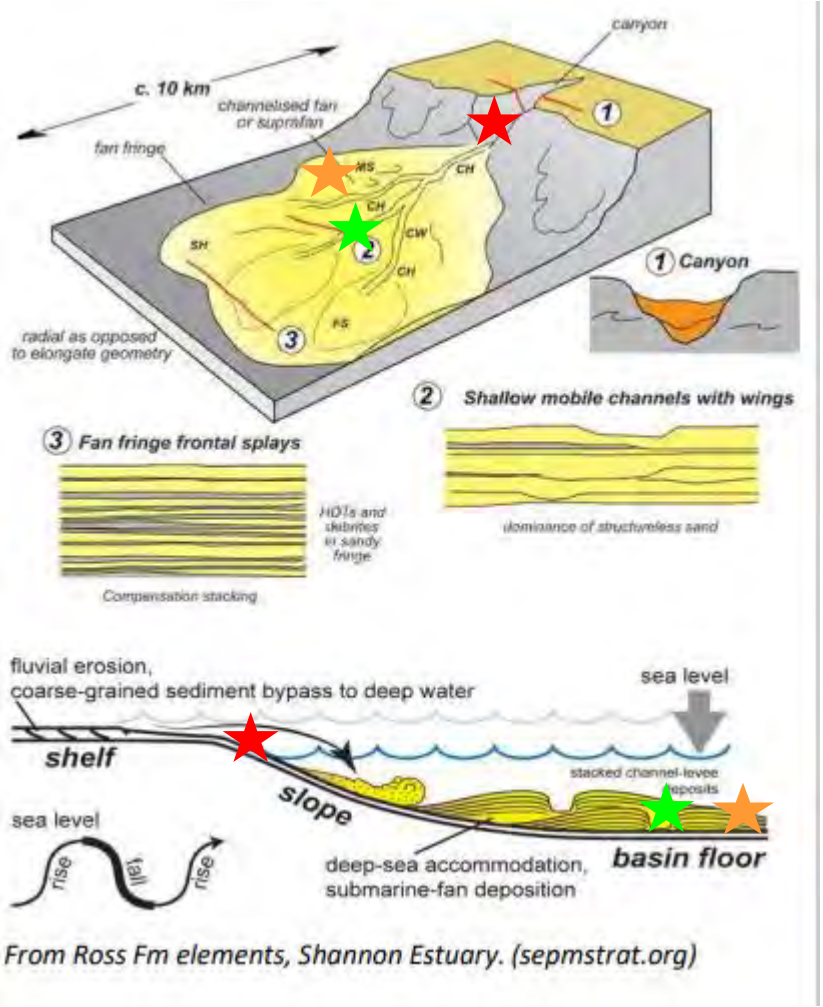
Poro-Perm Relationships Liberian Basin (2)

Where you explore the Slope Fan Matters – Facies dependencies!



Haughton & Kendall, 2008

Based on drilling results the axial facies of Fans hosts sandstones which are coarser gained and better sorted and thus higher Poro-Perm



From Ross Fm elements, Shannon Estuary. (sepmstrat.org)

The Role of Diagenesis in Controlling Reservoir Effectiveness (3)

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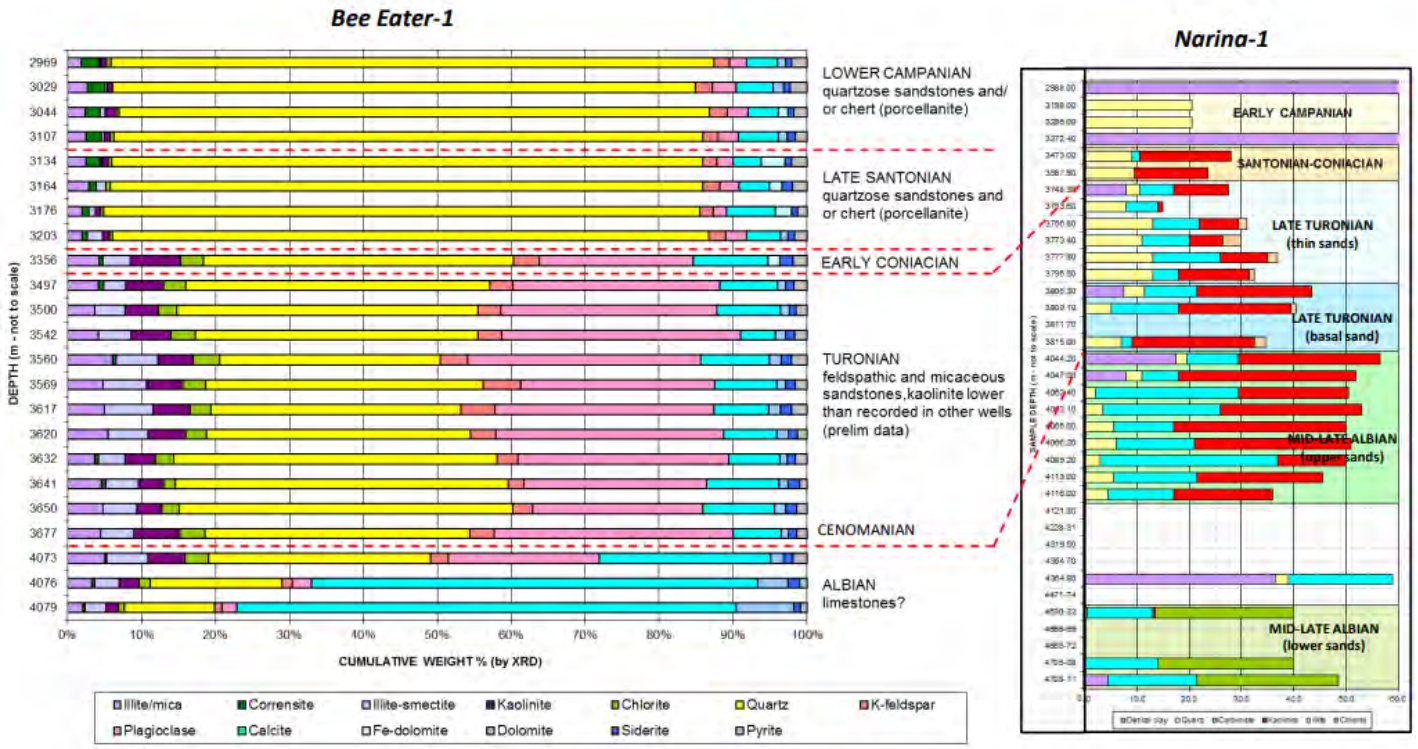

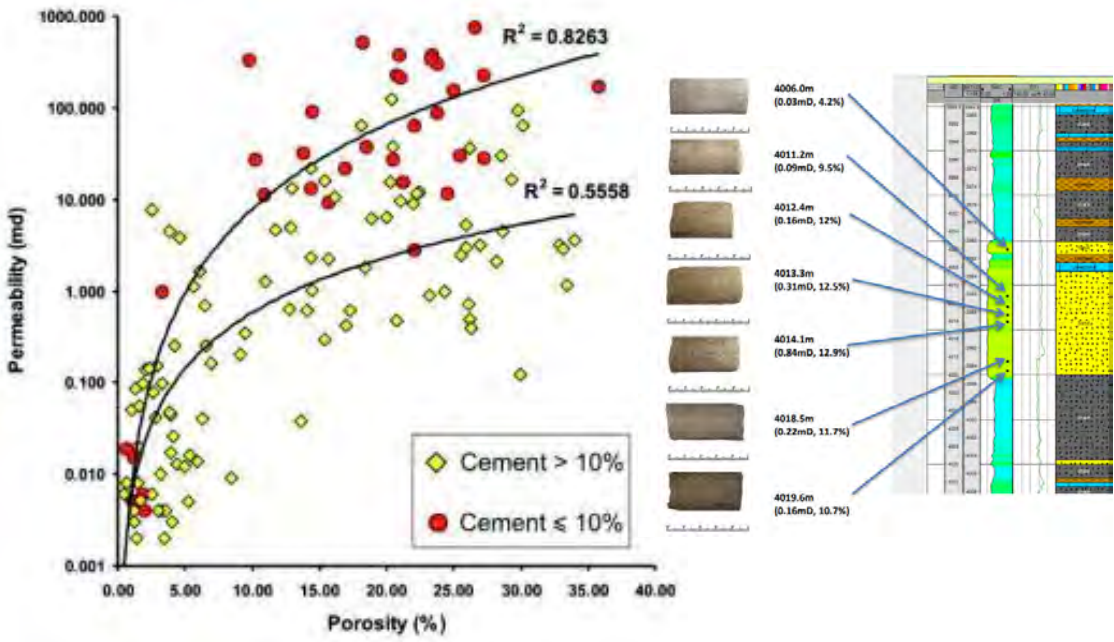

Deposition of calcite and quartz cement destroys permeability offshore Liberia
Provenance of clastic material has a bearing on the types of authigenic minerals and cements produced.
The hinterland (source to sink) is rich in granites and gneiss which containing abundant quartz and feldspars that can result in the precipitation of both calcite and quartz cements and crystallise out authigenic minerals such as kaolinite, chlorite and illite that all contribute to the occlusion of both porosity and permeability

Comparison Poro-Perm Relationships Narnia-1 and Bee-Eater -1 wells. Based on Cement presence – Non presence.

Slope Fan Versus Basin Floor Fans (Reservoir Quality) Liberia

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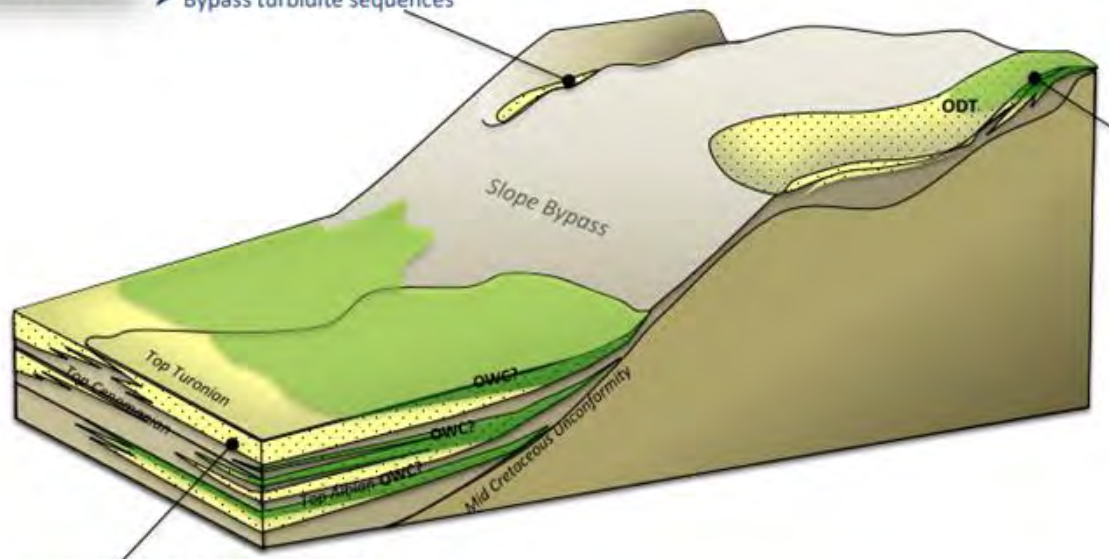
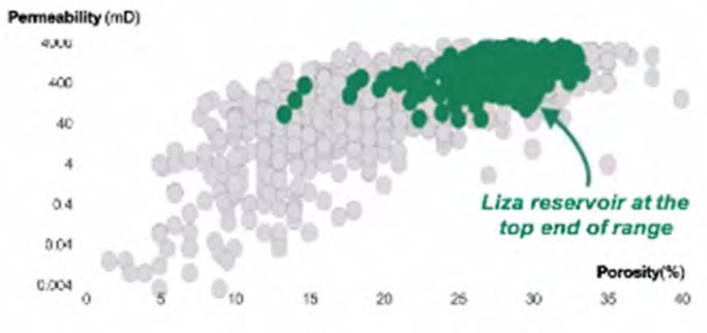
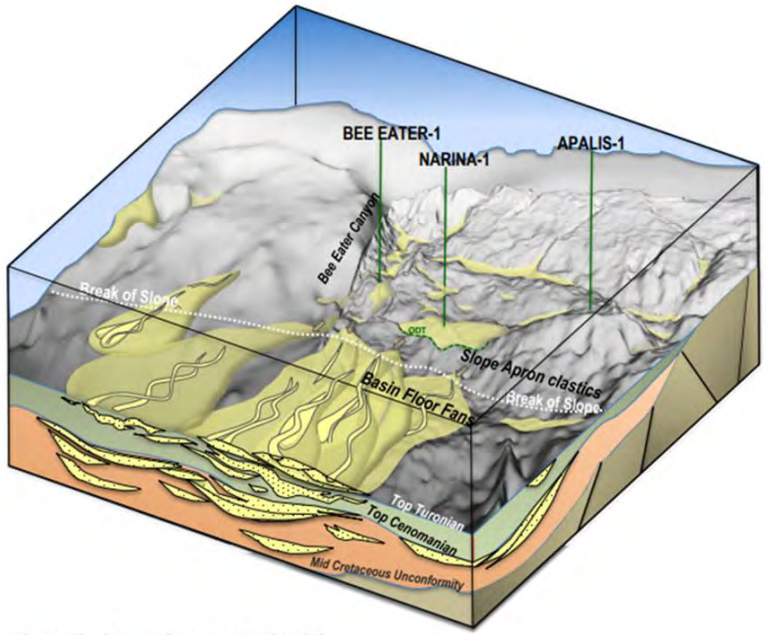
Canyon Fill Turbidites (Bee Eater-1)
- Oil bearing reservoir sandstones
- Poorly sorted sandstones with lithic clasts granular-fine sands and detrital clays
- Immature sediments
- Authigenic cements and clays
- Higher compaction – lower permeability
- Bypass turbidite sequences

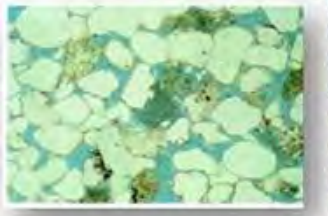


Slope Fan (Narina-1)
- Oil bearing reservoir sandstones
- Thinner slope sequences
- Mixed sorting
- Intergranular cements preserve porosity but limit permeability
- Low textural maturity
- Reservoir quality limited in finer grained sandstones





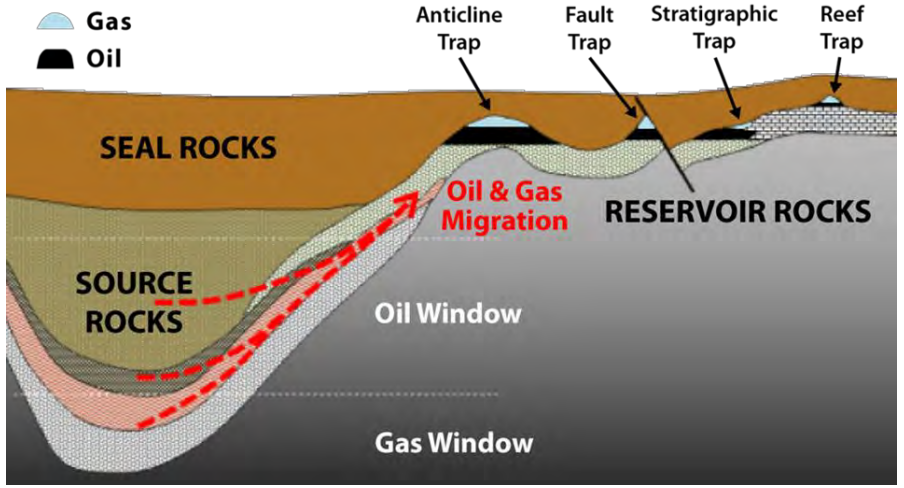
Liberia Block 9 – Submarine Fan Model.
Canyon system filled with low net-gross sediments. Steep gradients act as a bypass zone enabling sediment transfer to slope break. Basin floor fan geometries are mapped in this less confined region with Turonian, Cenomanian and Upper Albian clastic wedges onlapping the slope.



Predicted Basin Floor Fans
- Stacked reservoirs with possible multiple oil zones
- Thicker Sandstone Units
- Larger grain sizes
- Lower Compaction
- Better sorting
- Higher Textural Maturity
- Higher Poro/Perms

The Cretaceous Petroleum System

Seals (top & lateral) Presence and Quality



Seal Presence & Quality

Upper Cretaceous (Top & Lateral Seals)

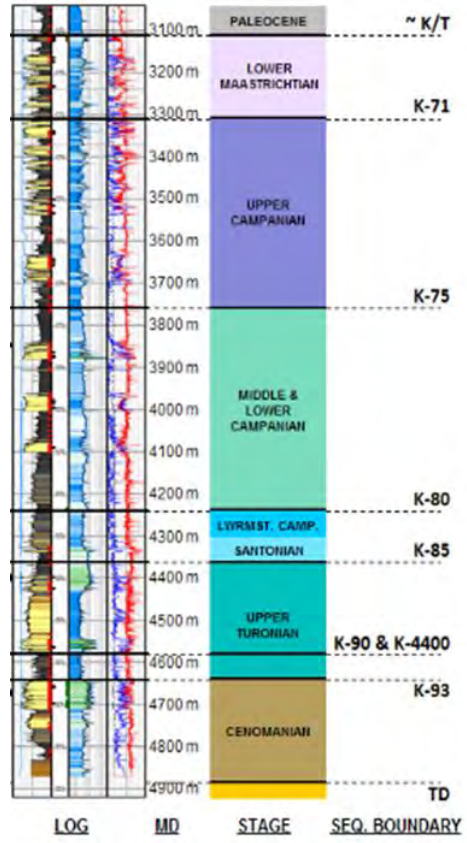
Cretaceous Shales as Seals in the Region

The Cretaceous shales in the offshore Sierra Leone-Liberia region demonstrate significant sealing potential for petroleum systems. The primarily basin-ward Upper Cretaceous deep-marine shales have proven to be an effective seal to turbidite sandstones in the Sierra Leone offshore. This indicates that these Cretaceous shale units have been validated as effective hydrocarbon seals in the area. (Claude AI Result)

Proven Hydrocarbon sealing Cretaceous Shales Liberian Basin

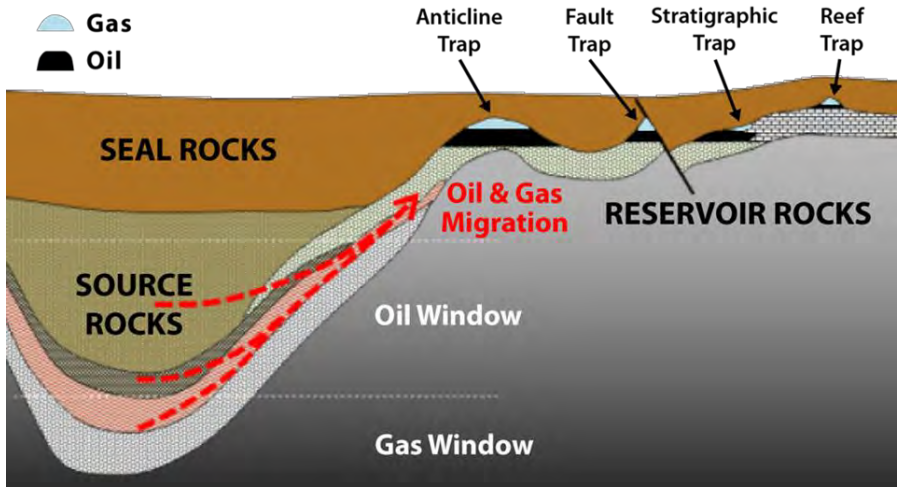
Well	Proven Seal 1	Proven Seal 2
Venus-1B	Santonian Shale	-
Mercury-1	Santonian Shale	Campanian Shale
Jupiter-1	Santonian Shale	-
Narnia-1	Turonian Shale	Aptian Shale
Bee–Eater-1	Turonian Shale	Aptian Shale
Savanah-1x	Turonian Shale	-
Montserrado-1	-	Aptian Shale

Well Based Validation (Top & Lateral) Proven Oil Retarding Seals



Summary Lateral facies change and late faulting are the predominant lateral seals in the Sierra Leone offshore basin. Top seal is provided by interbedded early Cretaceous shales and up dipping late Cretaceous deep-water shales.

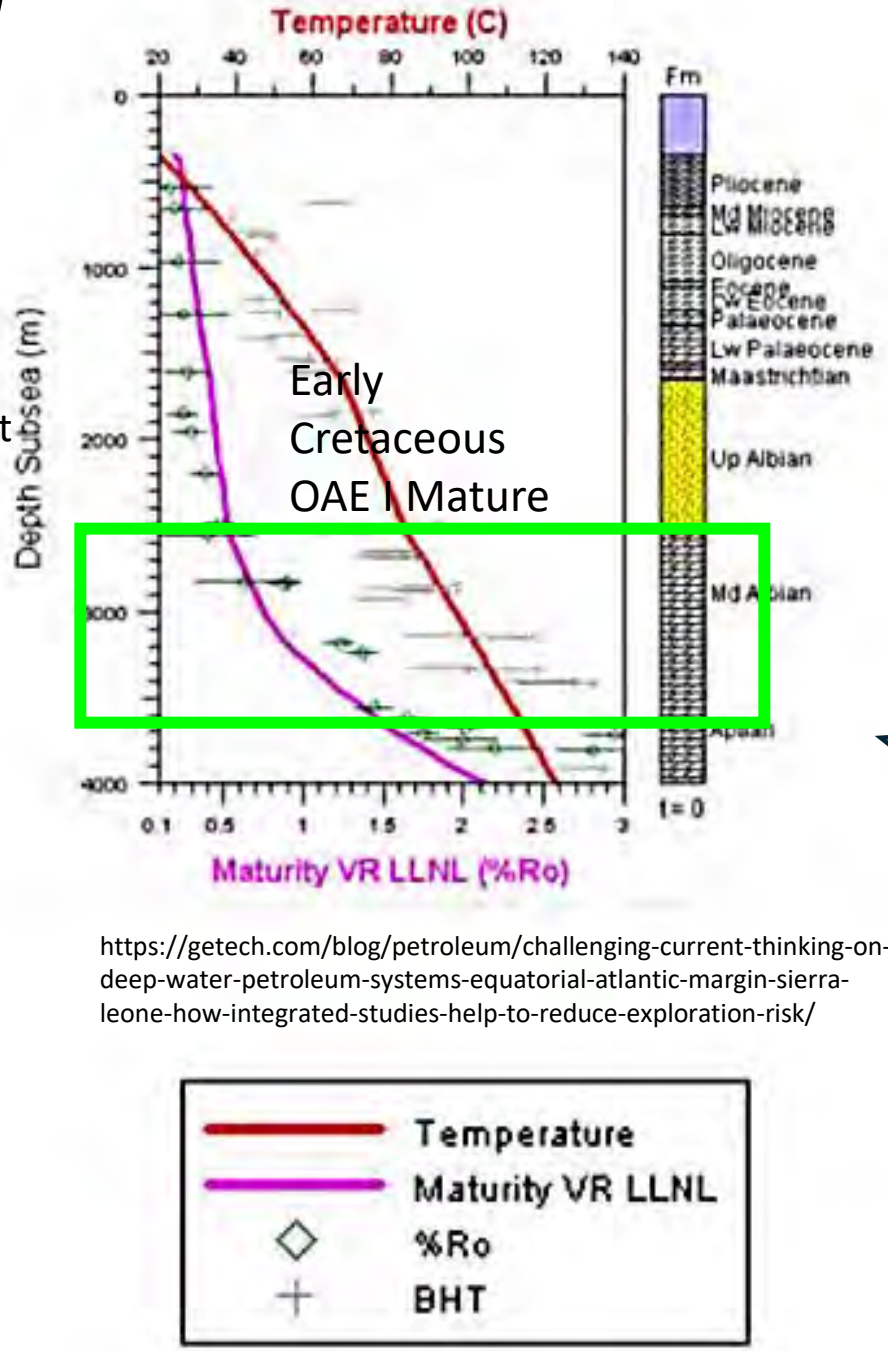
Maturity, Migration, Preservation & Timing



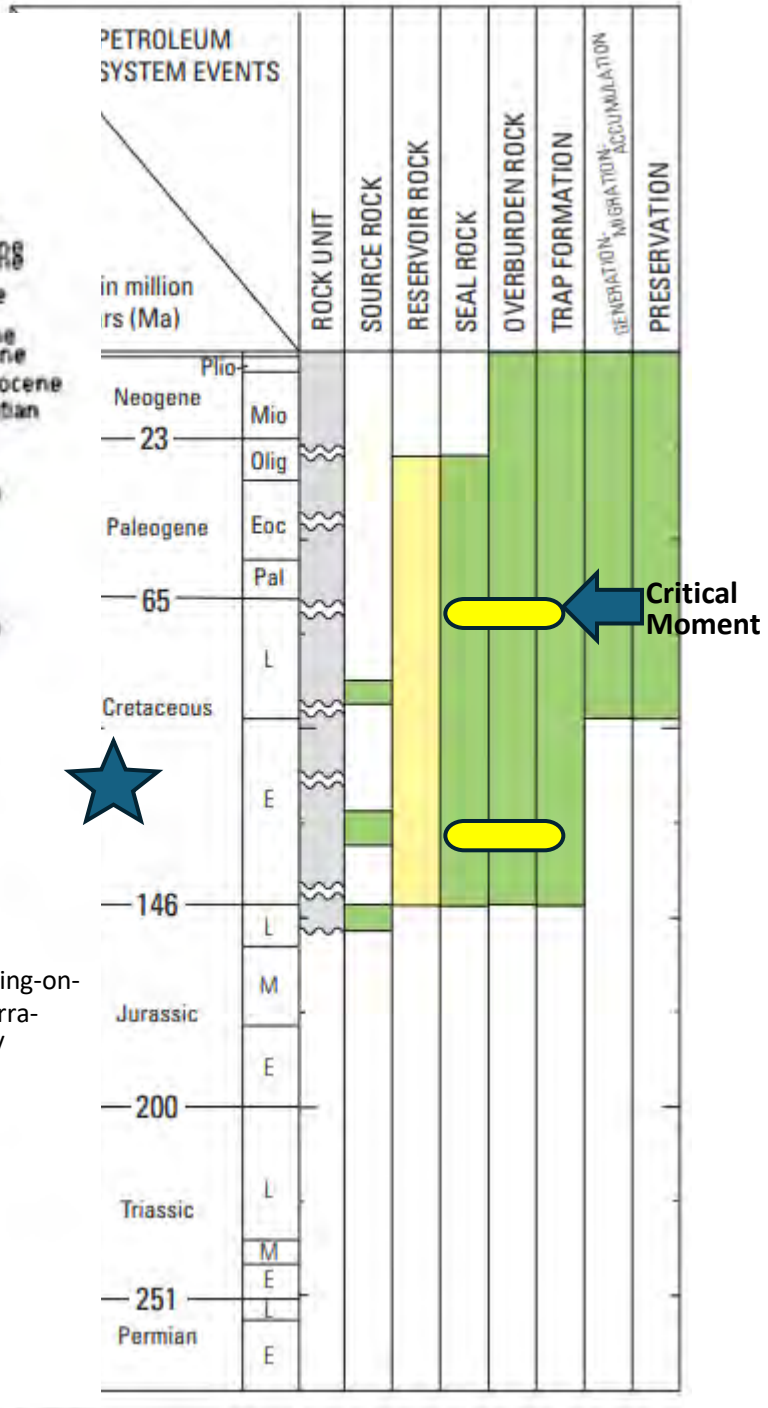
Maturity, Migration & Timing

- ***OAE I*** source rocks are mature across the basin The oil window is between 0.8 and 1.2 % R0, within the ***OAE I*** source.
- ***OAE II*** source rocks are demonstrably oil mature but with an increased gas flush risk deeper into the basin.
- 90% of all wells drilled in the Liberian Basin have oil shows, so Primary and Secondary Migration are working processes proven across the basin
- Geohistory favours oil presence in the Late Cretaceous (***Albian - Campanian***). The critical moment is in the late Cretaceous when all elements of the Aptian and Cenomanian Petroleum Systems are in place.

38 API Oil sampled from Narnia-1 well 2012!!



https://getech.com/blog/petroleum/challenging-current-thinking-on-deep-water-petroleum-systems-equatorial-atlantic-margin-sierra-leone-how-integrated-studies-help-to-reduce-exploration-risk/



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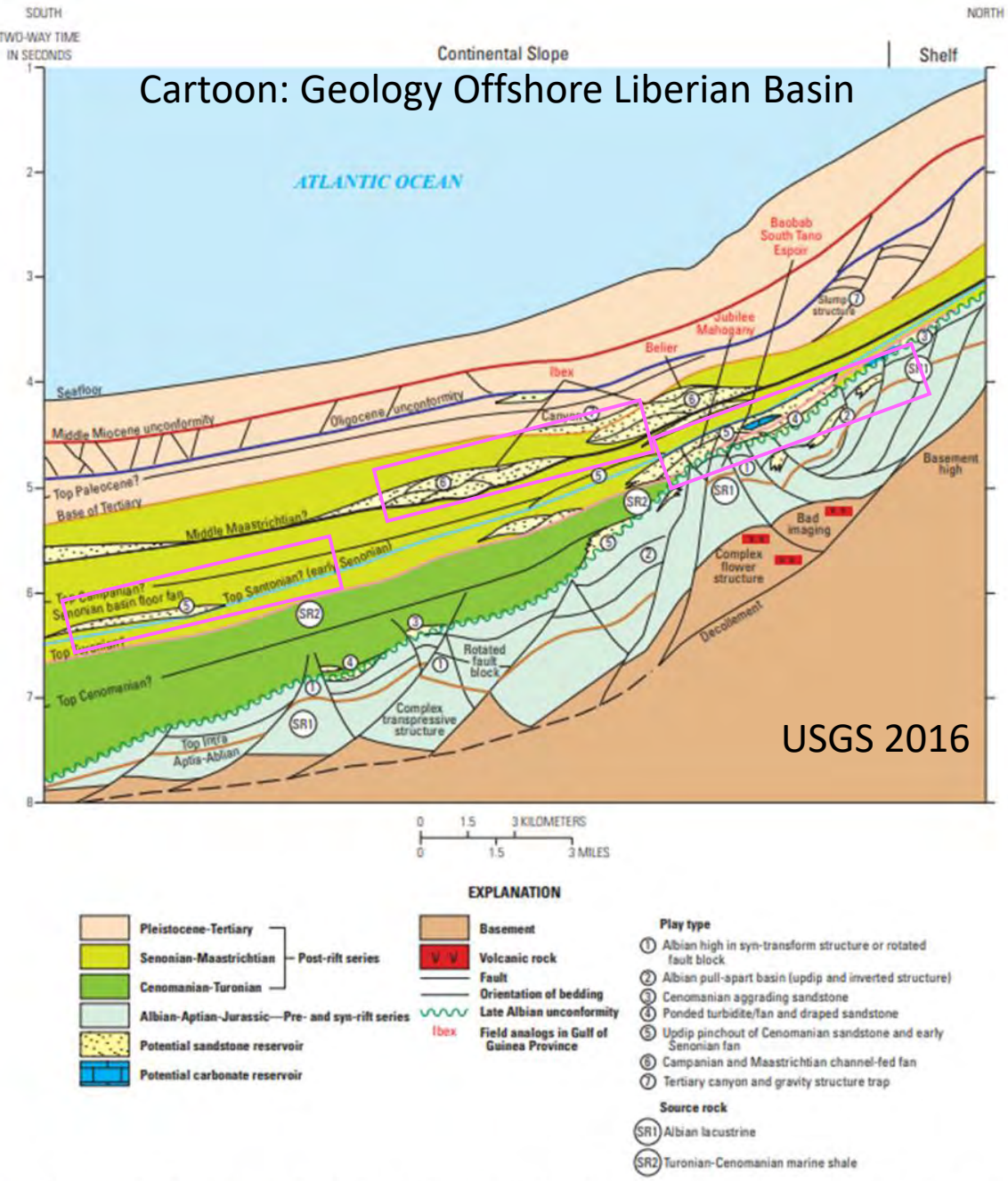
Cartoon: Geology Offshore Liberian Basin



EXPLANATION

- Pleistocene-Tertiary
- Senonian-Maastrichtian
- Cenomanian-Turonian
- Post-rift series
- Albian-Aptian-Jurassic—Pre- and syn-rift series
- Potential sandstone reservoir
- Potential carbonate reservoir
- Basement
- Volcanic rock
- Fault
- Orientation of bedding
- Late Albian unconformity
- Ibex
- Field analogs in Gulf of Guinea Province

Play type

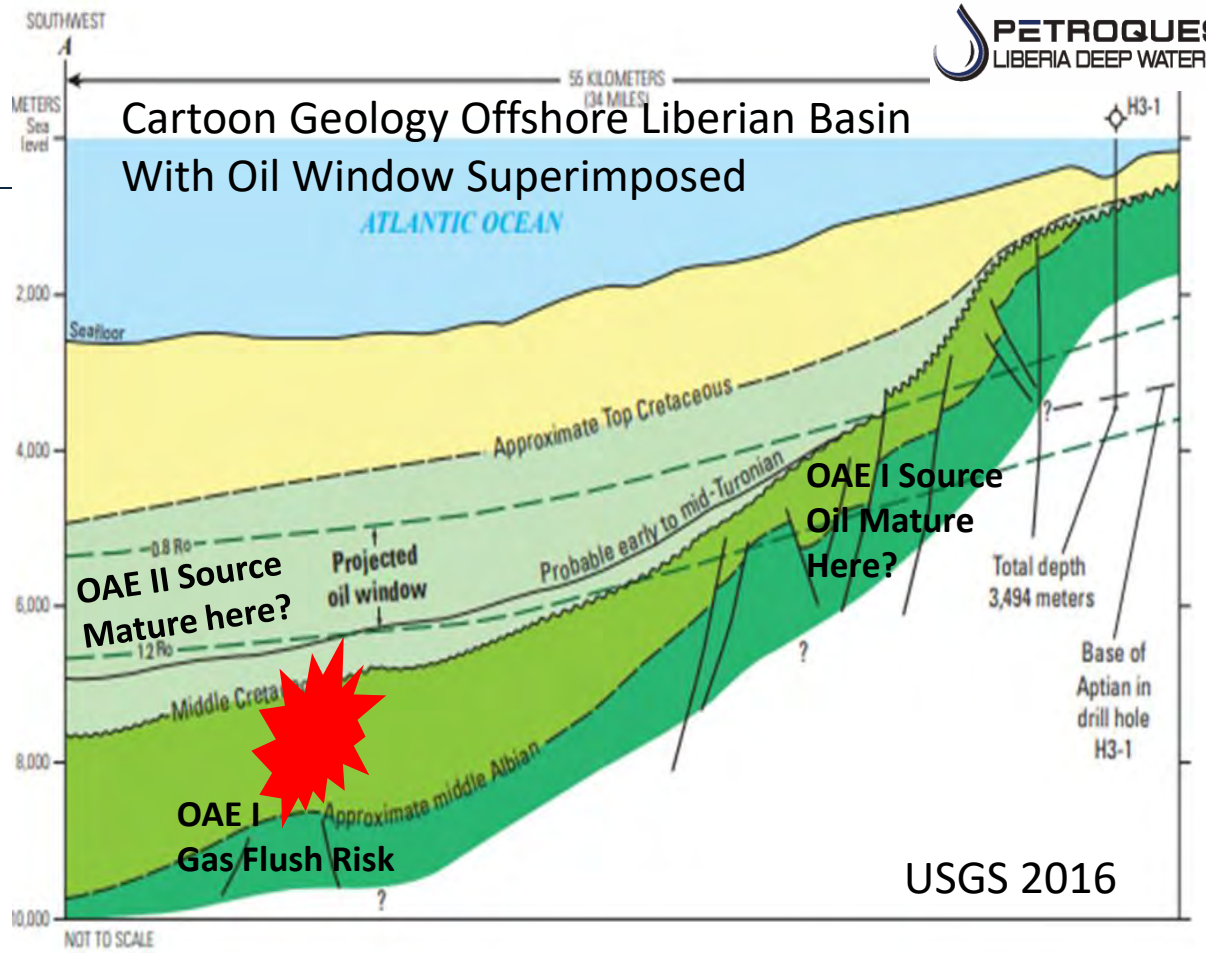
1. Albian high in syn-transform structure or rotated fault block
2. Albian pull-apart basin (updip and inverted structure)
3. Cenomanian aggrading sandstone
4. Ponded turbidite/fan and draped sandstone
5. Updip pinchout of Cenomanian sandstone and early Senonian fan
6. Campanian and Maastrichtian channel-fed fan
7. Tertiary canyon and gravity structure trap

Source rock

- SR1 Albian lacustrine
- SR2 Turonian-Cenomanian marine shale

Figure 6. Cross sectional stratigraphy based on seismic data of offshore Sierra Leone margin showing field analogs with Côte d'Ivoire offshore basin. Modified from Grand and others (2009).

Cartoon Geology Offshore Liberian Basin With Oil Window Superimposed



USGS 2016 Assessment of Hydrocarbon Resources Offshore Liberia & Sierra Leone

EXPLANATION

- Tertiary
- Late Cretaceous undifferentiated
- Middle Albian to Early Cenomanian
- Aptian to Middle Albian
- Fault
- Contact—Dashed where location approximate
- Unconformity
- 1.2 Ro — Vitrinite reflectance—In percentage of reflectance (Ro)
- H3-1 Well site and identifier
- ? Identity or existence questionable

Summary of Petroleum Systems Model : Liberian/Harper? Basins

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1. Hydrocarbons were generated from Aptian, early to middle Albian, and Cenomanian and Turonian marine shales. Type II kerogen ranges from 3 to 10 percent in Turonian source rocks. Hydrocarbon generation started in the Late Cretaceous and continues to the present.

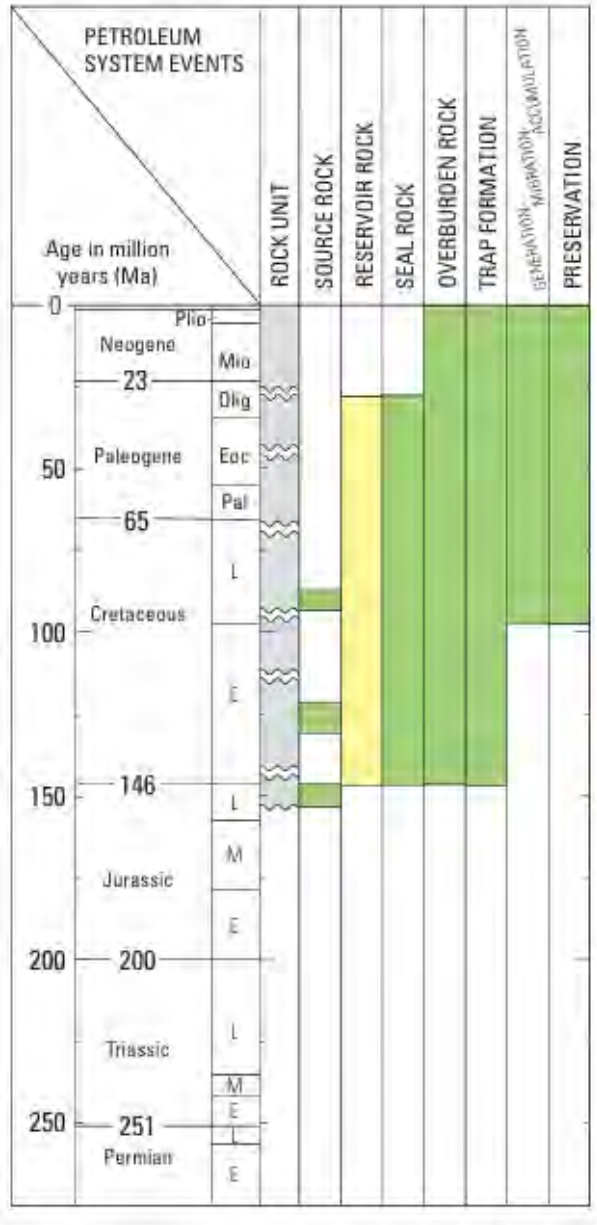
2. Generated hydrocarbons has migrated into Cretaceous reservoirs and possibly into Paleogene sandstone reservoirs.

3. Structural traps include growth-fault-related structures, such as rotated fault blocks within the continental shelf and below the mid-Cretaceous unconformity. Stratigraphic traps are related to deep-water fans, turbidite units, slope truncations along the present-day shelf and paleo-shelf edge, and Cretaceous and Paleogene stratigraphic pinch-outs along the eastern margin of the basin.

4. Upper Cretaceous and Tertiary marine mudstone and shale rocks are the primary seals.

5. Shallow reservoirs post K/T boundary are cool and any oil in them is likely to be biodegraded.

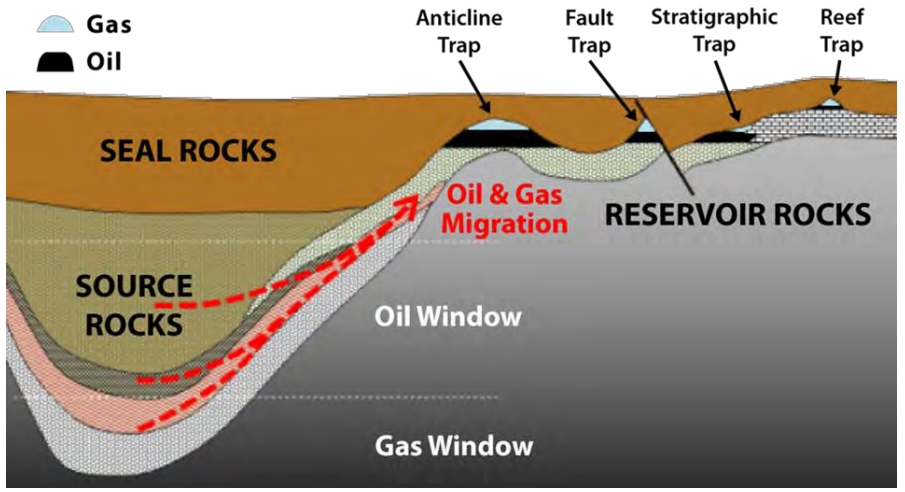
6. A passive-margin analog (Charpentier and others, 2007) was used because of similar source and reservoirs rocks and traps.



From USGS 2015

Traps (Liberian Basin)

Upper Cretaceous



Liberian Basin: Proven Stratigraphic Traps (Slope Fans)

Key Trap Type Submarine Fan (Pinch-out or Sedimentary by-pass)

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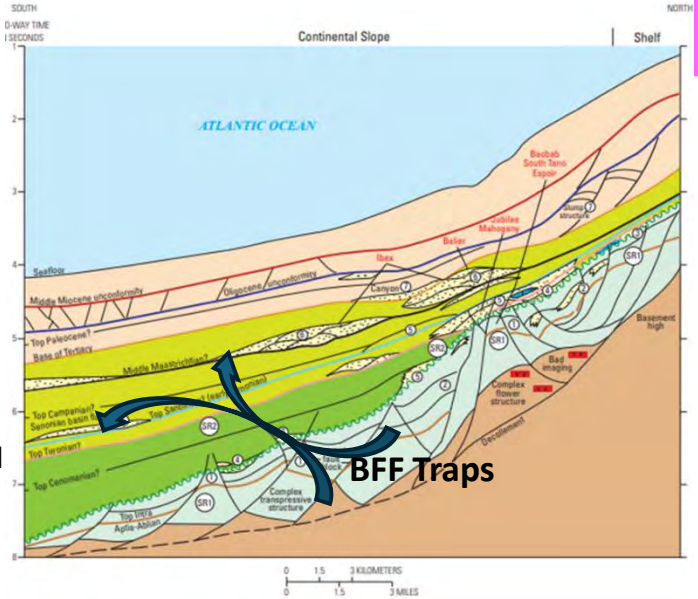
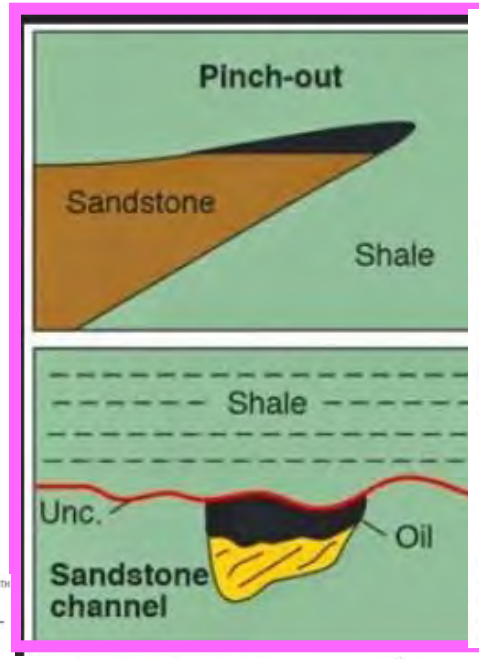
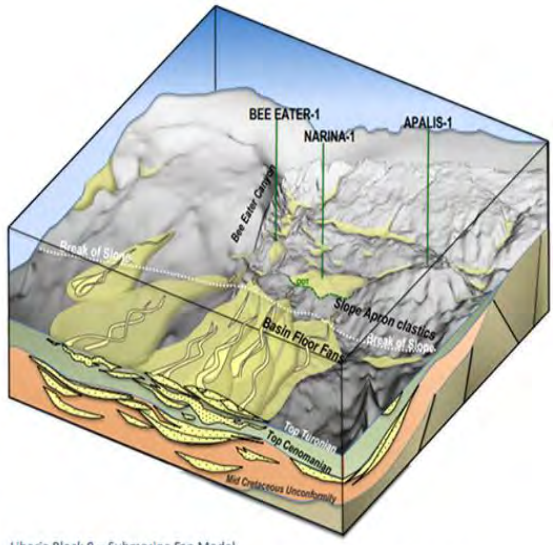
Well	Proven Oil Bearing Stratigraphic Traps SF
Venus-1B	Santonian Slope Fan (Pinch-out)
Mercury-1	Santonian Slope Fan (Pinch-out)
Jupiter-1	Santonian Slope Fan (Pinch-out)
Narnia-1	Turonian Slope Fan (Pinch-out)
Bee–Eater-1*	Turonian Slope Fan (Canyon Fill)
Savanah-1x	Turonian Slope Fan (Pinch-out)

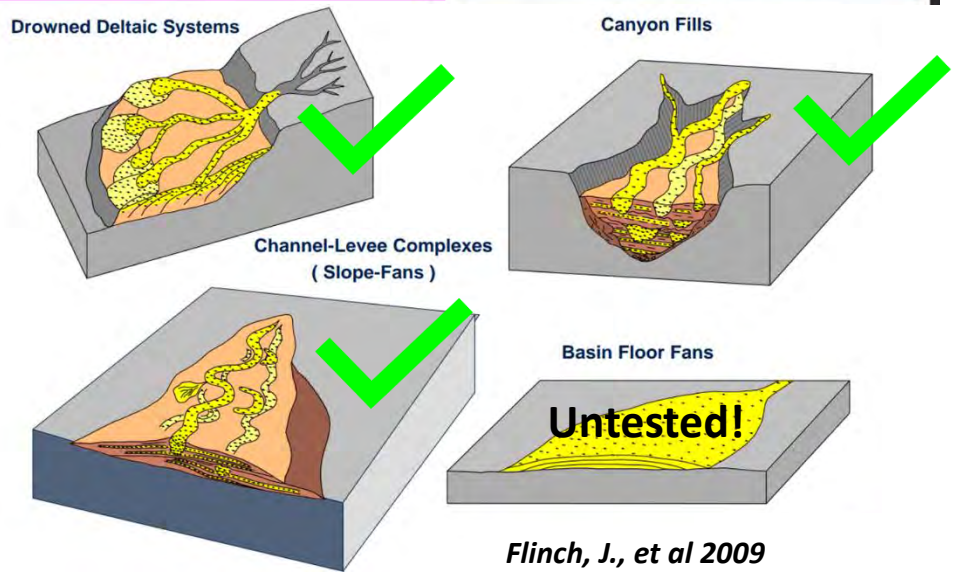
- ✓ Stratigraphic Traps are proven in Slope Fan plays offshore Liberian Basin. However, reservoir quality is highly variable.
- ✓ Stratigraphic Traps in Basin Floor Fans plays remain untested Offshore Liberian Basin and these traps are likely to be comprised of effective multi-storey reservoirs.







Liberia Block 9 – Submarine Fan Model.
Canyon system filled with low net-gross sediments. Steep gradients act as a bypass zone enabling sediment transfer to slope break. Basin floor fan geometries are mapped in this less confined region with Turonian, Cenomanian and Upper Albian clastic wedges onlapping the slope.



Flinch, J., et al 2009

BFF Play Fairways

Harper & Liberian Basins

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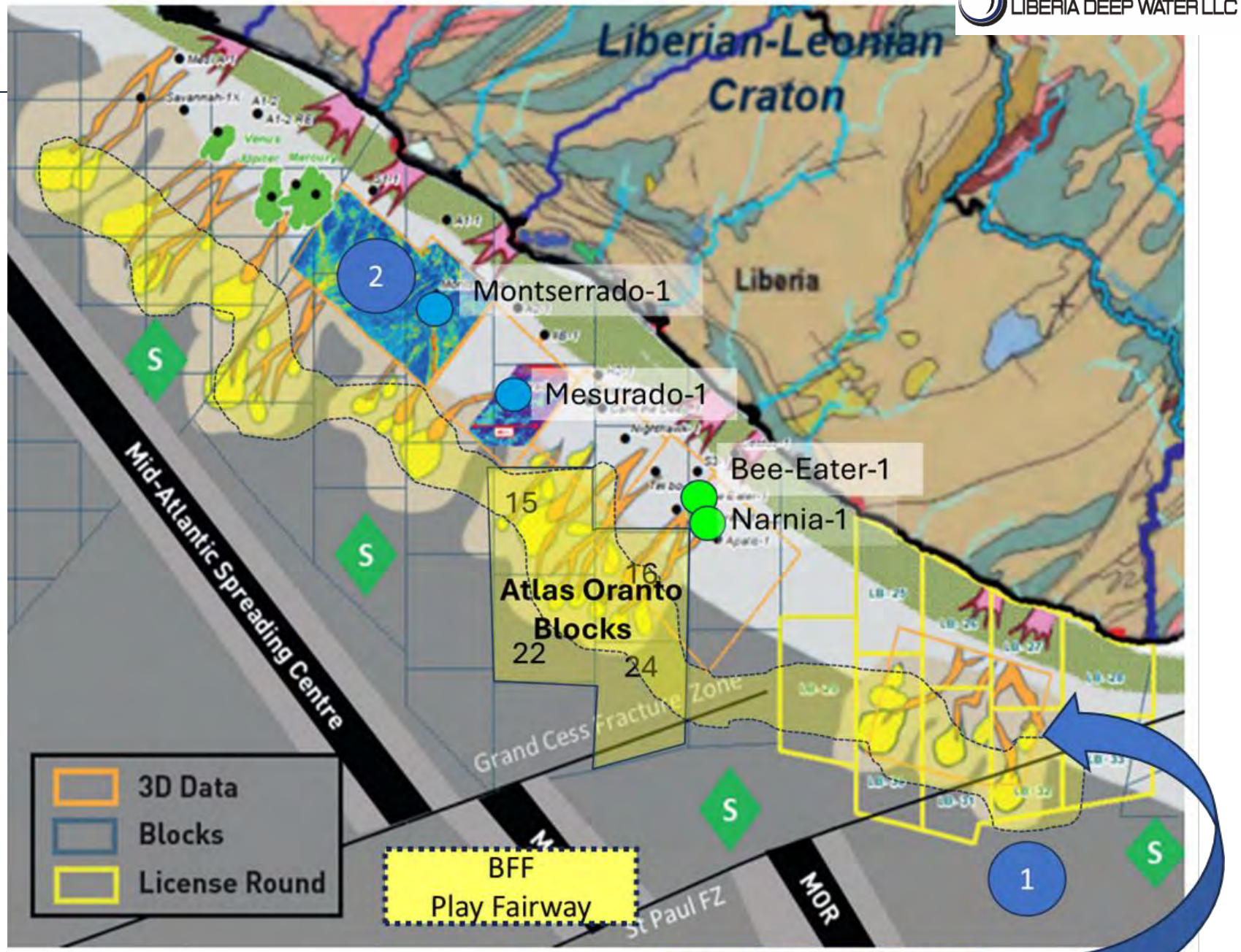
- The Upper Cretaceous BFF play fairway which extends the length of the entire basin margin, likely comprises multiple hydrocarbon bearing stratigraphic traps currently, within the oil generative window.
- Oil is proven already in-board in the upper K Slope Fan Play at; ***Narnia-1*** and ***Bee-Eater-1*** ***Mercury-1***, ***Venus-1*** and ***Jupiter-1.***
- Due to water depth ***> 3000 m*** the ***BFF*** play was not accessible with drilling technology back in 2009 -2016. But it is now!
- Billions of barrels of oil is already discovered in the CATM, including Ghana (Jubilee), Cote D'Ivoire (Baleine-1x and Murene-1x) 2024.
- ExxonMobil returning to Liberia after exiting in 2017 bid for blocks 15, 16, 22 and 24 in 2024. Atlas Oranto Petroleum, were awarded these blocks in October 2025
- BFFs are the hot new play world-wide, ***Cote D'Ivoire***, ***Namibia*** and of course ***Guyana***.



Winter, F., et al 2020

TGS Jupiter Fan schematic LB32
Mapped independently from BluEnergies

Investor Teaser 2: The 'Jupiter Fan ' All Within Block 32 (PQLDW)

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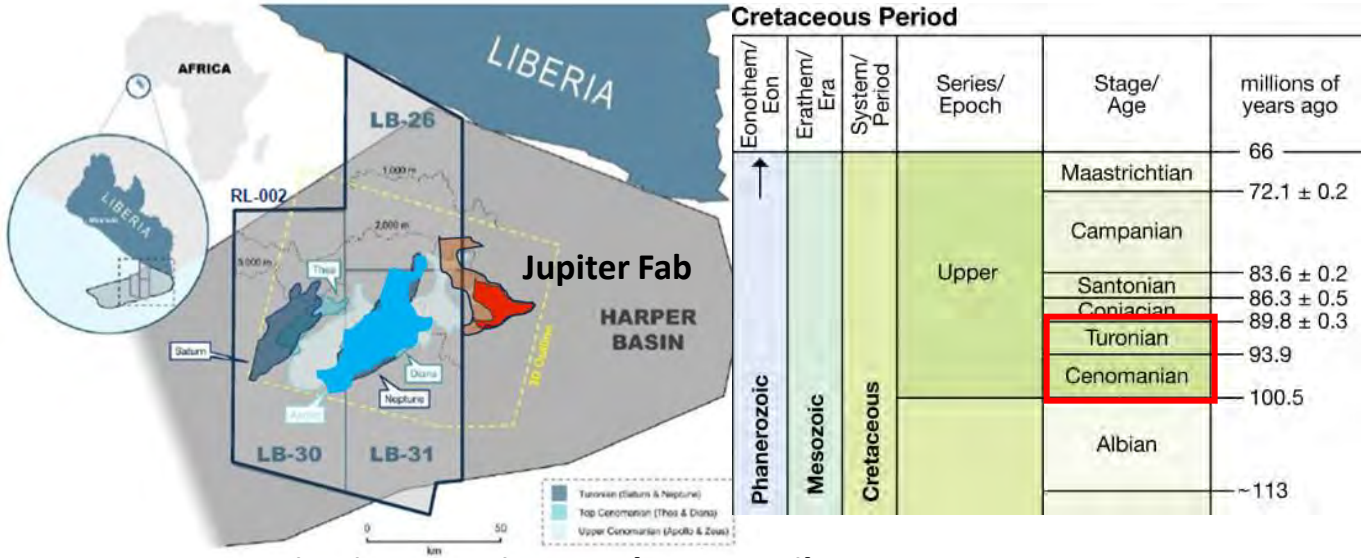
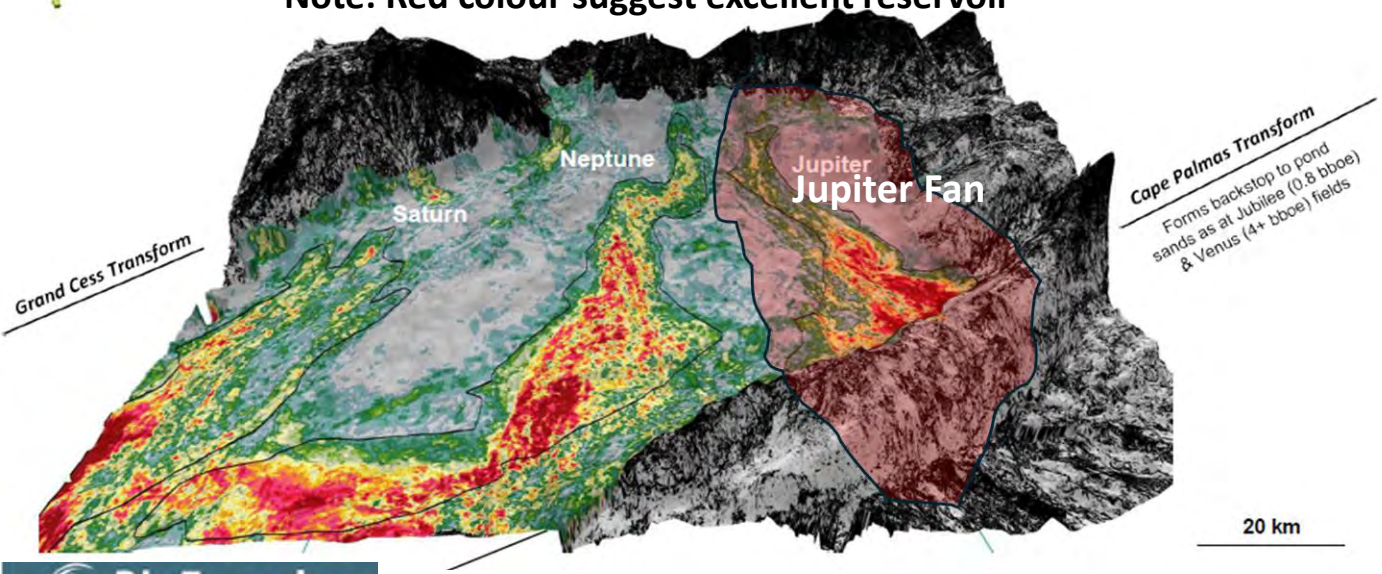


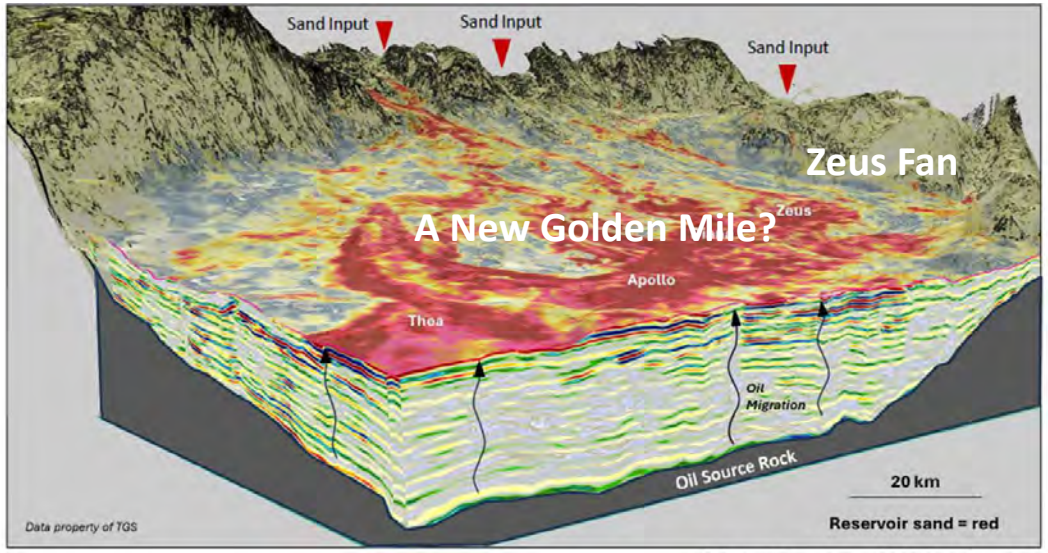
Prospects Block 32 Only	OOIP (NPV 10%) 70 USD/Barrel
Jupiter Fan	3.6 Bbls (NPV 9 Billion USD)
Zeus Fan	0.9 Bbls (NPV 3 Billion USD)

3D Seismic Acoustic Impedance Attribute
Note: Red colour suggest excellent reservoir



Turonian Aged Fans

3D Seismic Acoustic Impedance Attribute
Note: Red colour suggest excellent reservoir



Cenomanian Aged Fans

BluEnergies

Offshore Ivorian Coast – Turbidite Systems Across A Regional Scale

A Profusely Active & Confined Sandy System! Broad Band Data Is Required

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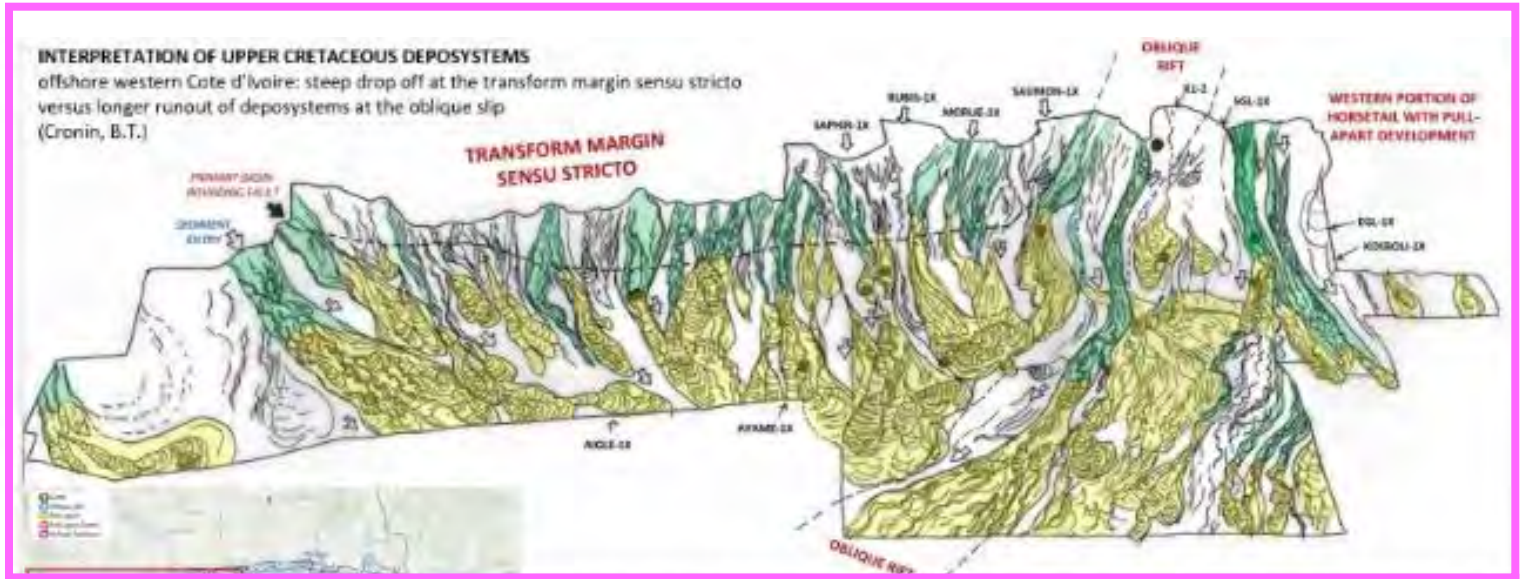
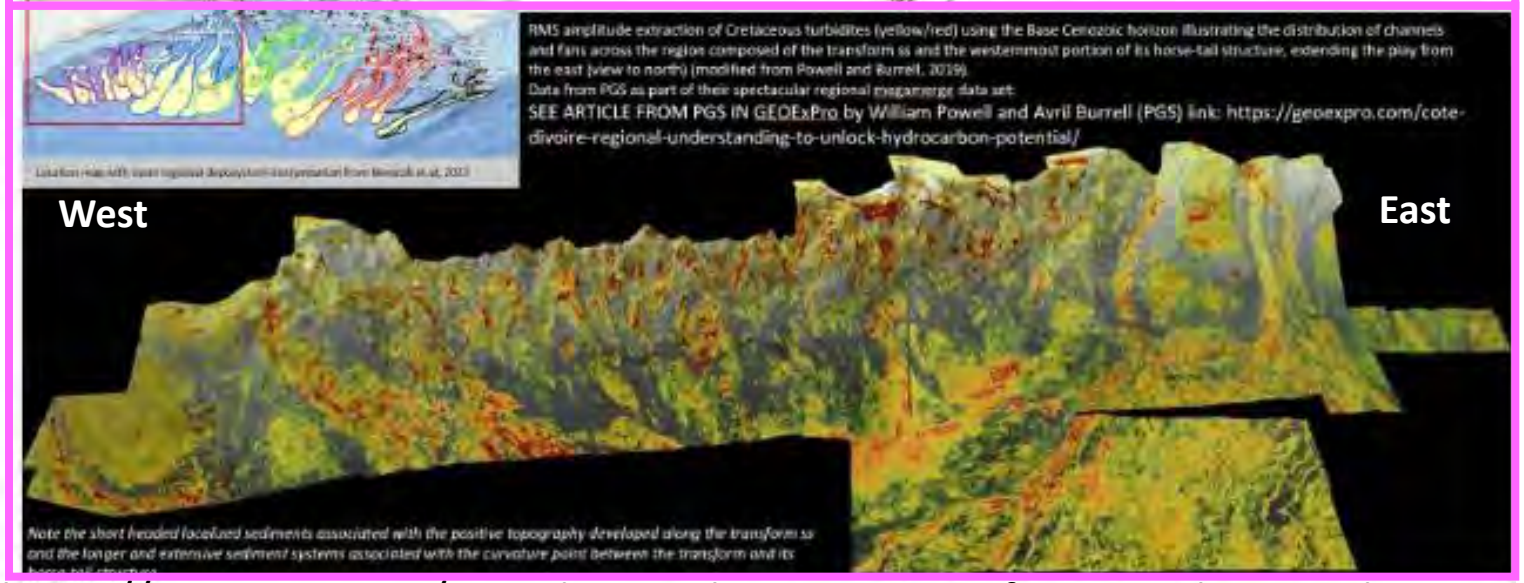




https://geoexpro.com/cote-divoire-the-new-west-african-exploration-hotspot/

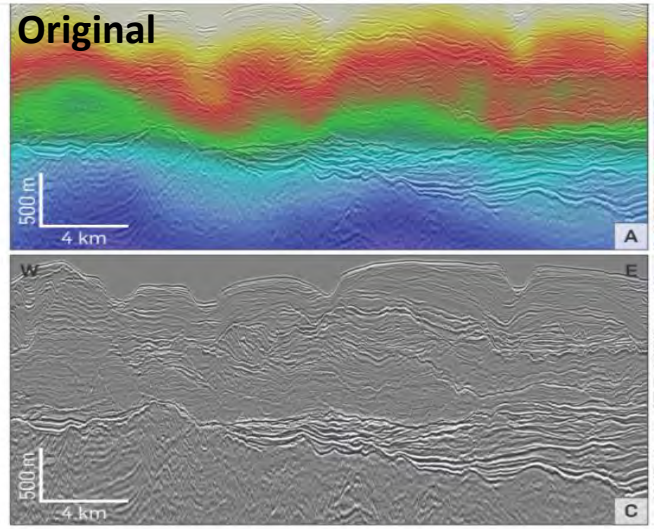
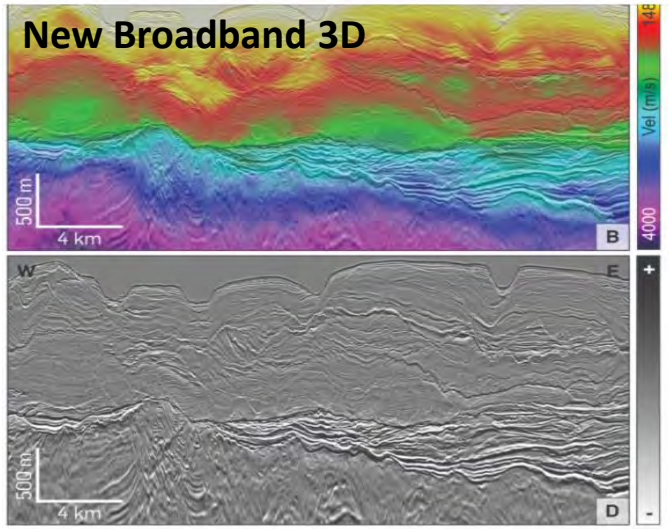


Figure 1: Legacy stack section with (A) and without (C) velocity overlay c
improved imaging of the sub-Albian section and higher resolution thanl



and newly re-imaged data (B, D). The newly reimaged data shows
ks to de-ghosting, de-multiple and time-lag full-waveform inversion.

BFFs, The Hot New Play World Wide

Global Creaming Curve For Slope & Basin Floor Fans

BFF are the Hot New Global Play

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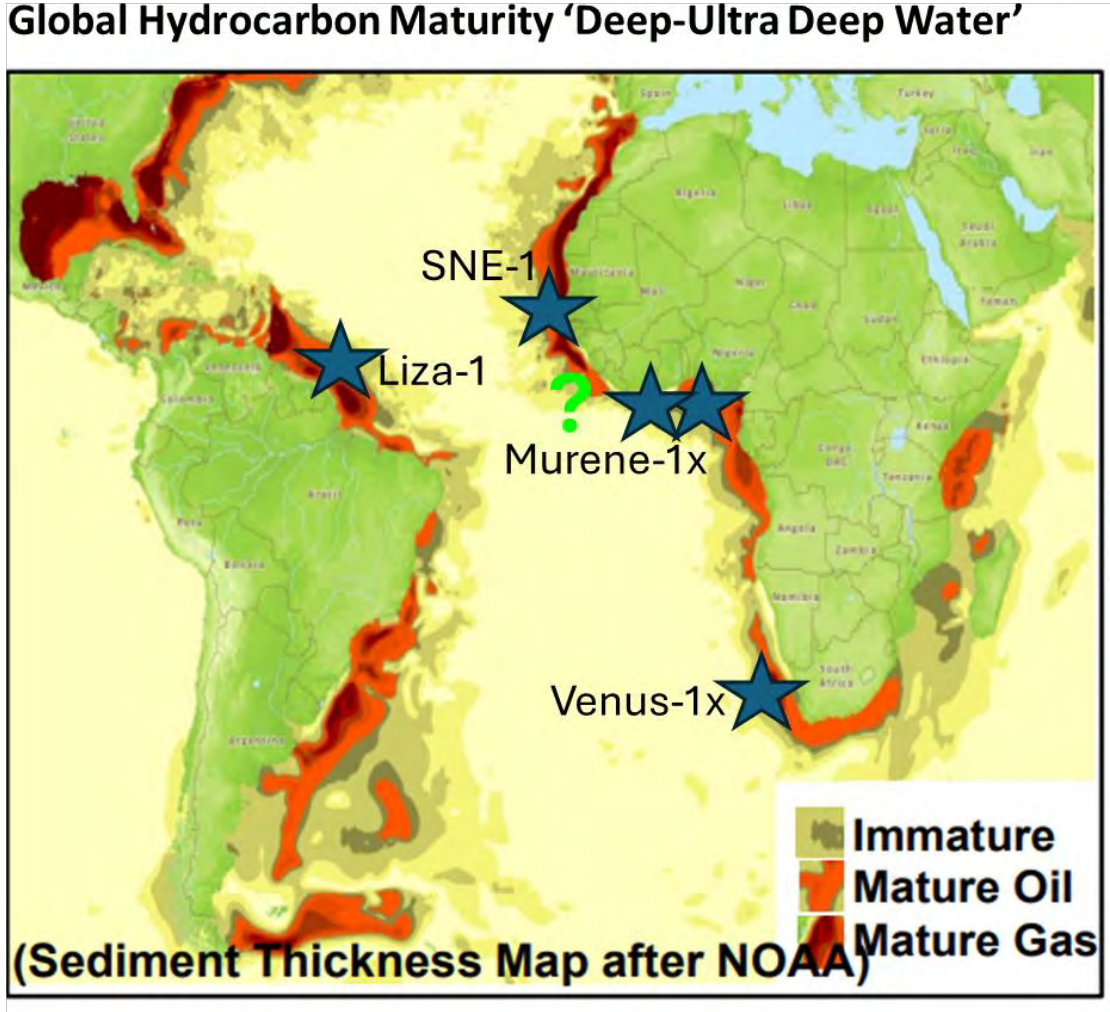

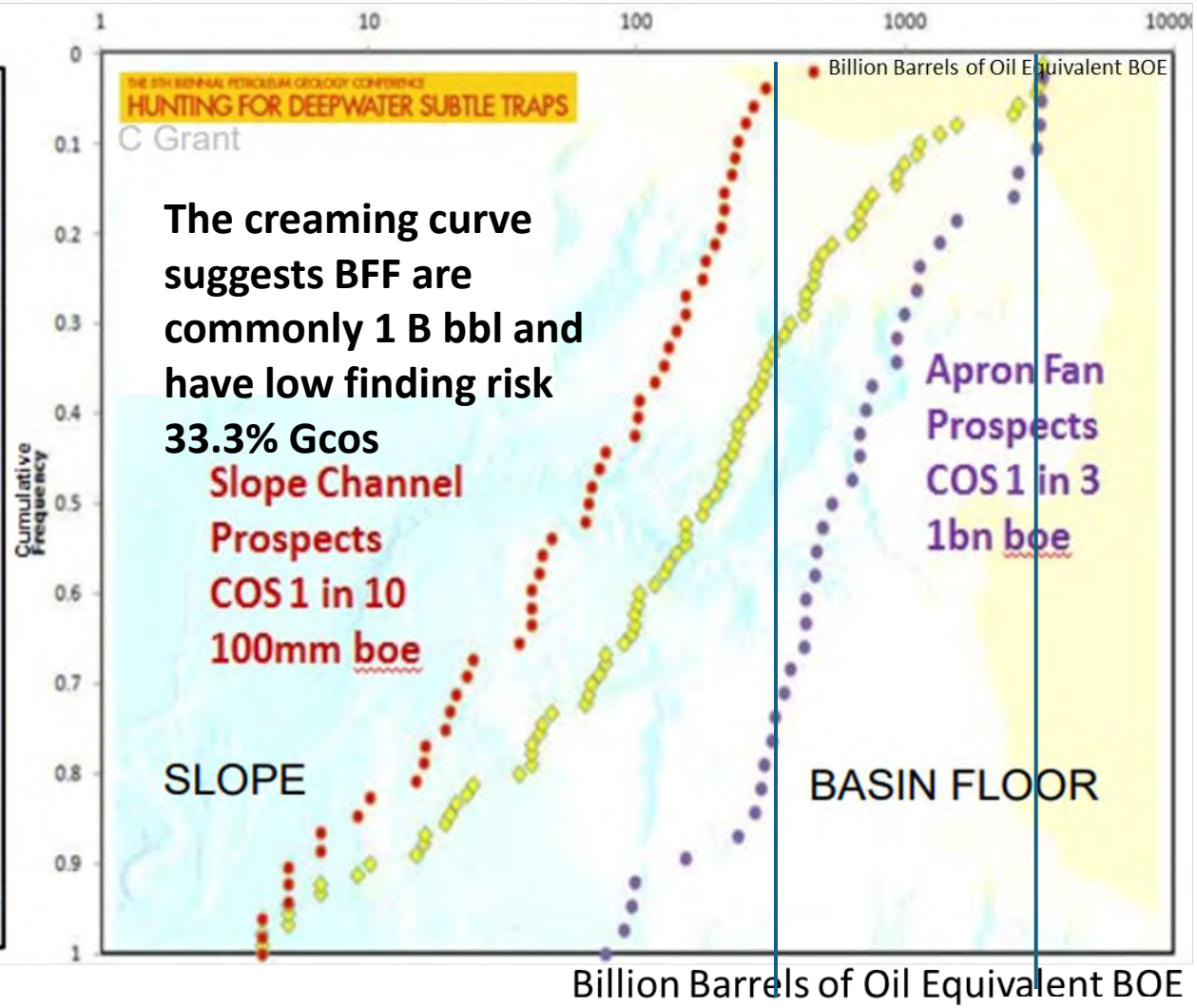

Ultra Deep-Water BFF are the Hot New Play!

BFF Significance Offshore African Equatorial Margin

The Hot New Play (2018) Before Baliene-1z and Murene-1x

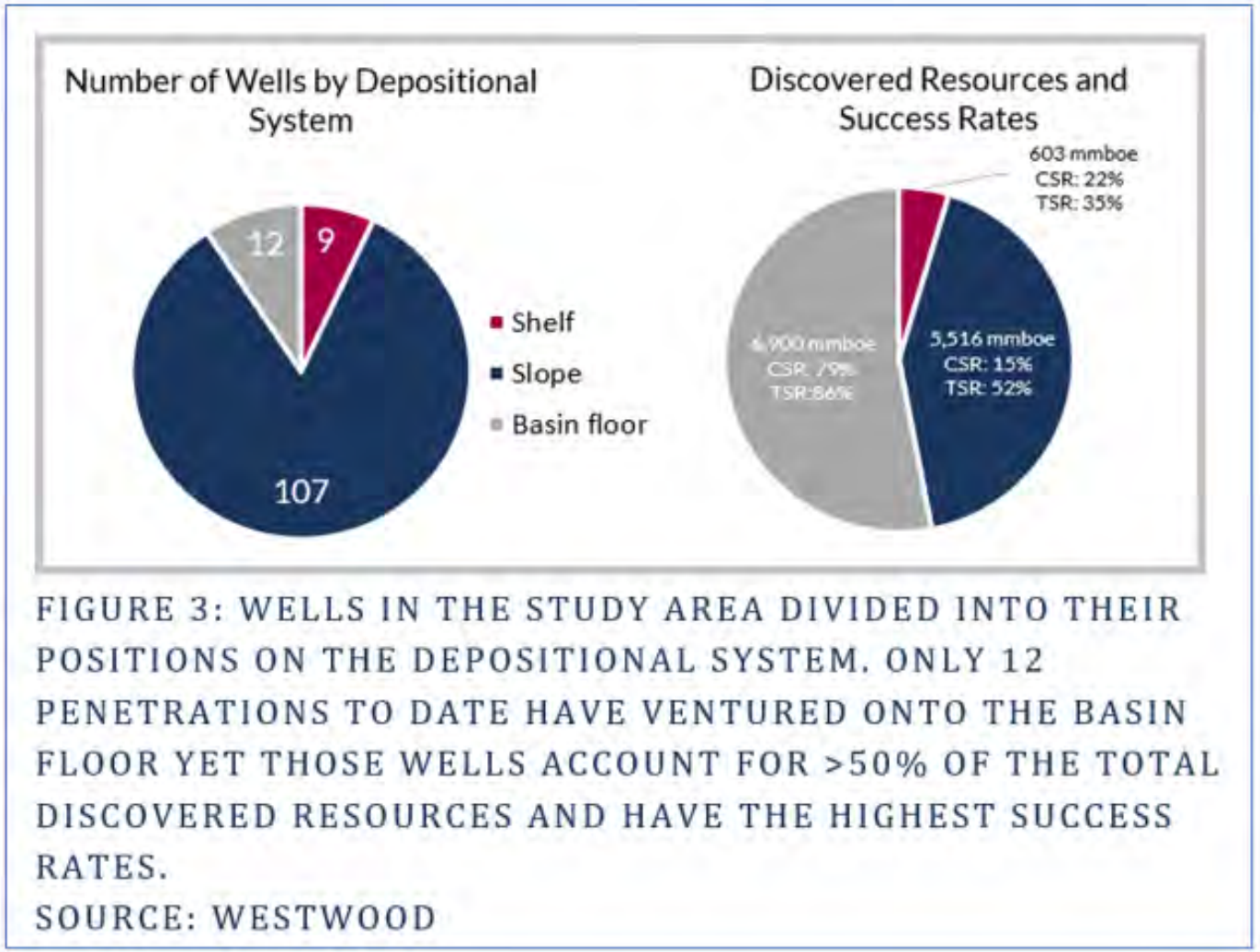

FIGURE 3: WELLS IN THE STUDY AREA DIVIDED INTO THEIR POSITIONS ON THE DEPOSITIONAL SYSTEM. ONLY 12 PENETRATIONS TO DATE HAVE VENTURED ONTO THE BASIN FLOOR YET THOSE WELLS ACCOUNT FOR >50% OF THE TOTAL DISCOVERED RESOURCES AND HAVE THE HIGHEST SUCCESS RATES.
SOURCE: WESTWOOD

Fig WC7: Equatorial Margin – Classification of wells based on Shelf/Slope/Basin Floor (Westwood Global 2

BFF Plays Central Transform Margin

Namibia, Ghana, Cote D'Ivoire, Liberia, Sierra Leone and Guyana

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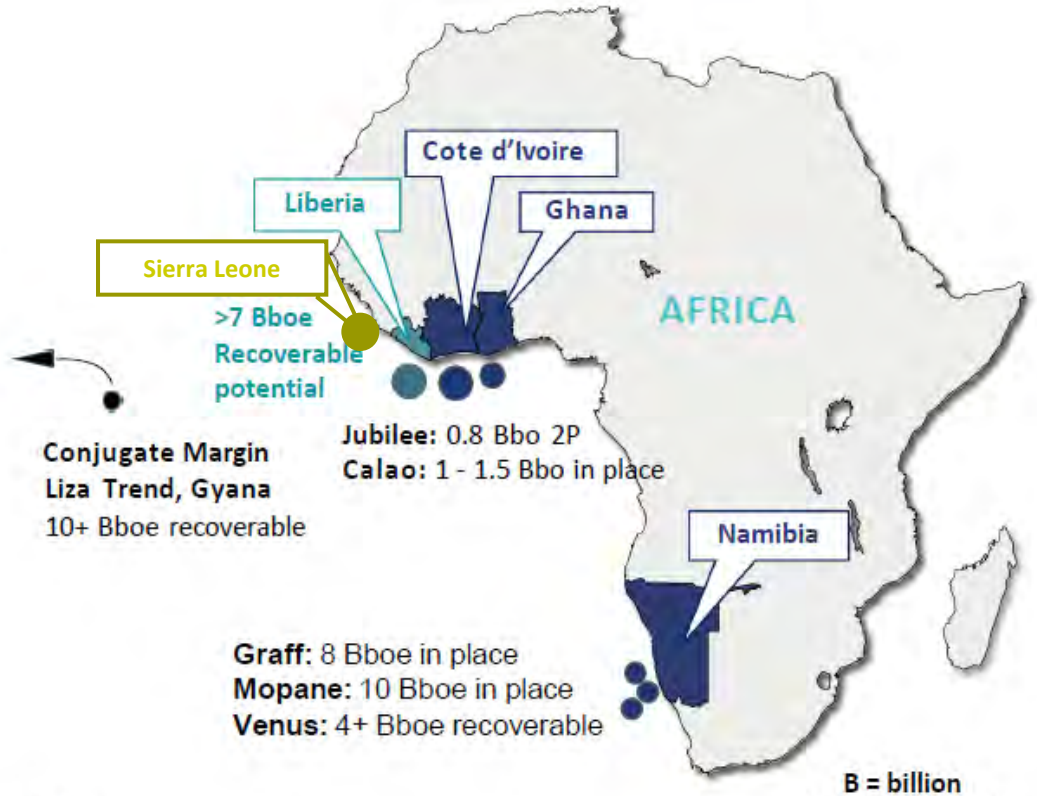

Liberia's Harper Basin

The last remaining undrilled South Atlantic margin basin containing the multi-billion-barrel deepwater fan / channel play

Refer to the Presentation of Oil & Gas Information at the end of this Presentation for additional information.

B = billion
bo = barrel of oil

All are Cretaceous deepwater fan depositional analogues

Namibia Well Count Before Venus-1x Discovery

No Ideas & New Plays

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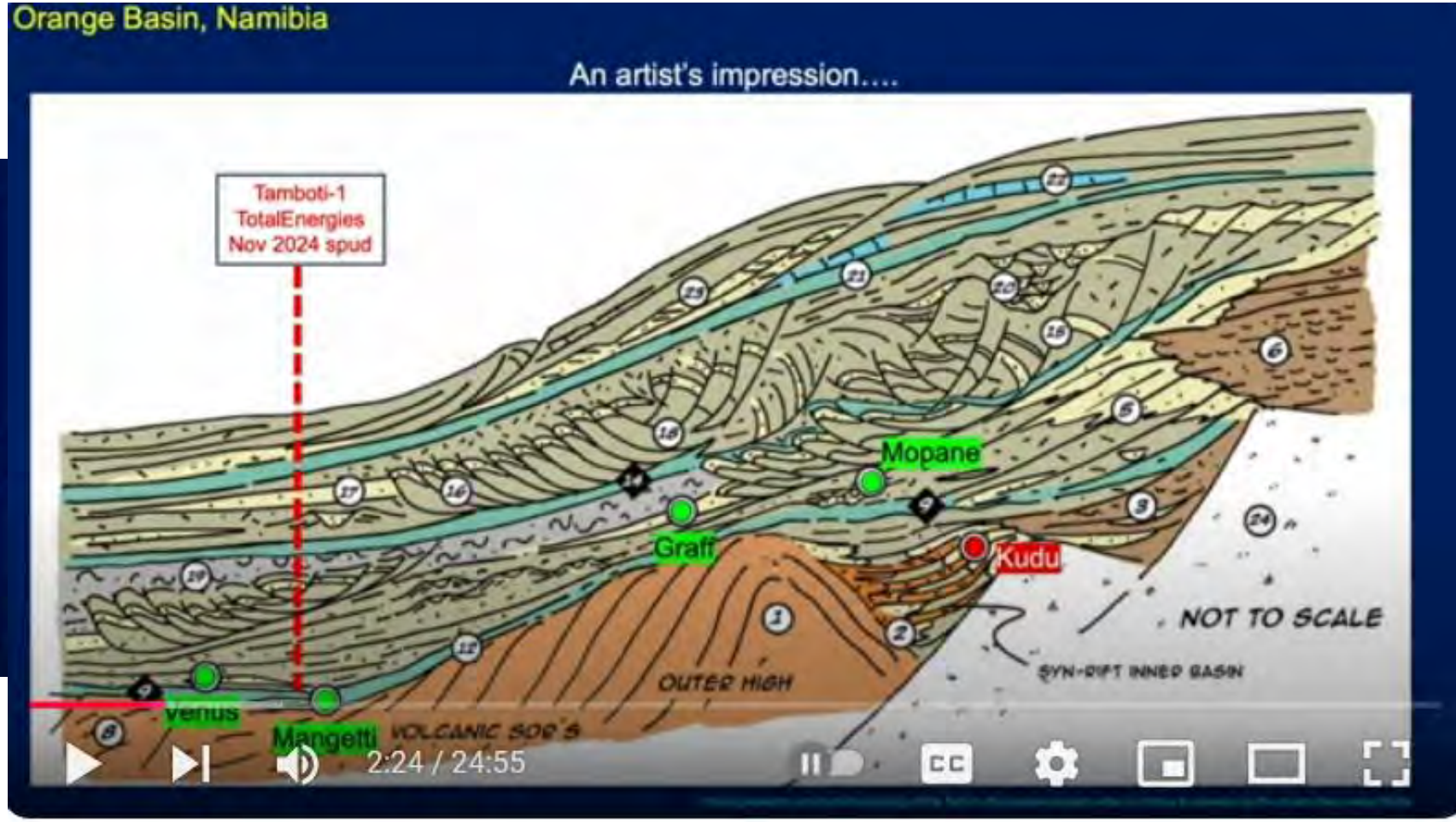
1,600km long continental shelf

Offshore exploration wells	12
Coastal wells	3
DSDP/ODP wells ("Research boreholes")	11
Total	26

~1 well per 60 km

Deep tests were all shelfal/coastal (similar in G-S basin)

Proved petroleum system – e.g. Wingat-1 (shows)



Reservoir	Enigmatic in early exploration Deepwater turbidites – basin floor fans (Venus) Stacked slope channel complexes (Mopane) Channels modified/truncated by gravity slides (Graff, Jonker, Enigma, La Rona, Lesedi)

Liberia : Analogue: Venus Mopane Multi-Bbls Oil Discovery

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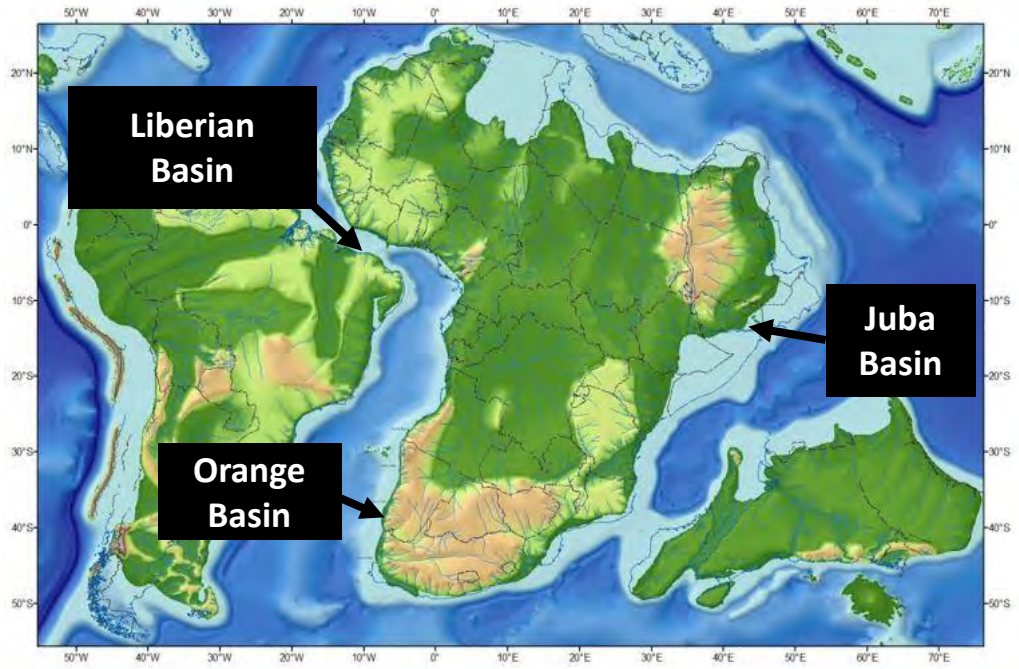
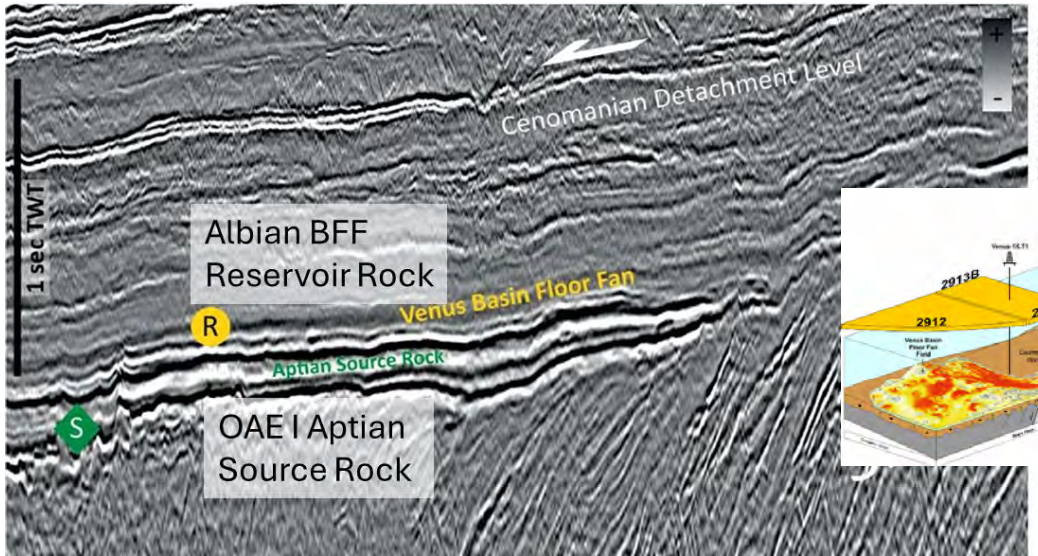
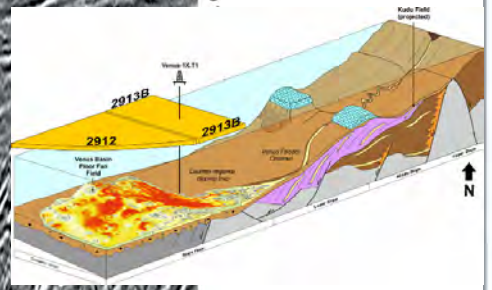
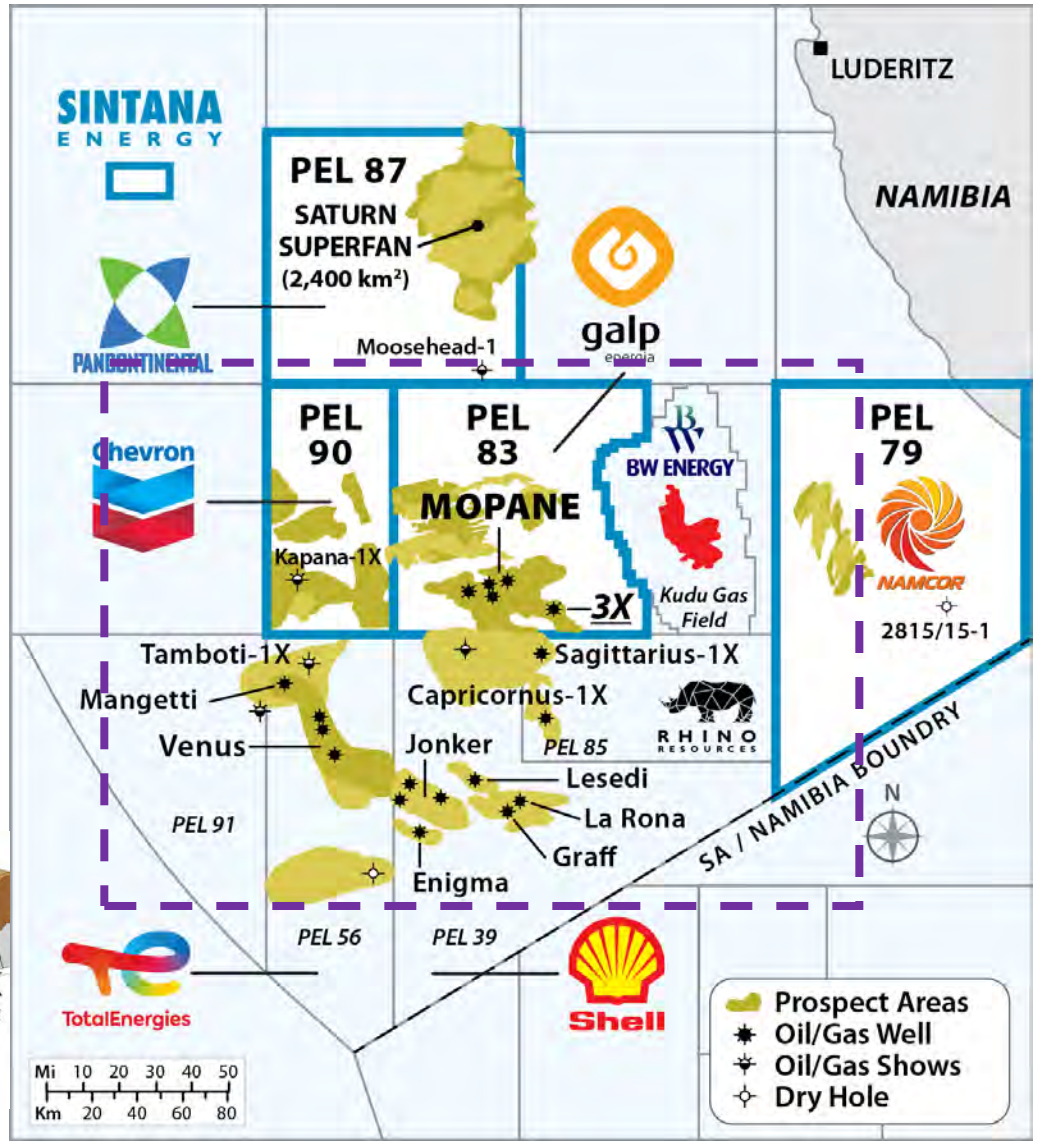
Namibia (Ultra –Deep water Aptian-Albian Aged Fans) Mopane 10 Bbls Recoverable?









Venus-1X: Introducing a New Distal Basin Floor Fan Play for Margins - GeoExpro

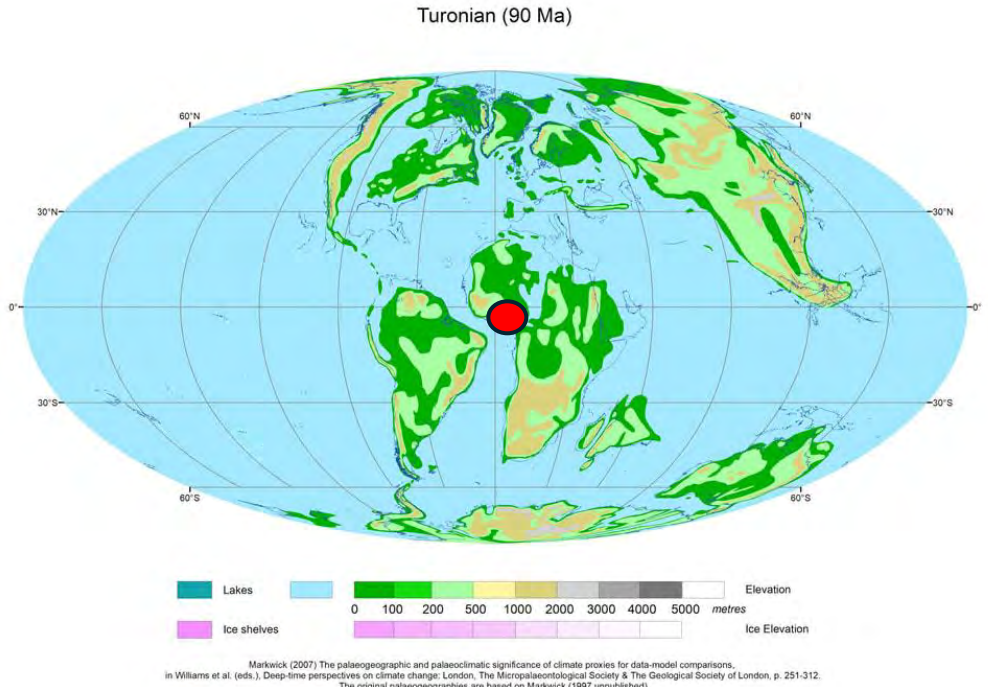
Turonian-Cenomanian (90Ma) Oil and Gas Reservoirs of The CATM

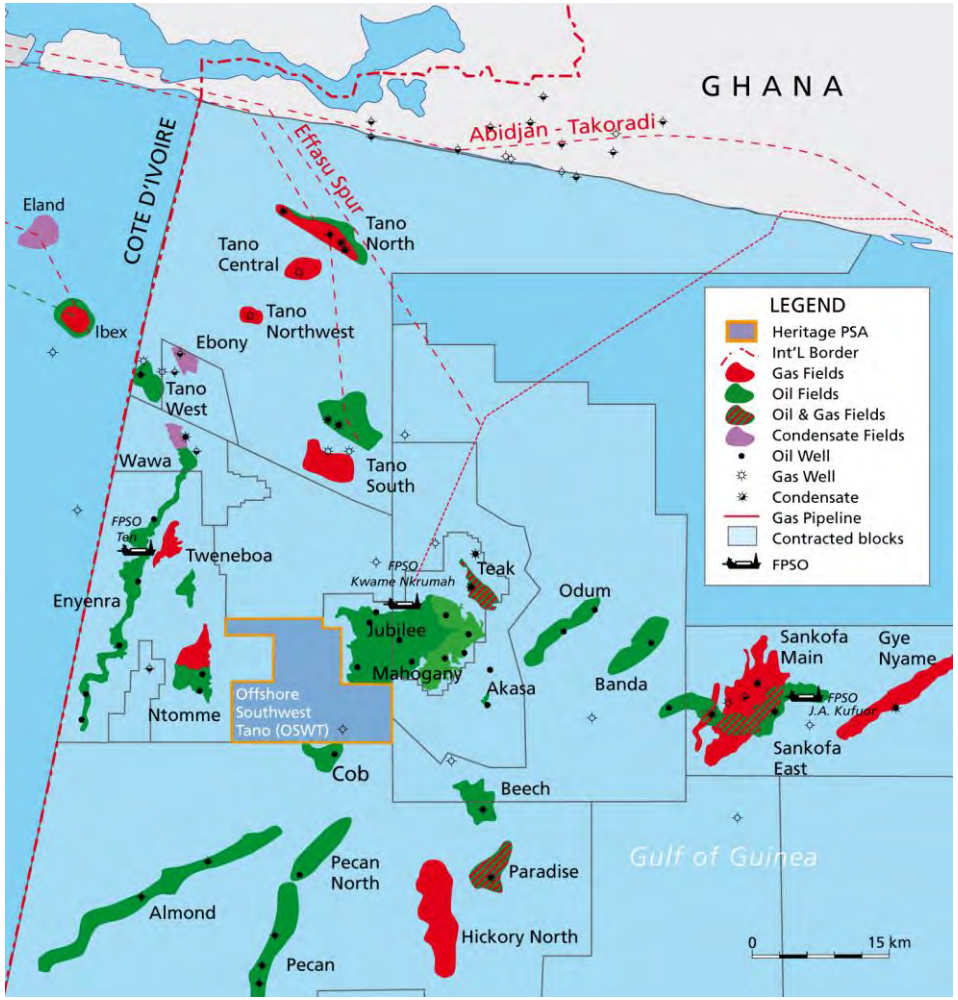
Direct Oil Field Analogues

Turonian-aged reservoirs in Ghana are primarily located in the Tano Basin, which has become prominent due to the Jubilee field discovery in 2007. The reservoirs are characterized by high-quality oil pay within fan sequences that are trapped in structural and stratigraphic traps. Noteworthy properties include:

Jubilee Field: Discovered in 2007 with the Mahogany-1 well encountering 98 meters of high-quality oil pay in a Turonian fan sequence. The field has since reached production levels exceeding 100,000 barrels of oil per day (BOPD)

Teak Prospect: This area contains approximately 21 meters of net hydrocarbon pay in the Turonian reservoirs, with static pressure data suggesting it forms a gas cap over the Jubilee field. Teak-2 well, drilled in 2011, confirmed significant hydrocarbon discoveries, including 27 meters of net hydrocarbons spread across both Turonian and Campanian reservoirs



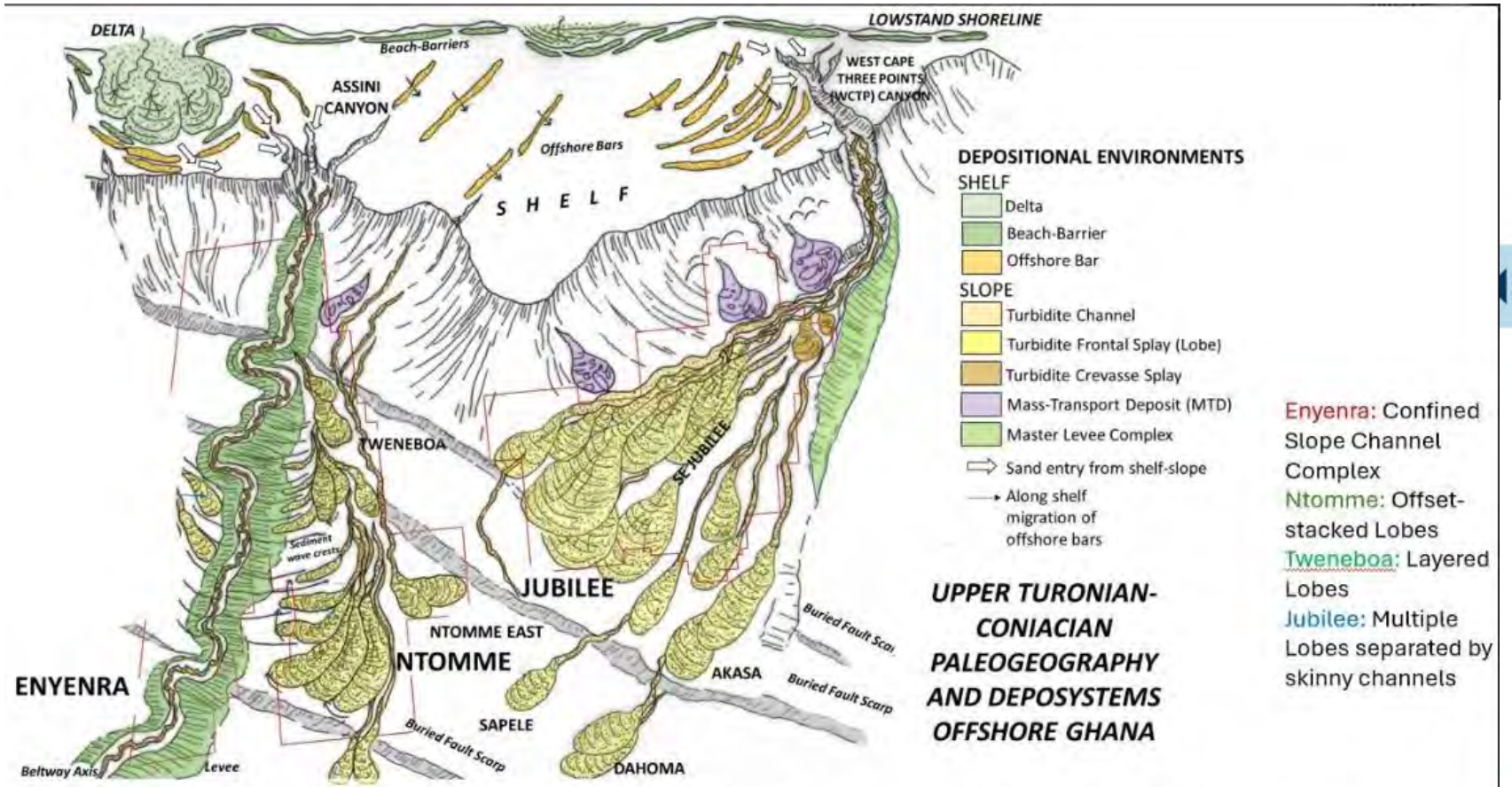


WELL	Net Oil Pay Turonian
Teak-1	21 m
Maghony-1	98 m

Offshore Ghana Depositional Systems

After Cronin 2024 (pers com)

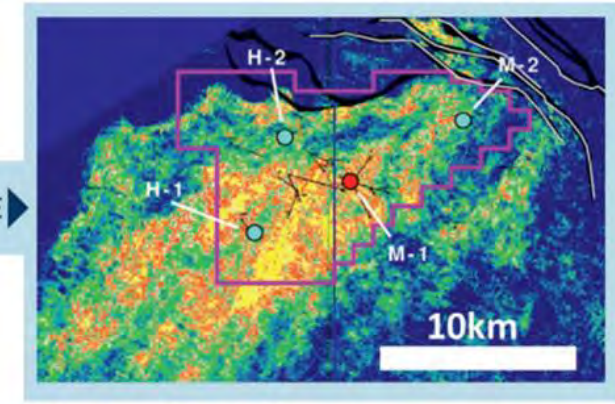
Section 2



Enyenra: Confined Slope Channel Complex
Ntomme: Offset-stacked Lobes
Tweneboa: Layered Lobes
Jubilee: Multiple Lobes separated by skinny channels

From: **Cronin, B.T. (2024)** Innovations in Deep-Water Sedimentology and Their Impact on Field Development on the Cote d'Ivoire-Ghana Margin: hybrid system impact on slope channel complex stacking, frontal splay stacking, mass-wasting, stratigraphic trapping, and field development and planning HGS/GESGB Africa E&P Meeting, Houston, September.

SAME SCALE



Ghana, Tano Basin

Up-dip faults are crucial

Jubilee Field in Ghana

Rec. reserves

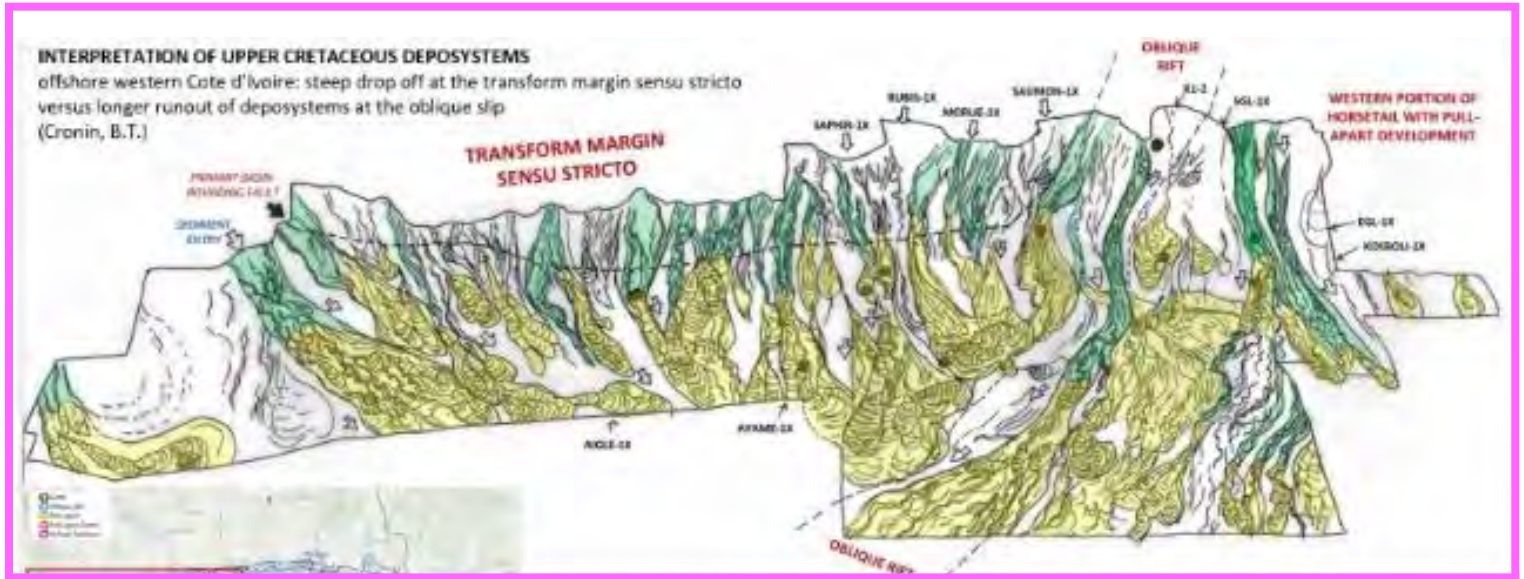
>600 mmstb to >1200 billion bbls

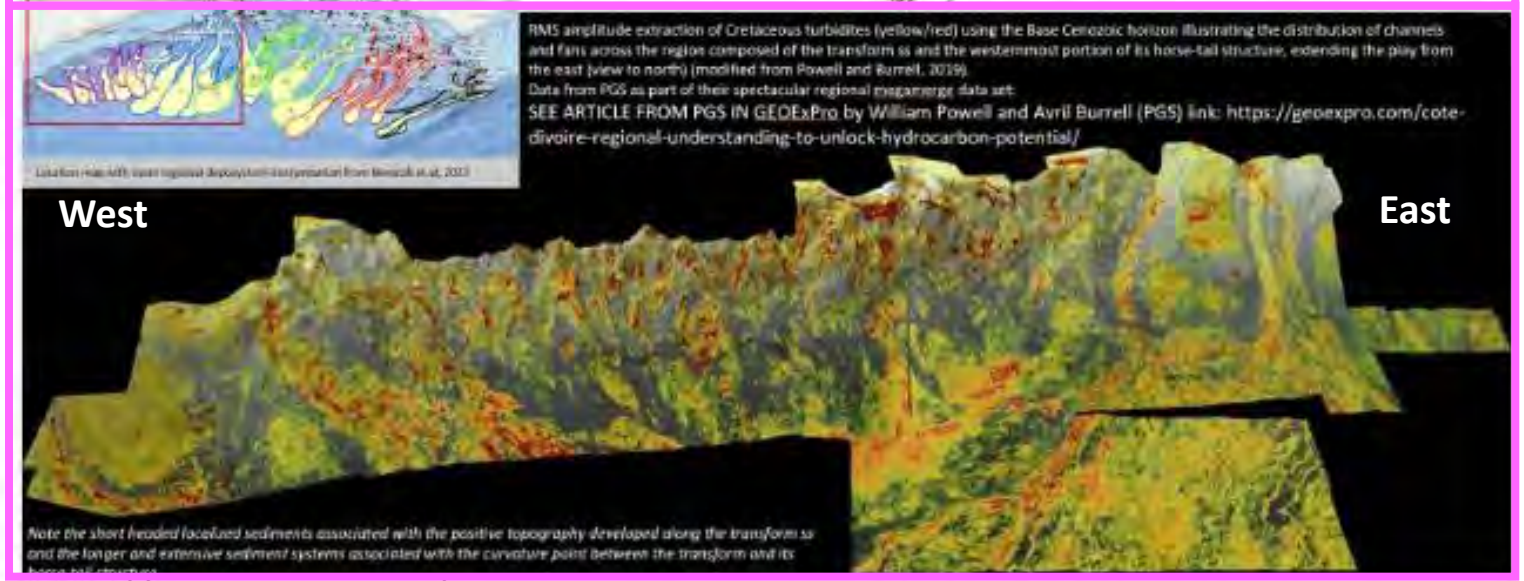
Production plateau 150,000 bopd

Offshore Ivorian Coast – Turbidite Systems Across A Regional Scale

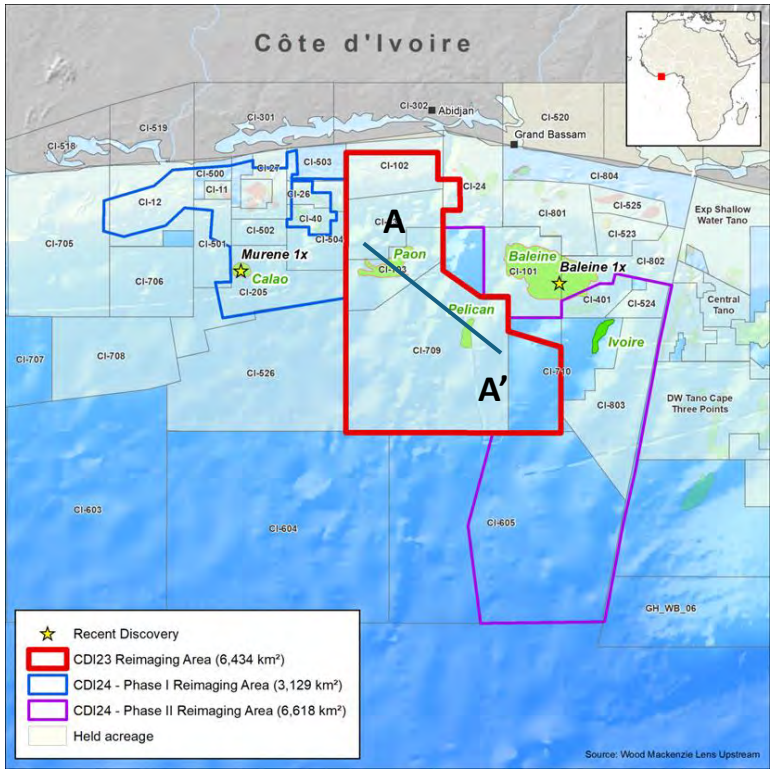
A Profusely Active & Confined Sandy System! Cronin 2024 (Pers com)

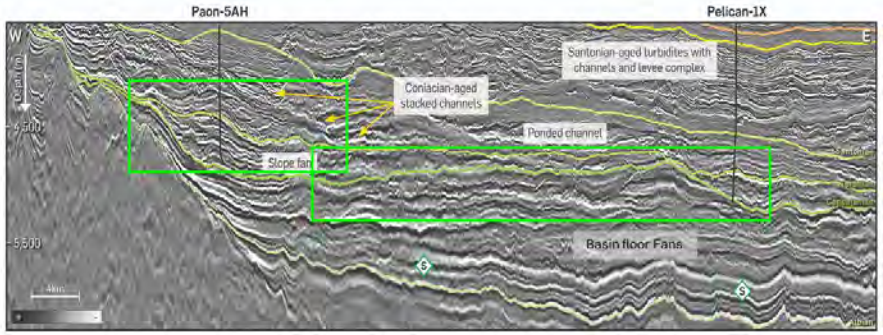
PETROQUEST LIBERIA DEEP WATER LLC





https://geoexpro.com/cote-divoire-the-new-west-african-exploration-hotspot/





Seismic Line A-A'

2016 Guyana ExxonMobil's Giant BFF 'Liza' Oil Discovery

Over 43+ wells have now been drilled Offshore Guyana

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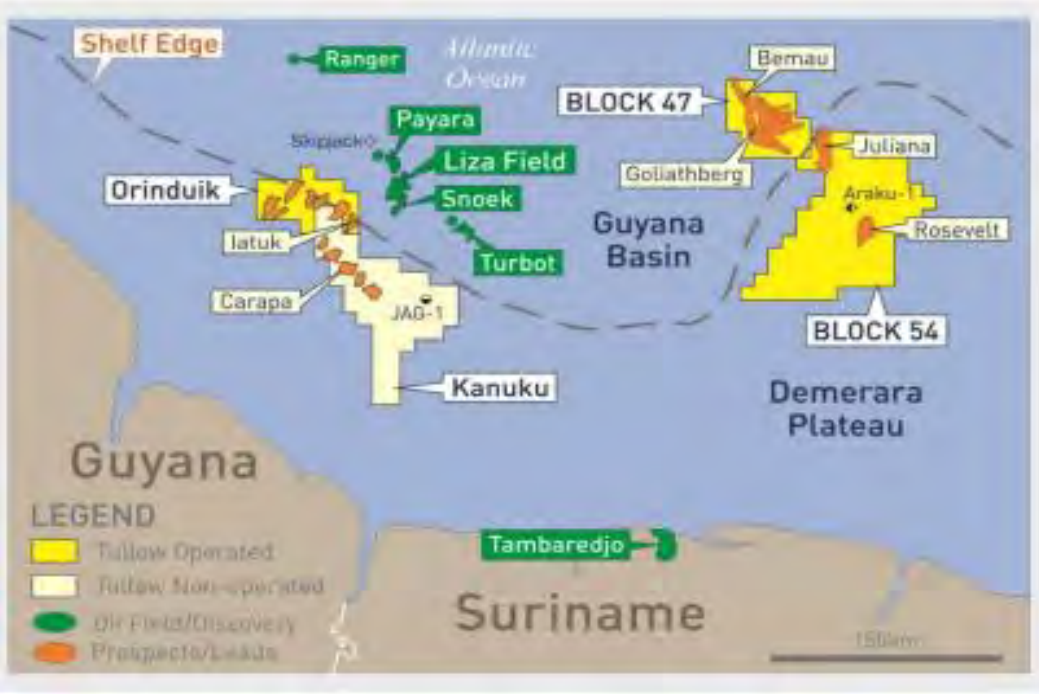
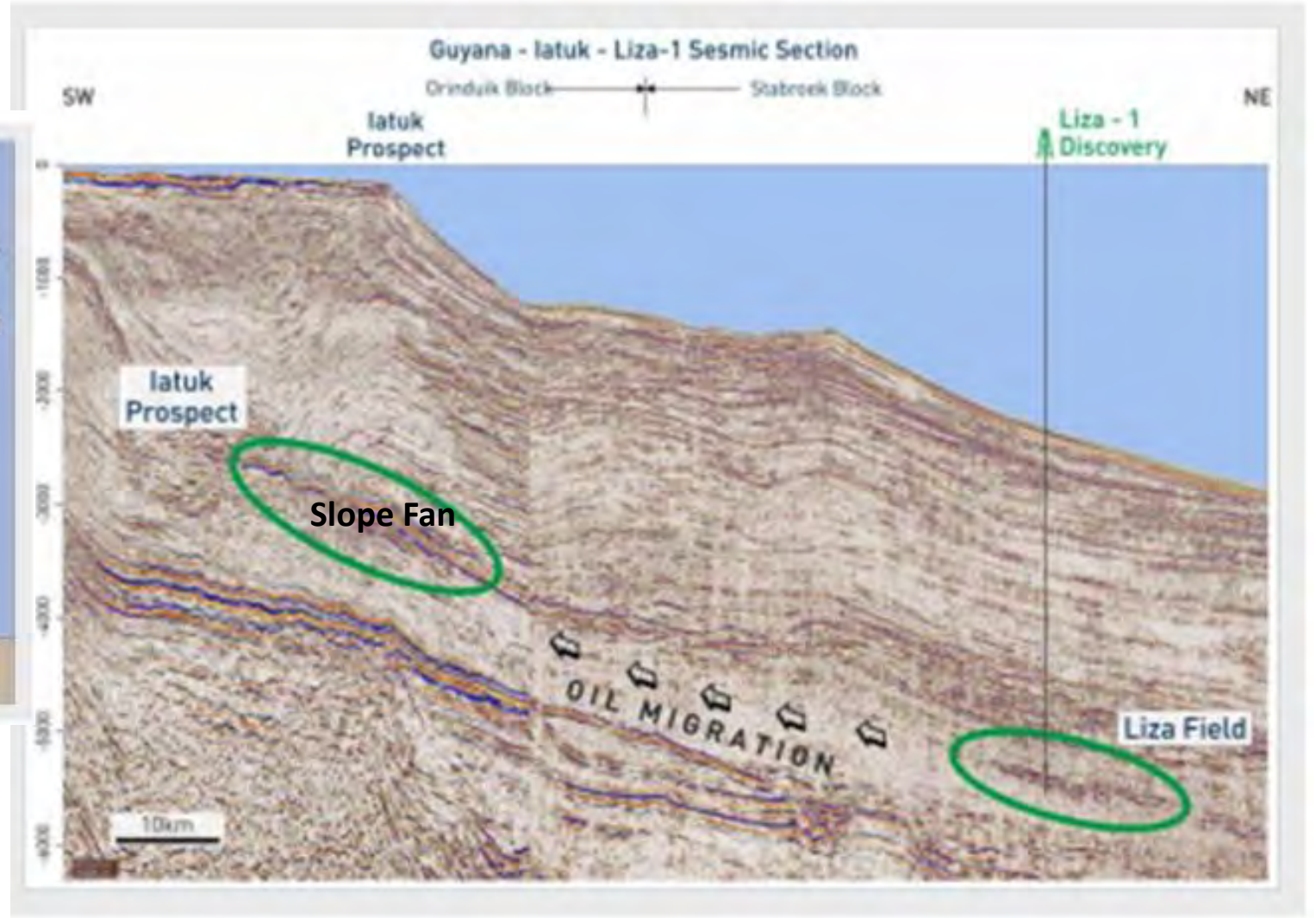




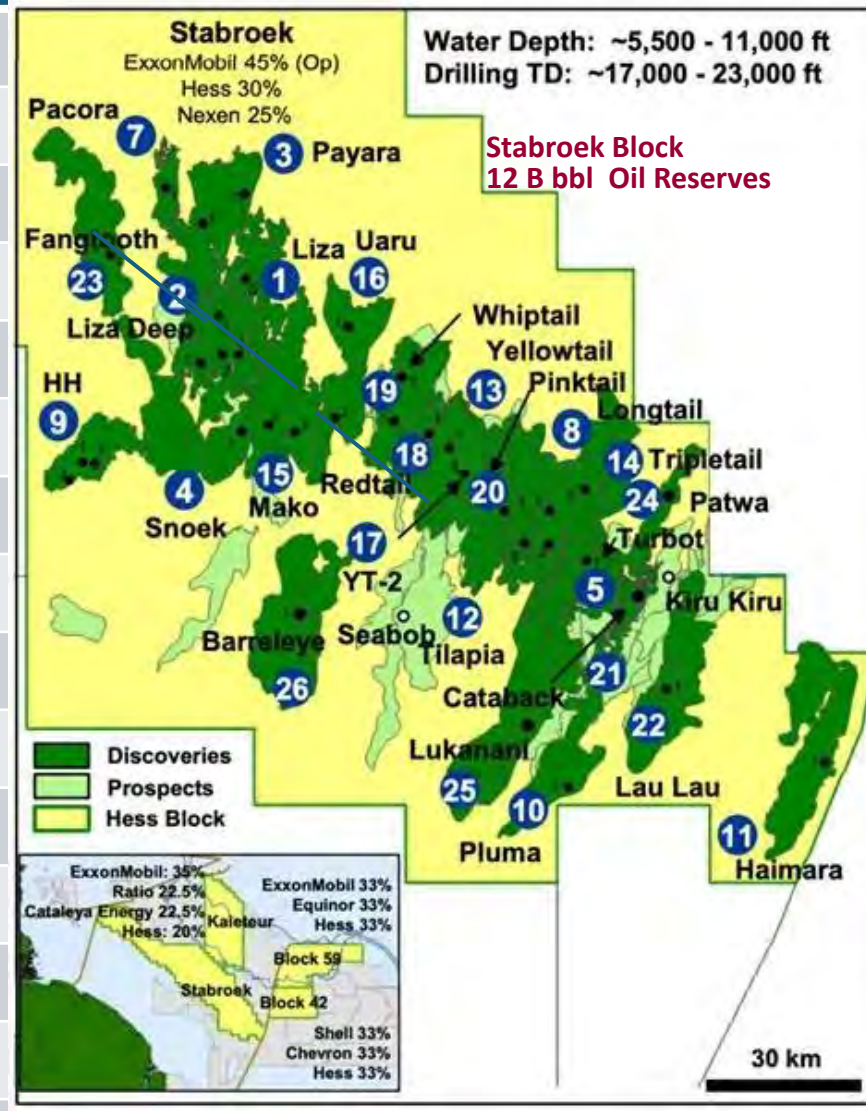
BFF Fan

Campanian-Maastrictian (90Ma) Oil & Gas Reservoirs of The CATM

PETROQUEST
LIBERIA DEEP WATER LLC

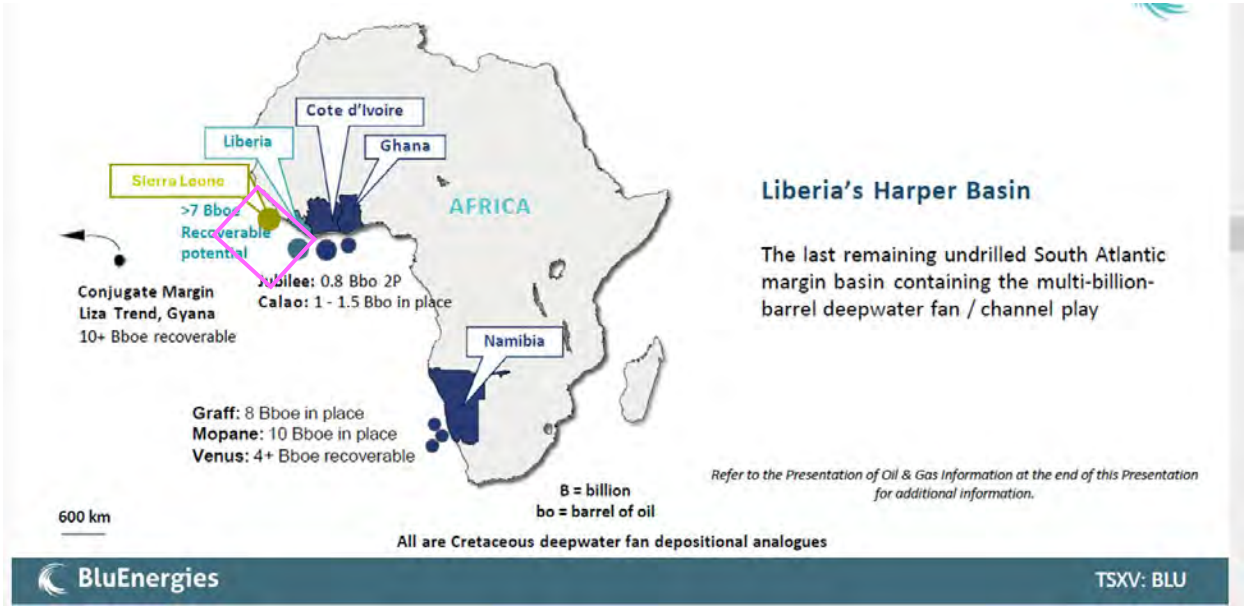
Offshore Guyana 23 oil discoveries in Campanian to Maastrictian Reservoirs

Well	Net Hydrocarbon Pay	Well	Net Hydrocarbon Pay
Liza-1 (2015)	90m	Fangtooth-1 (2022)	50m
Payara-1 (2017)	30m	Barreleye-1 (2022)	70m
Snoek-1 (2017)	25m	Patwa-1 (2022)	33m
Turbot-1 (2017)	23m	Lukanani-1 (2022)	35m
Pacora-1 (2018)	20m	Seabob-1 (2022)	40m
Longtail-1 (2018)	78m	Kiru-Kiru-1 (2022)	30m
Pluma-1 (2018)	37m	Sailfin-1 (2022)	95m
Yellowtail-1 (2019)	89m	Yarrow-1 (2022)	23m
Mako-1 (2019)	50m		
Uaru-1 (2020)	30m		
Redtail-1 (2020)	70m		
Whiptail-1 (2021)	51m		
Pinktail-1 (2021)	67m		
Cataback-1 (2021)	74m		
Lau Lau-1 (2022)	96m		



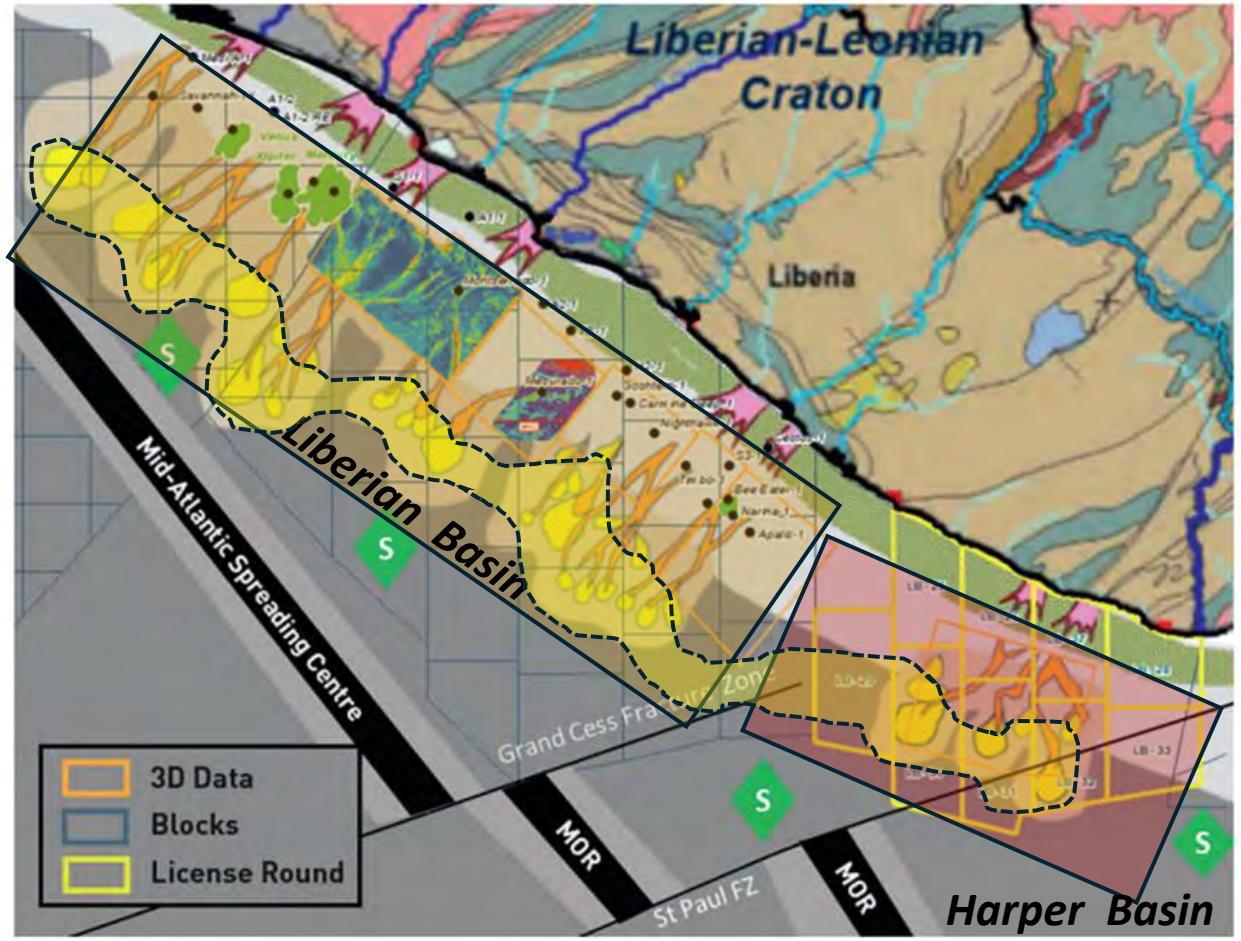
Prospect Generation Harper Basin

Jupiter & Zeus BFFs



Liberian Basins & Play Types (Local)

The Liberian Basin and the Upper K BFF Play straddles two jurisdictions, Liberia & Sierra Leone



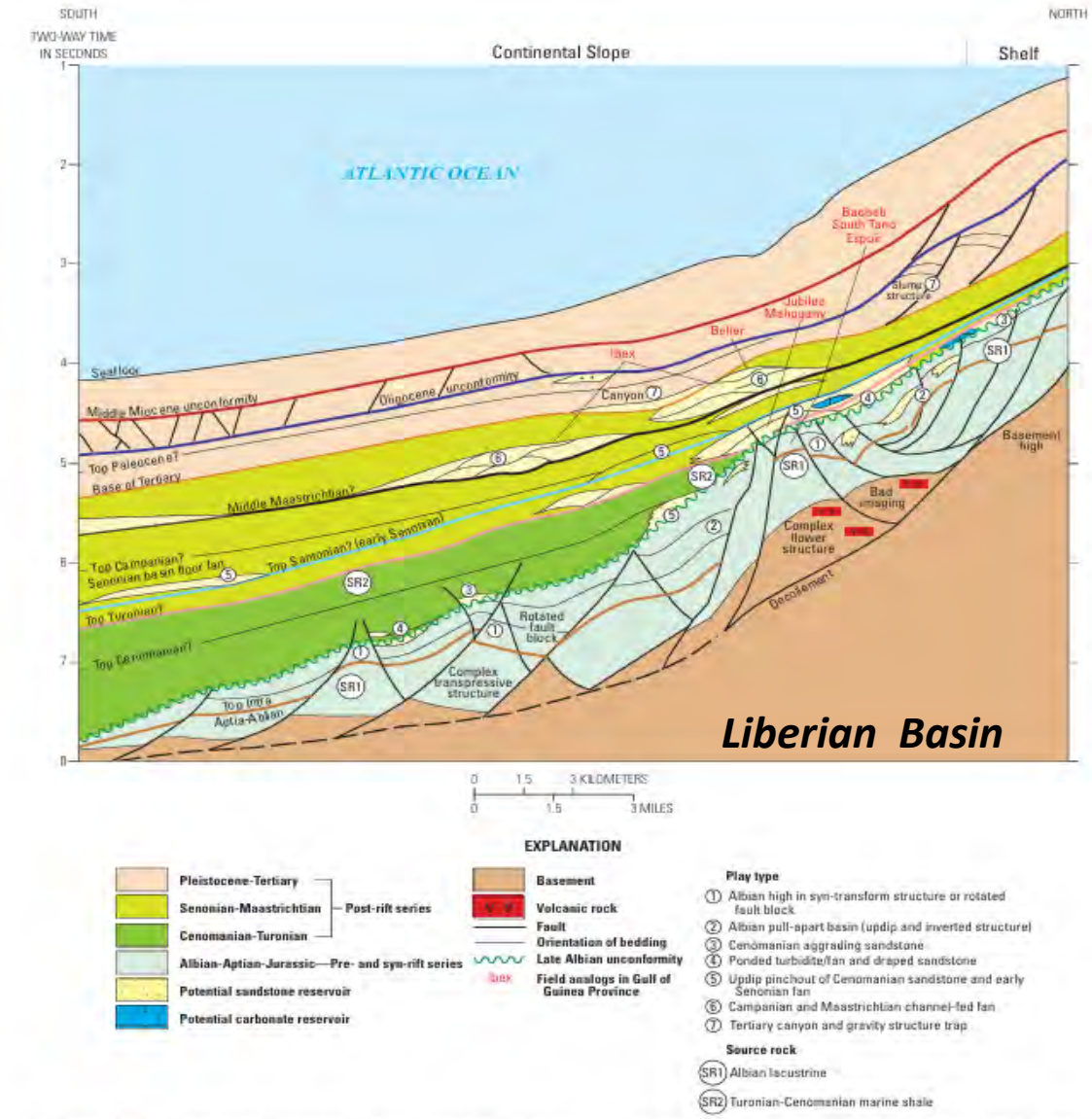


Figure 6. Cross sectional stratigraphy based on seismic data of offshore Sierra Leone margin showing field analogs with Côte d'Ivoire offshore basin. Modified from Grand and others (2009).

Prospect Generation – Opportunities Available

Current Acreage Positions- July 2025 Offshore Liberia

PETROQUEST
LIBERIA DEEP WATER LLC

Oil & Gas Permits

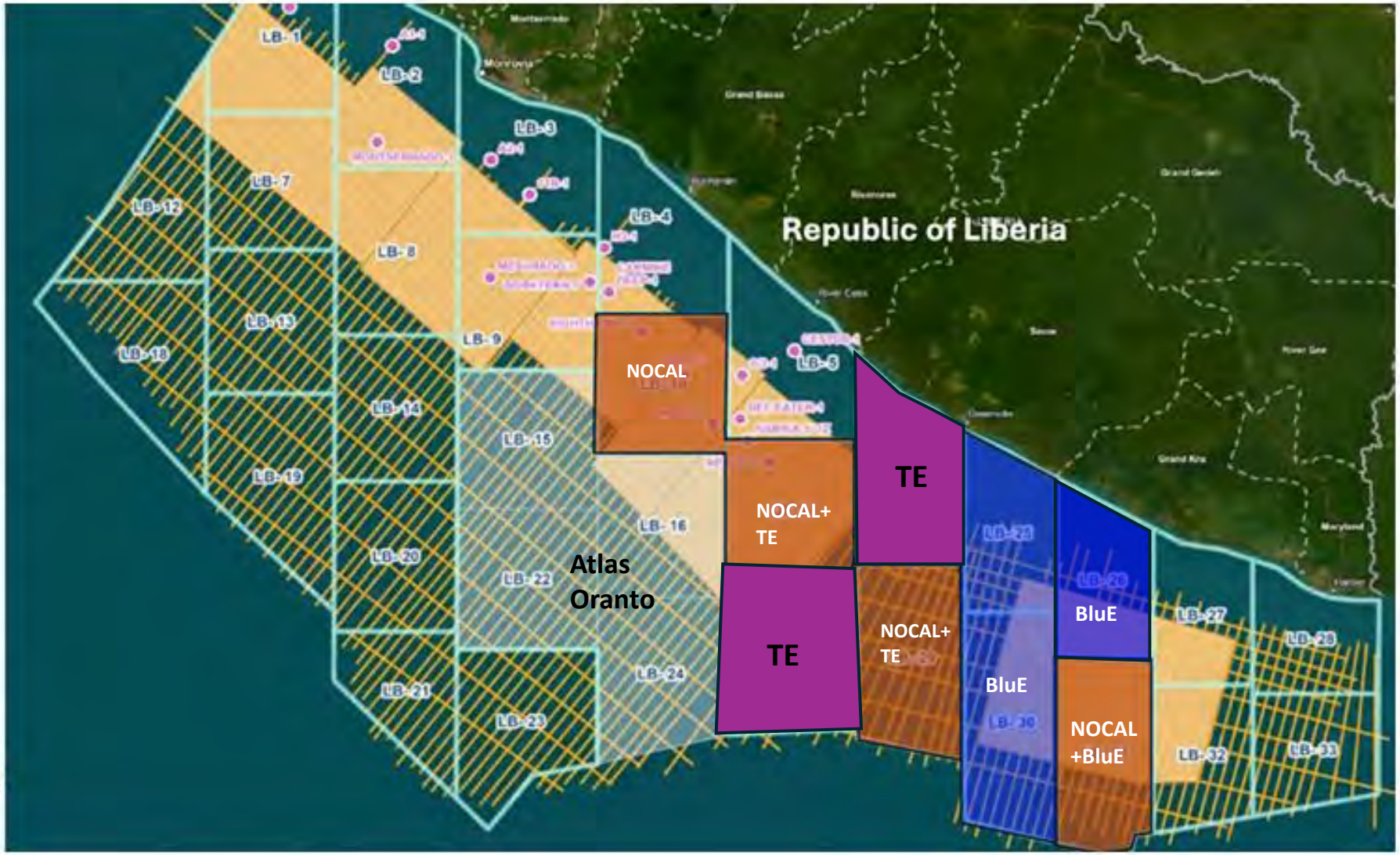
Bid Round Closed November 2024

Note ExxonMobil negotiating PSCs for 15,16 22 and 24

NOCAL Awarded LB 10, 11, 29 and 31 by Executive Allocation

Blue Energies have Blocks 30 and 25 as LR001 (Recon Permit)

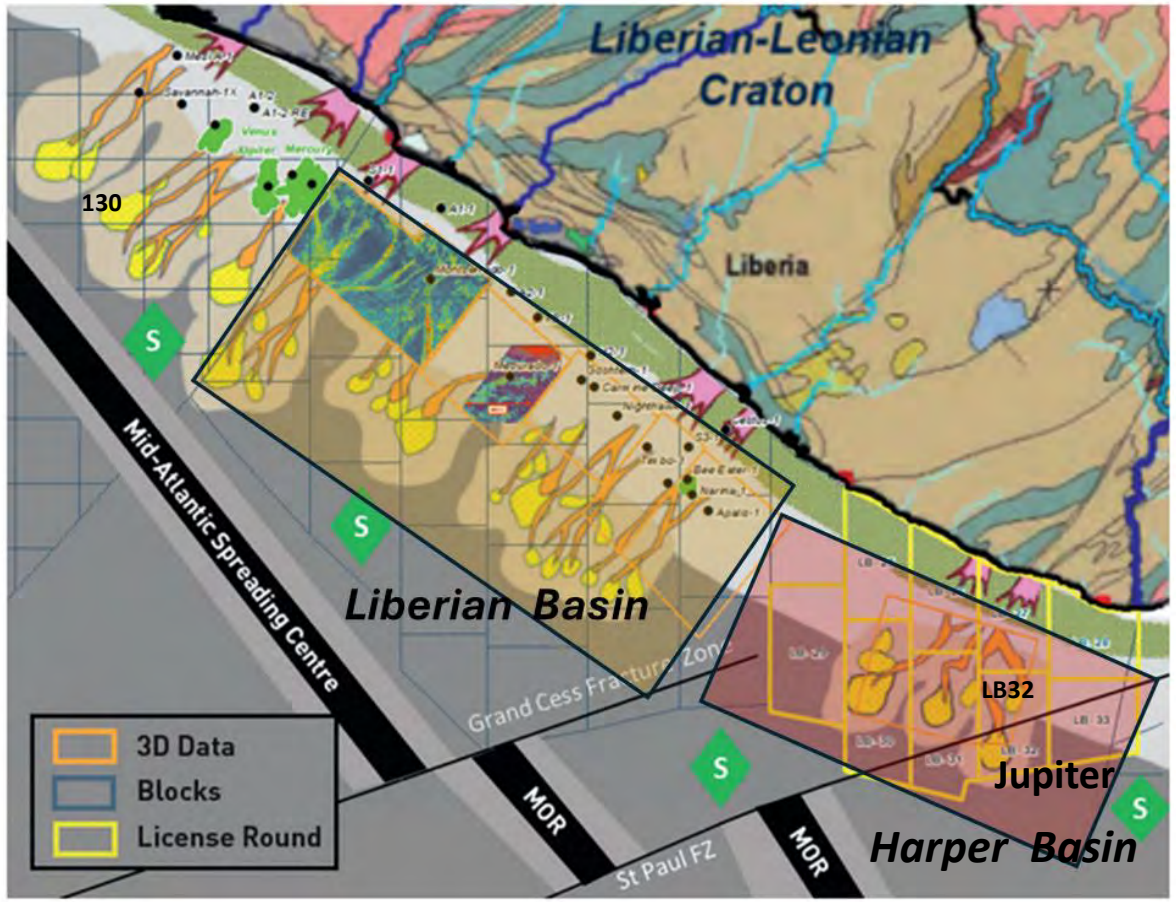
Liberia's Future focus on BFF due to global drilling results in the period 2020-2025



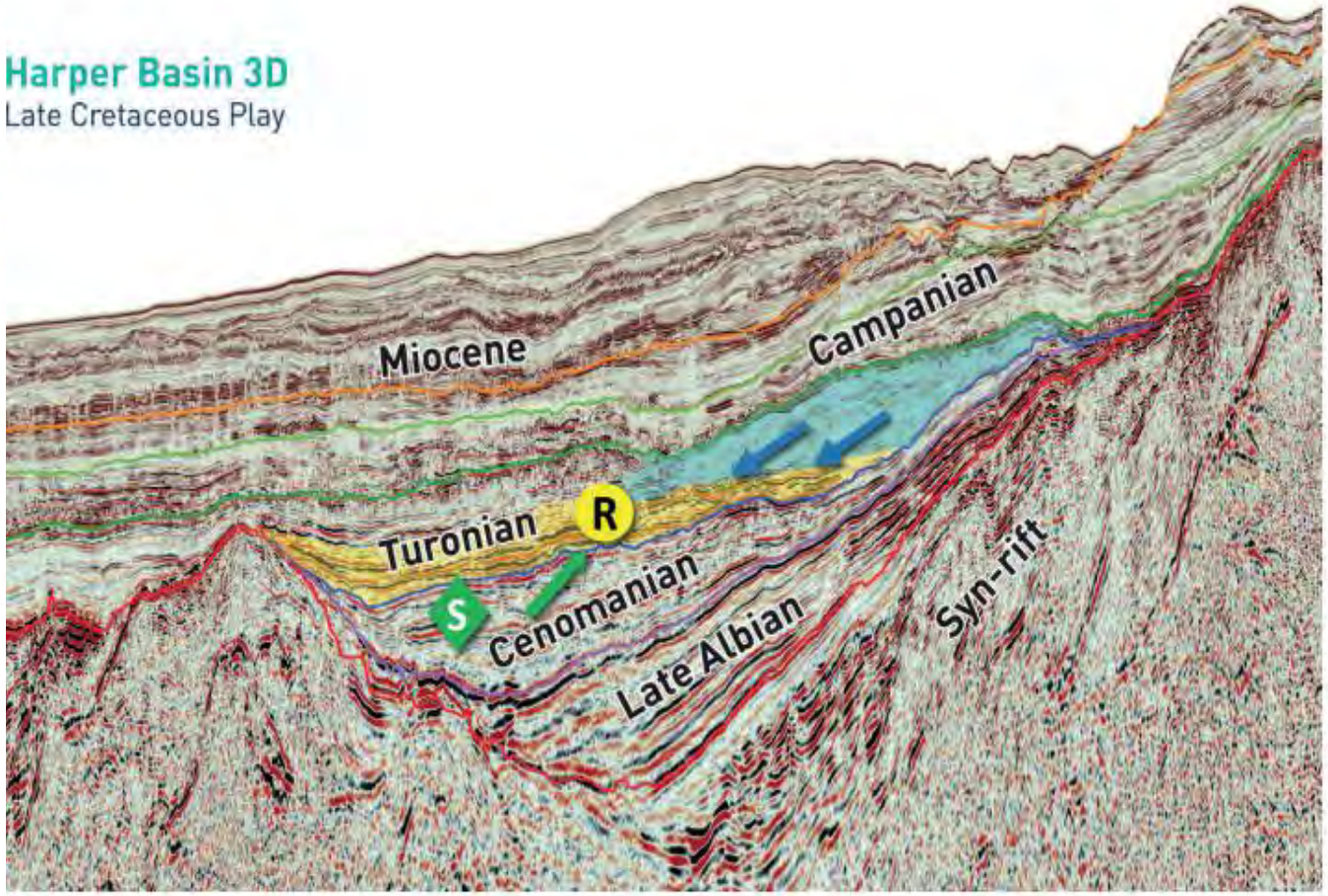
Harper Basin: No prior drilling (Basin Size 22,000 km2)

BFF Play (Blocks 30, 31 and 32).

PETROQUEST
LIBERIA DEEP WATER LLC



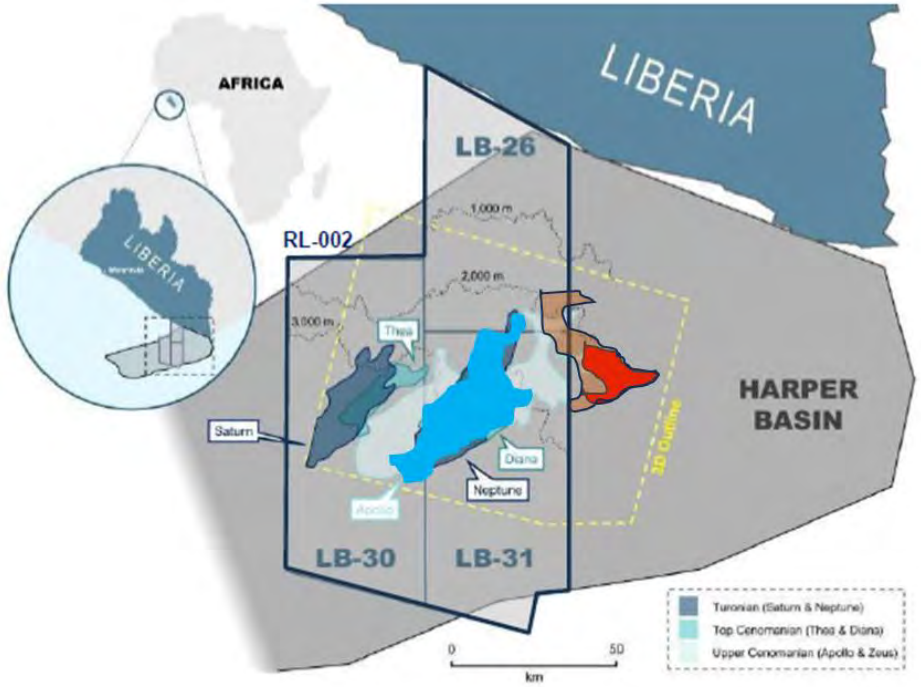
TGS Published Map Offshore Liberian And Harper Basin

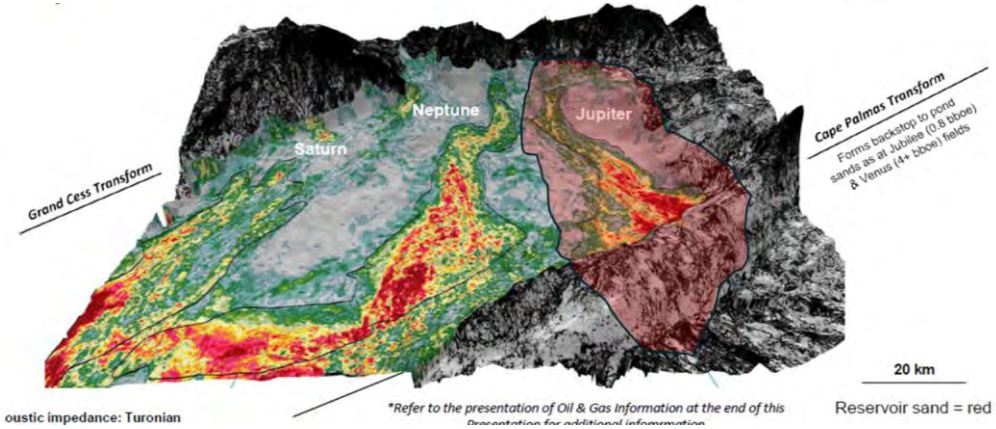


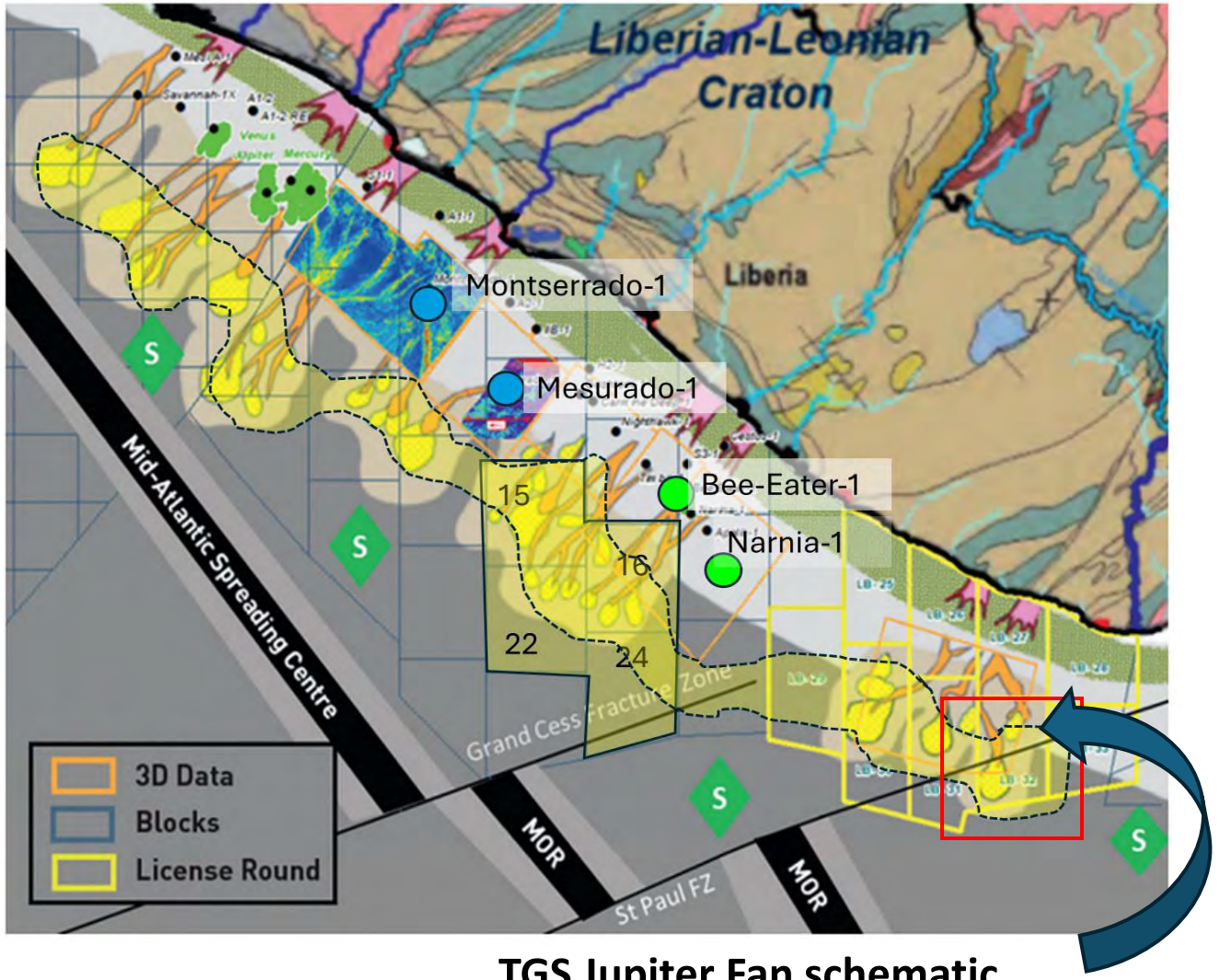
TGS Published Seismic Line Through The Harper Basin

Jupiter Fan LB32

Mapped by BluEnergies and TGS





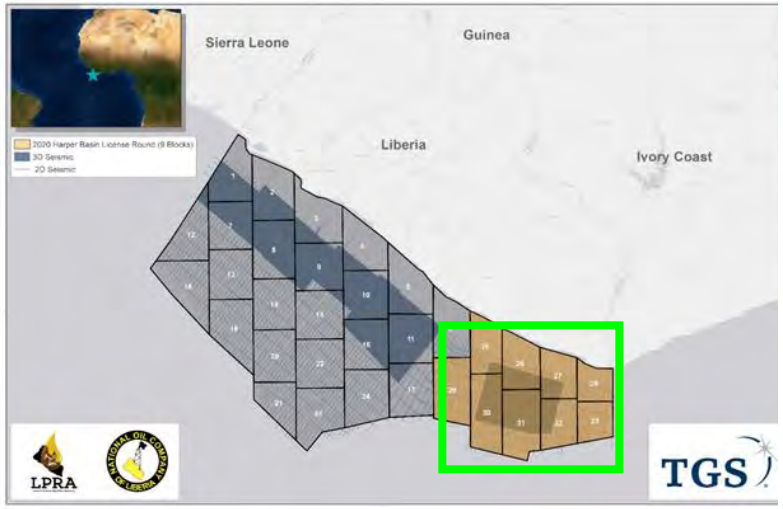


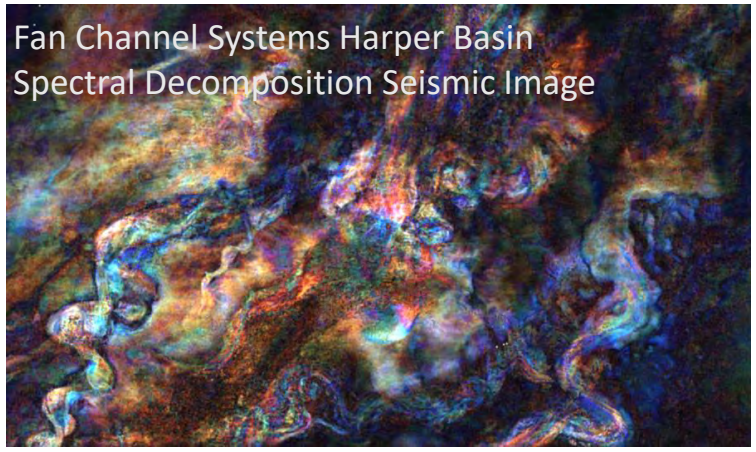
TGS Jupiter Fan schematic

Harper Basin Stratigraphic Traps are Untested!

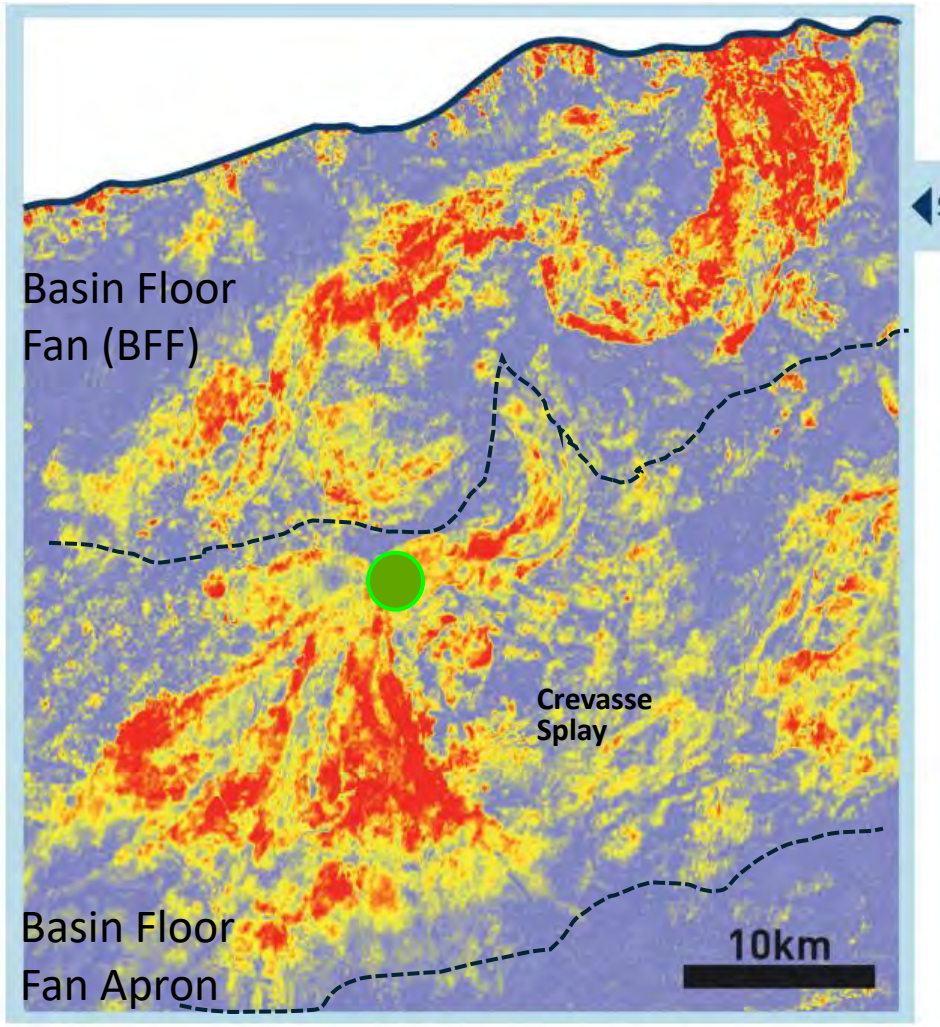
Morphology of Fans Observed on 3D Seismic Data in the Turonian and Cenomanian

PETROQUEST
LIBERIA DEEP WATER LLC



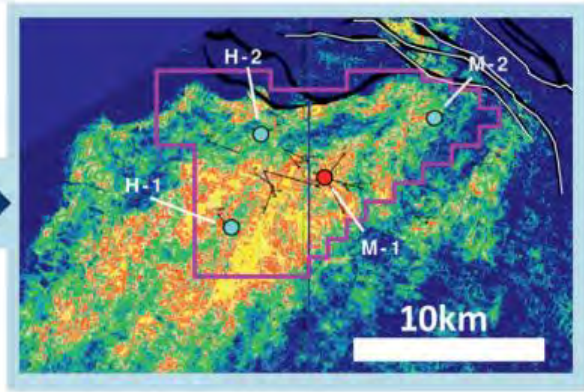


Multiple Morphologies and Fan types



Basin Floor Fan(BFF)

SAME SCALE



Ghana, Tano Basin

Up-dip faults are crucial

Jubilee Field in Ghana

Rec. reserves

>600 mmstb to >1200 billion bbls

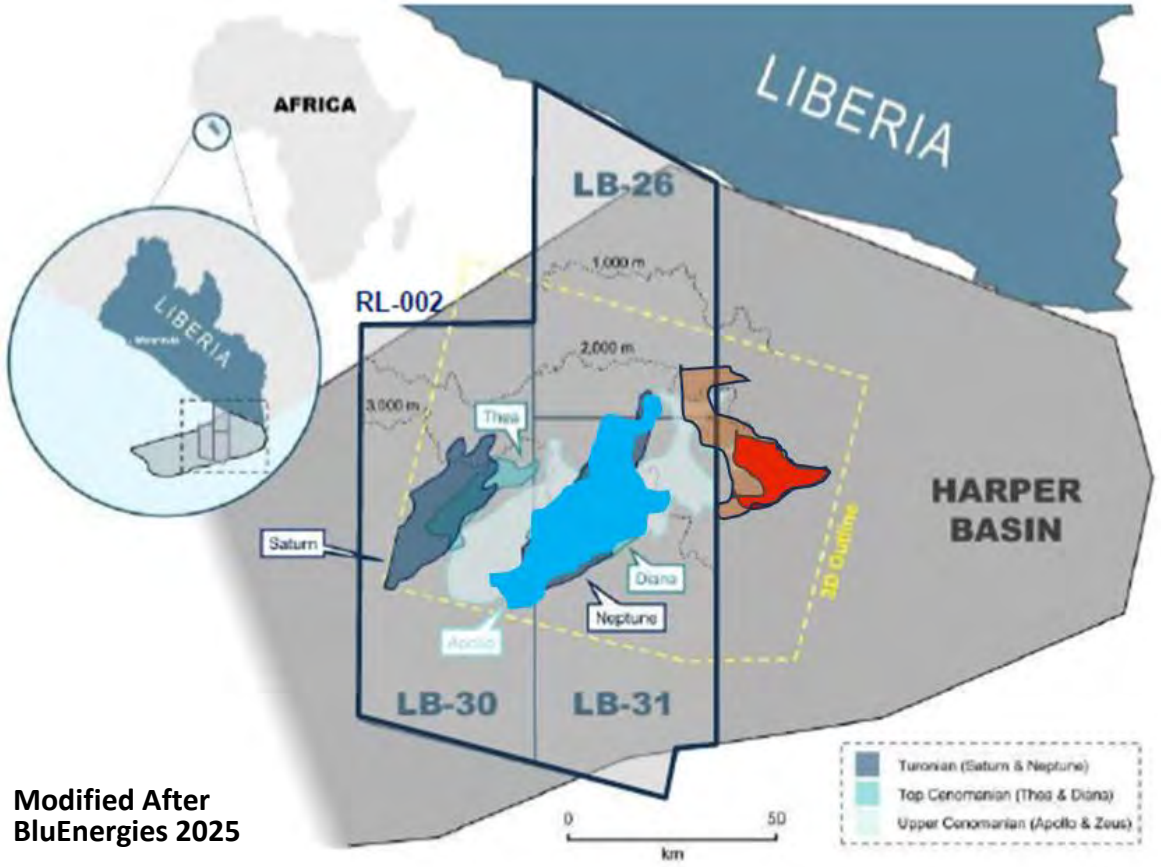
Production plataeu 150,000 bopd

Harper Basin: Deep Water Fan Plays Abound!!

A series of Upper Cretaceous Basin Floor Fan Systems

PETROQUEST
LIBERIA DEEP WATER LLC

Resource Potential: 7.3 Billion Recoverable boe Identified Thus Far*



Modified After BluEnergies 2025

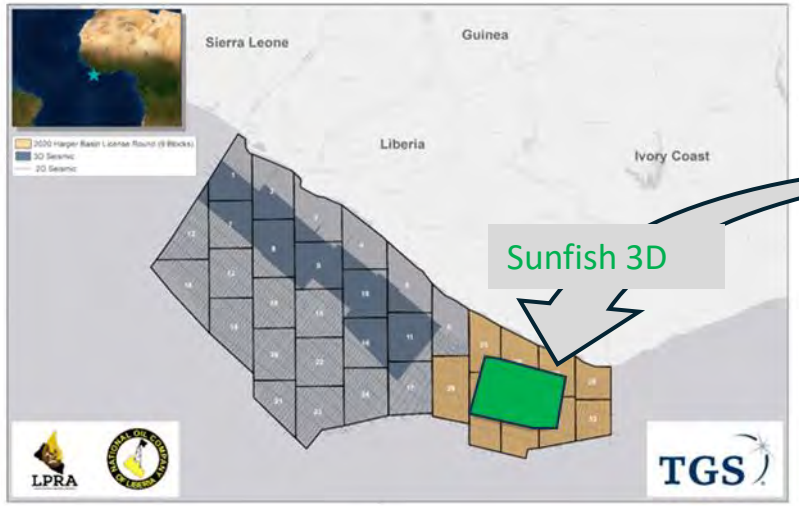
- Reconnaissance License No. LPRA - 002: **100% WI**
- Comprises around 40% of the Harper basin
- 2.5 - year primary term ending March 5, 2026; extendable by 1 year
- 7 deepwater fans: 6 assessed thus far
- **7.3 bboe** unrisked recoverable prospective resource potential*
- Block 26 as yet unassessed
- Scale, repeatability, synergy, short cycle time
- Multiple targets can be tested with one well
- High risk tolerance: >$200 MM Expected Monetary Value

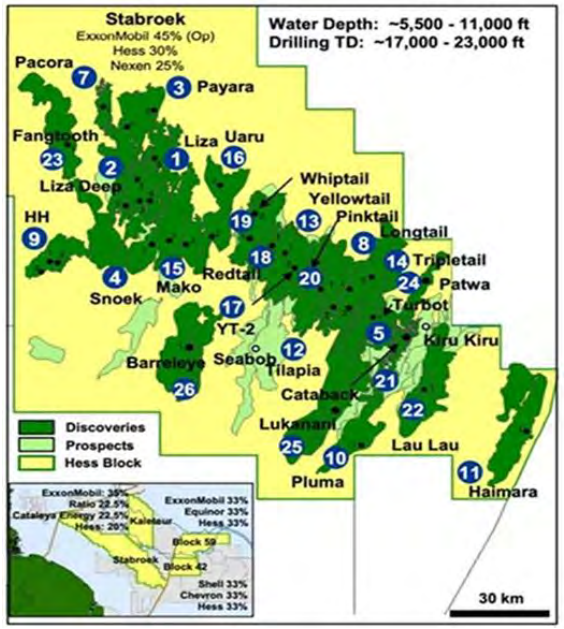
**Refer to the Presentation of Oil & Gas Information at the end of this Presentation for additional information.*

Cenomanian Play Fair-way: Harper Basin Laterally Stacked BFFs

West Africa's Untested Golden Lane?

PETROQUEST LIBERIA DEEP WATER LLC



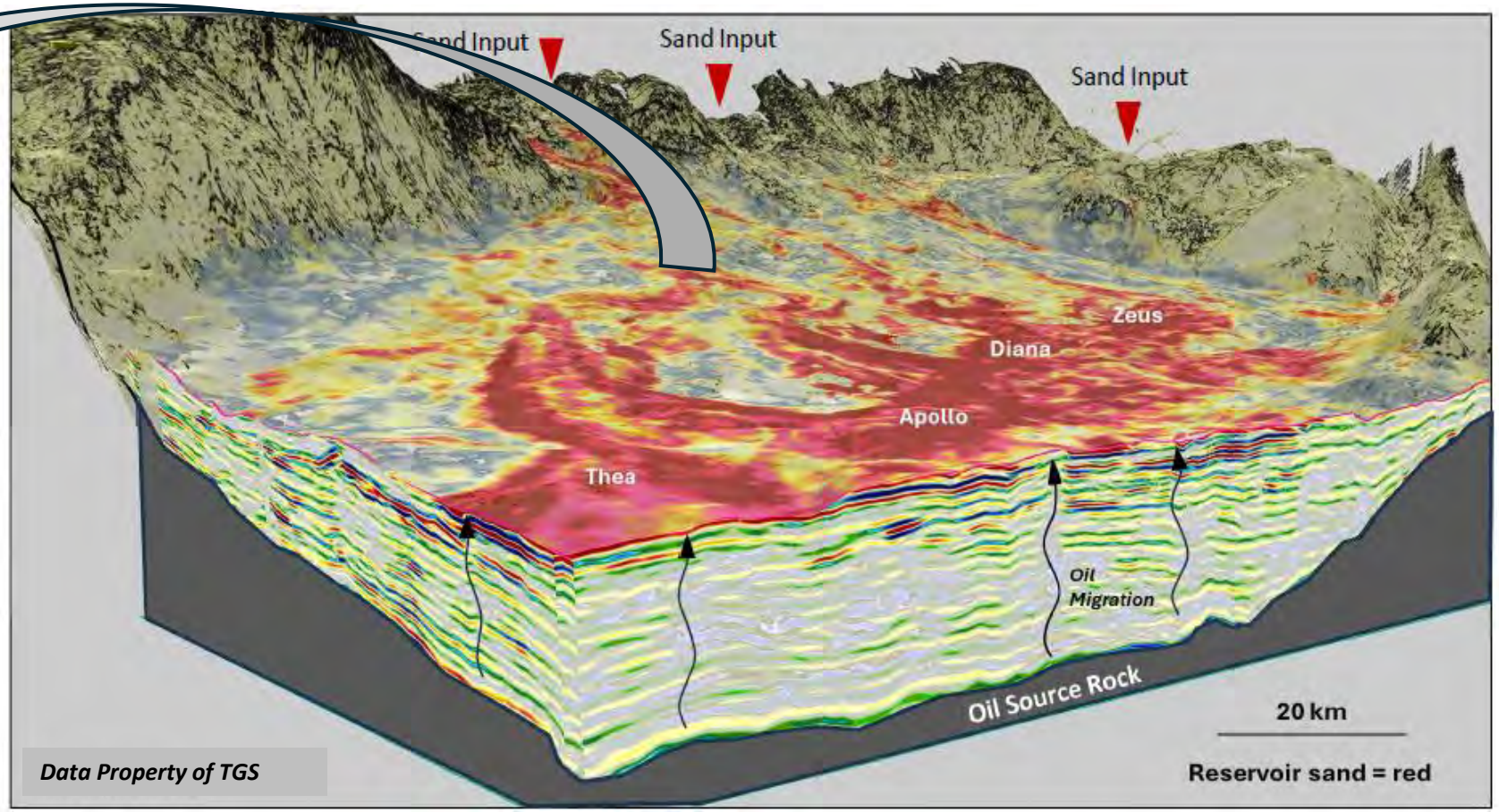


Stabroek Block (Offshore Guyana)

Harper Basin Published 3D Seismic AI Volume (Zeus)

TGS (2010) Sunfish 3D

Red colour = Reservoir Sand



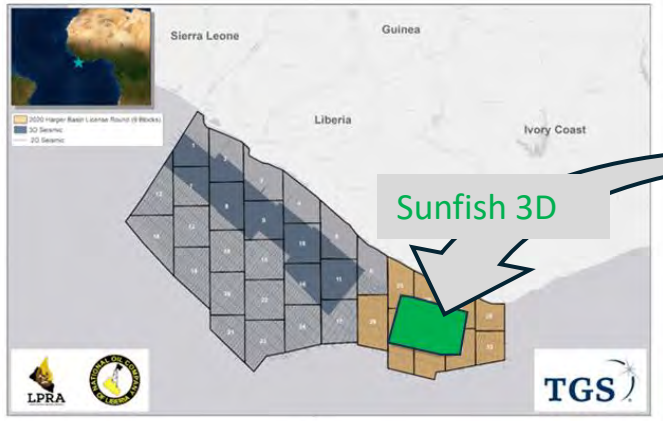
After BluEnergies 2025

Do these coalesced fan systems comprise another 'Golden Lane', conjugate to Guyana?

Turonian BFF Harper Basin: Run-out Systems & Fan Aprons

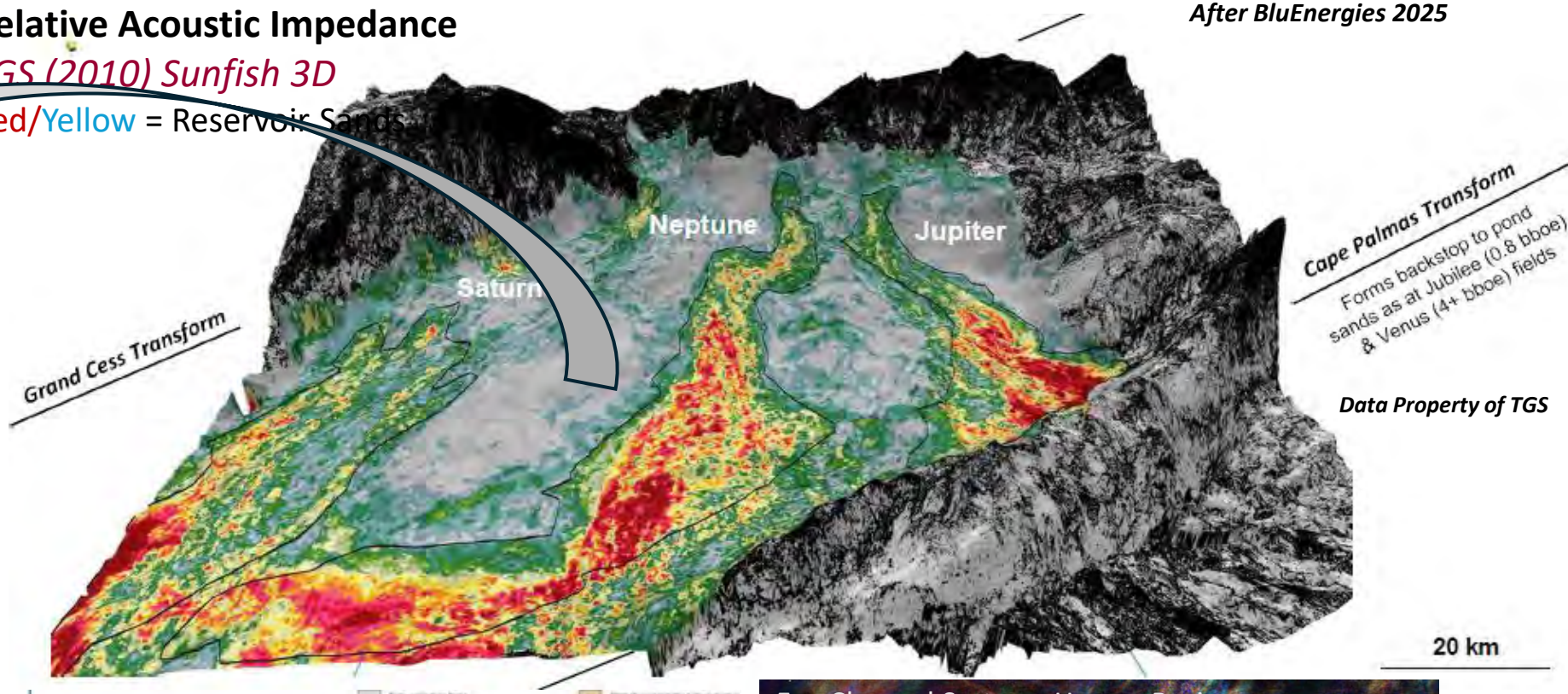
West Africa's Untested Golden Lane?

PETROQUEST
LIBERIA DEEP WATER LLC



Harper Basin Published 3D Seismic Extraction, (Jupiter)
Relative Acoustic Impedance
TGS (2010) Sunfish 3D
Red/Yellow = Reservoir Sands

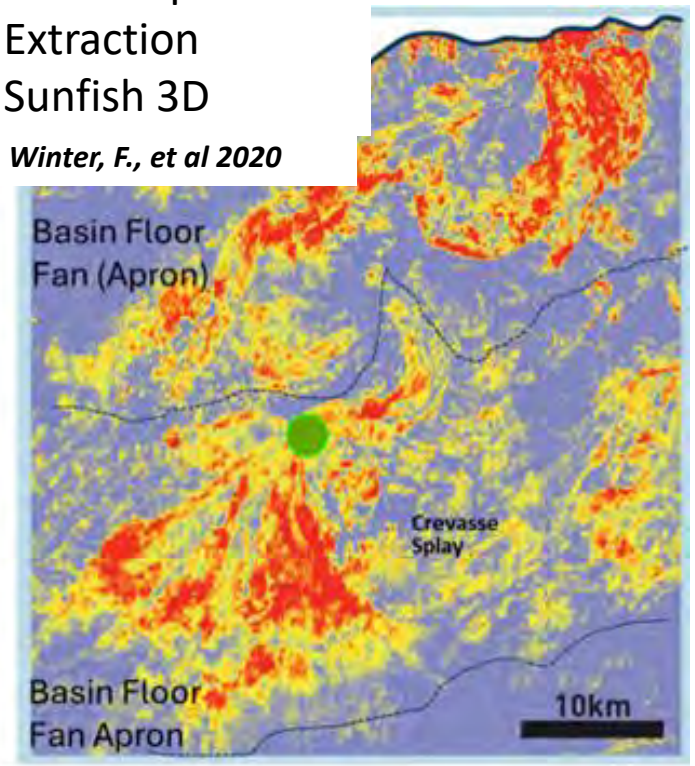
After BluEnergies 2025

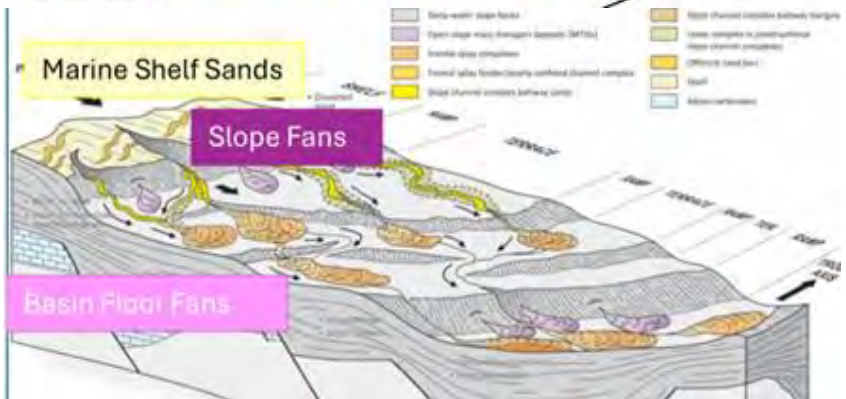


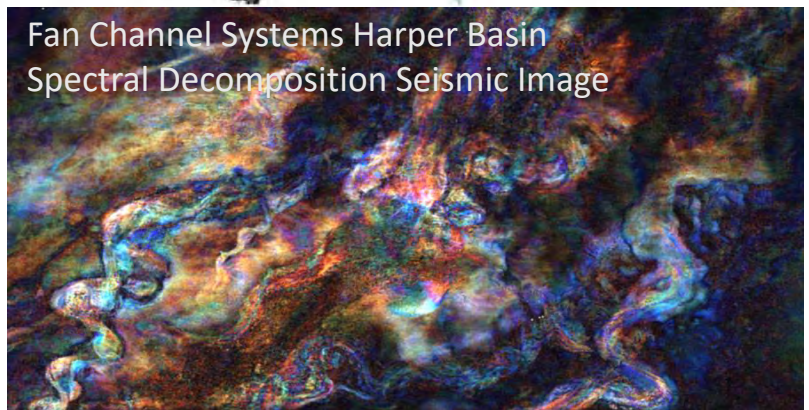
Data Property of TGS

RMS Amplitude Extraction Sunfish 3D

Winter, F., et al 2020







Derisking: Regional Well Calibration(Class III AVO & rEEI)

Harper & Liberian Basins the rEEI AVO Attribute is a likely DHI

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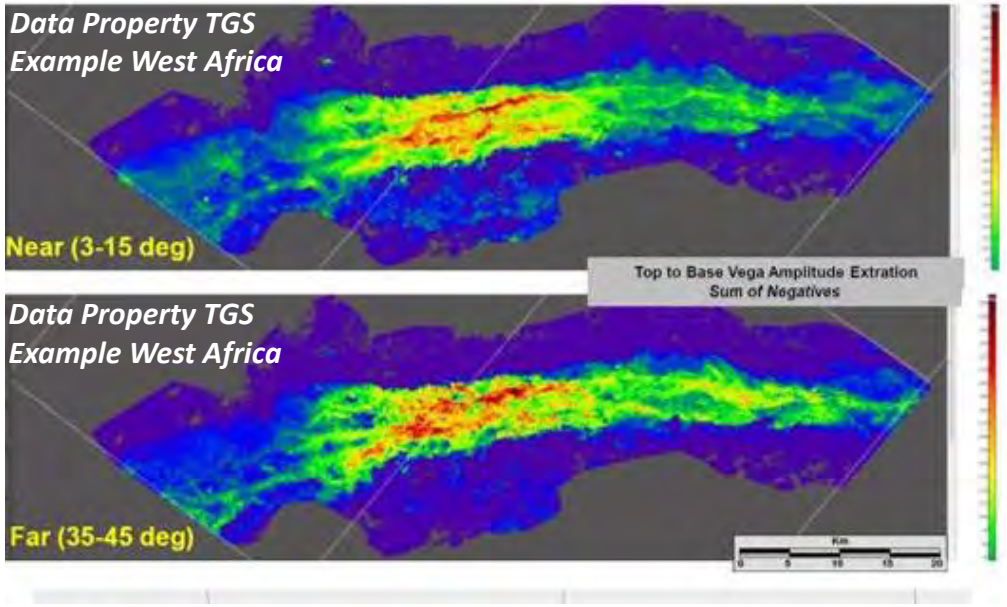
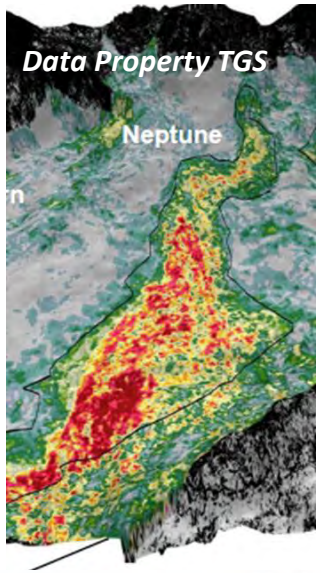
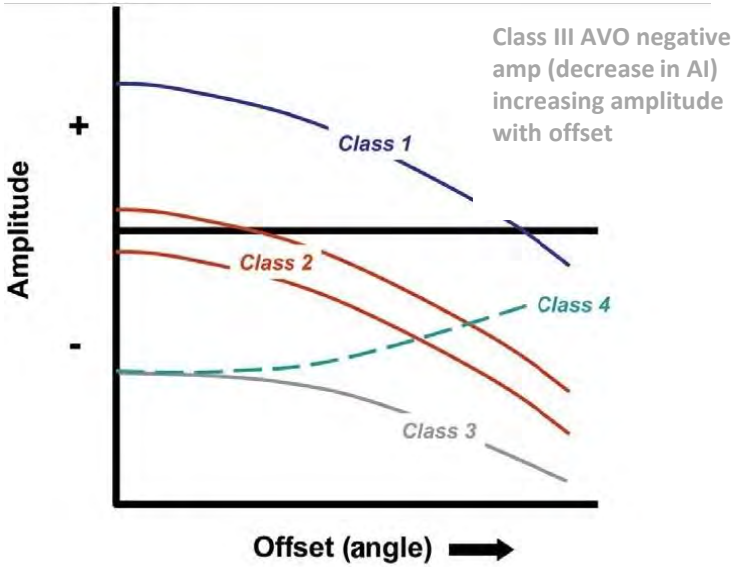


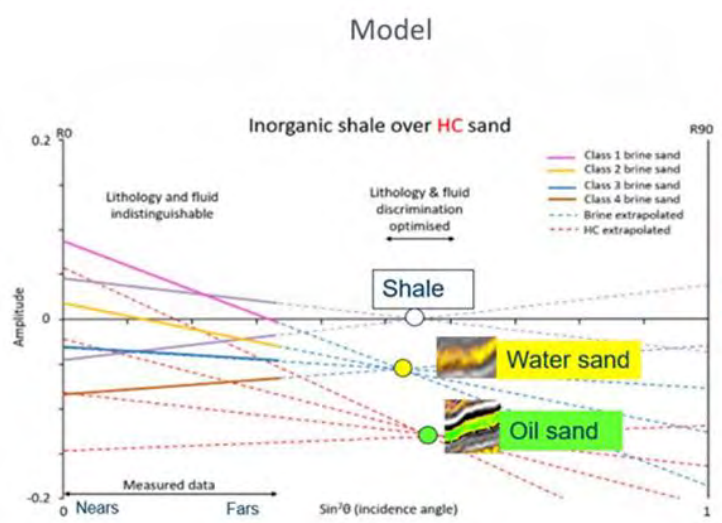
BFF Displays Class III AVO

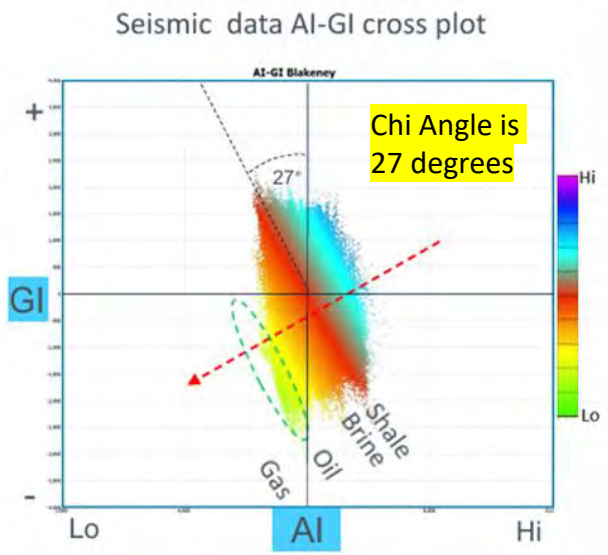
Neptune Fan Harper Basin (Turonian). Relative Acoustic Impedance red= negative low

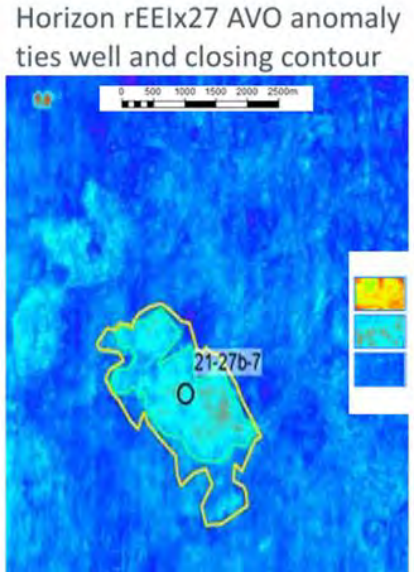


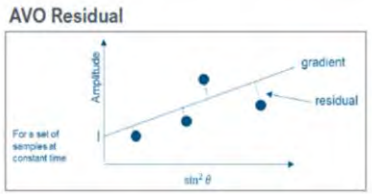
Note (rEEI) = Relative Extended Elastic Impedance



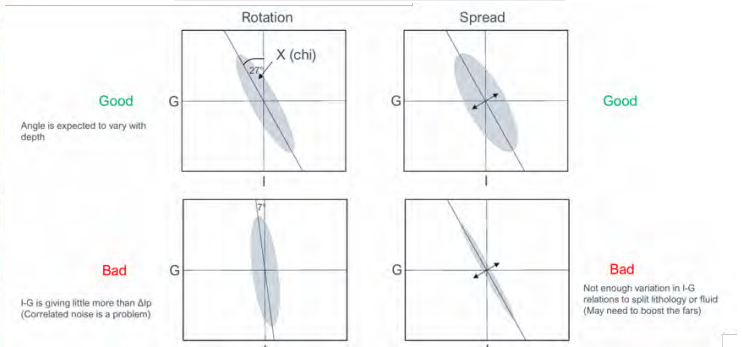








- Horizon based
- Produced on (migrated) angle stacks

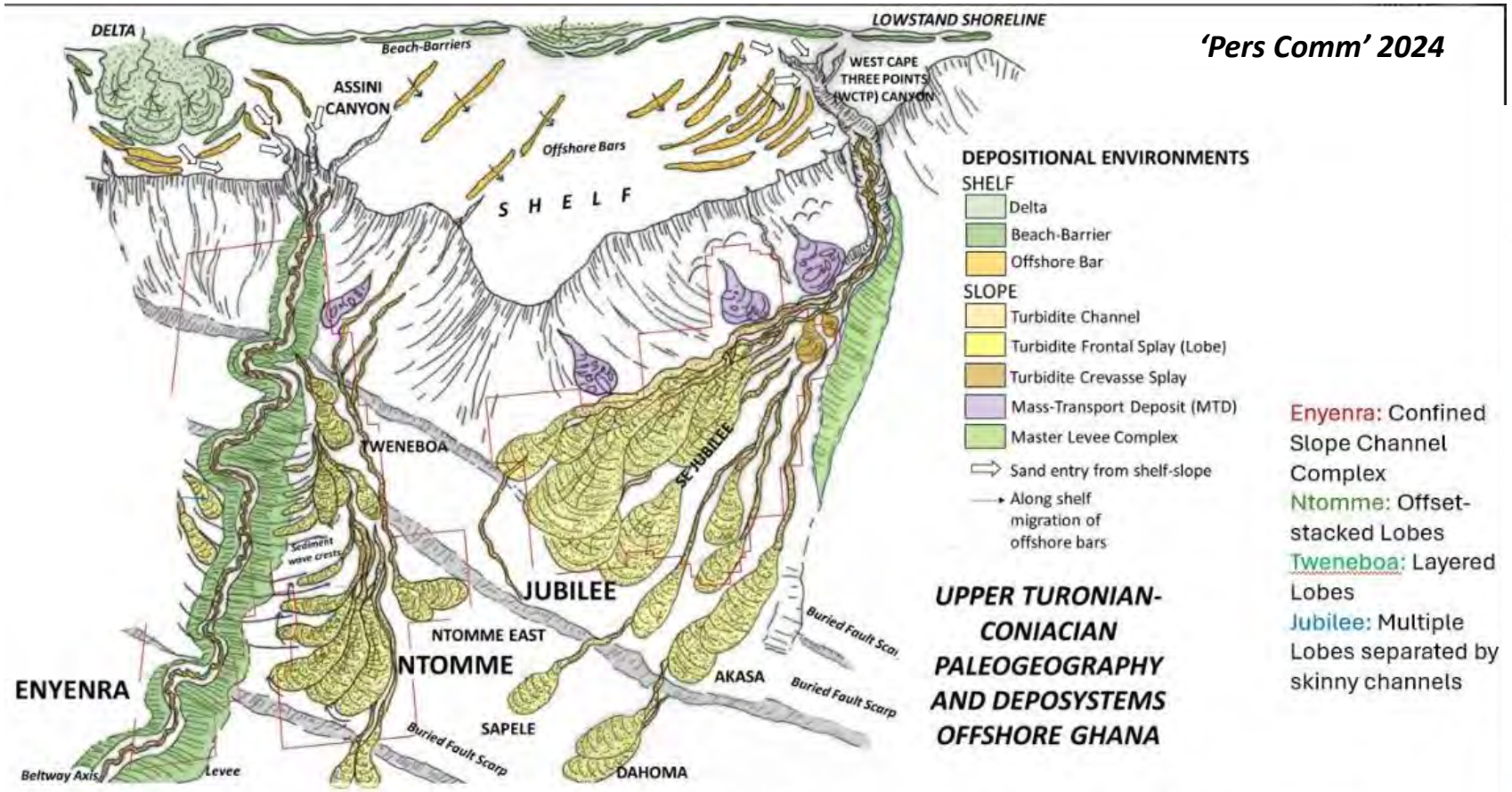


Went, D., et al 2024 & PDSL Webinar 2025

Offshore Ghana Depositional Systems After Cronin 2024

Host the Billion Barrel Jubilee Oil-field! (3.1 Bbls In place)

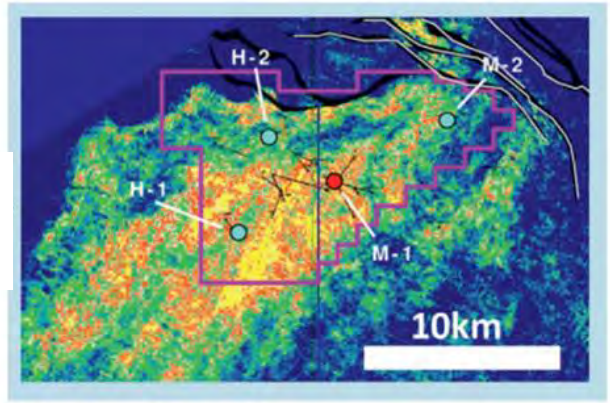
PETROQUEST LIBERIA DEEP WATER LLC



'Pers Comm' 2024

Enyenra: Confined Slope Channel Complex
Ntomme: Offset-stacked Lobes
Tweneboa: Layered Lobes
Jubilee: Multiple Lobes separated by skinny channels

From: **Cronin, B.T. (2024)** Innovations in Deep-Water Sedimentology and Their Impact on Field Development on the Cote d'Ivoire-Ghana Margin: hybrid system impact on slope channel complex stacking, frontal splay stacking, mass-wasting, stratigraphic trapping, and field development and planning HGS/GESGB Africa E&P Meeting, Houston, September.



Ghana, Tano Basin

Up-dip faults are crucial

Jubilee Field in Ghana

Rec. reserves

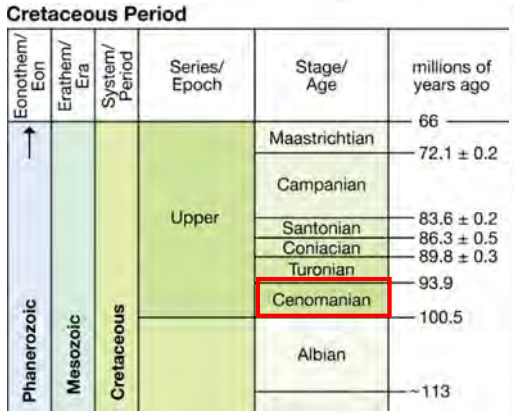
>600 mmstb to >1200 billion bbls

Production plataeu 150,000 bopd

BFF Opportunities Offshore Harper Basin

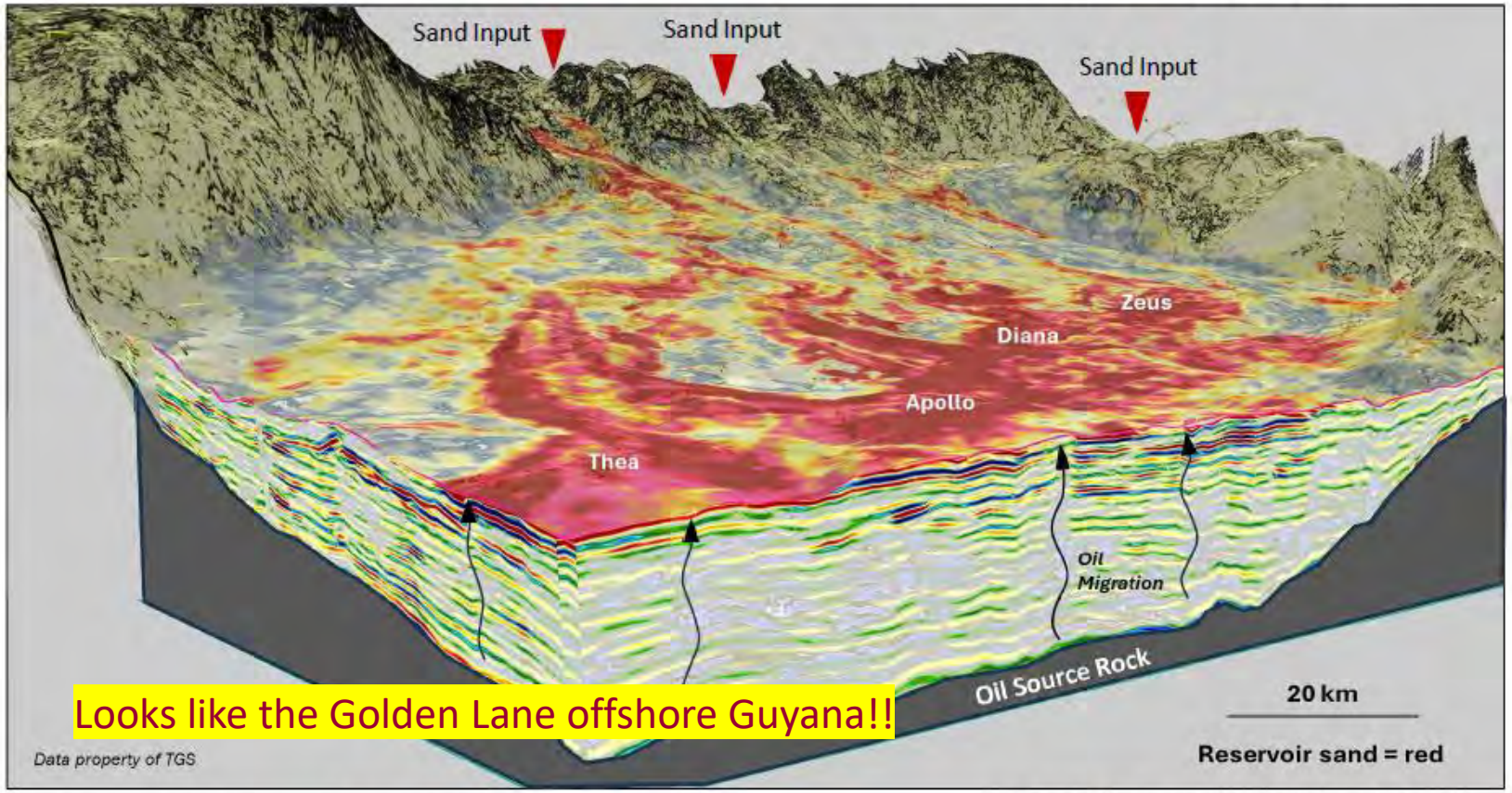
West Africa's Upper Cretaceous (Cenomanian) 'Golden Lane' OAE2 Source Rock Below!

PETROQUEST
LIBERIA DEEP WATER LLC



Deep Water Fans in BluEnergies License are Well Defined by 3D Data

Cretaceous (Cenomanian): Thea, Apollo, Diana & Zeus Fans: **3.1 billion boe recoverable prospective resource potential***



Looks like the Golden Lane offshore Guyana!!

Relative acoustic impedance: Cenomanian top 100 m

**Refer to the Presentation of Oil & Gas Information at the end of this Presentation for additional information.*

Mature Source Rock Evaluated via SWC's in Bee-Eater-1

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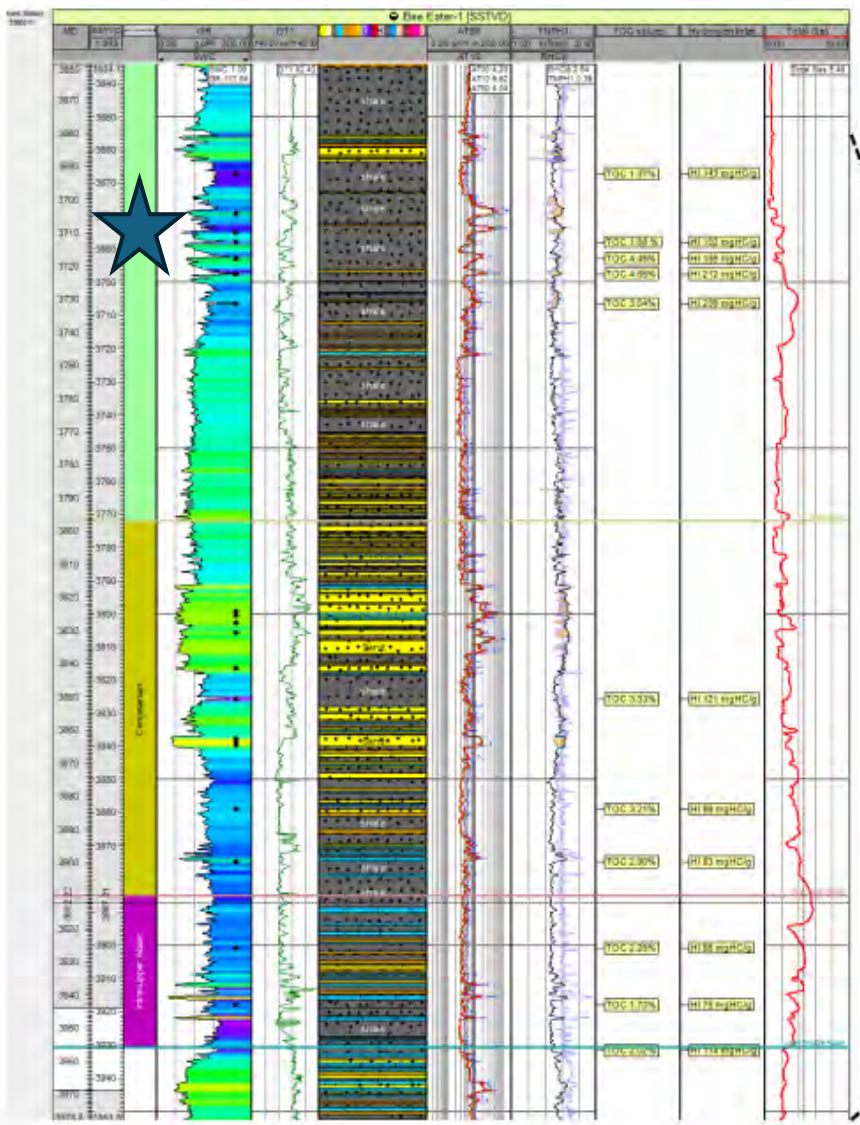
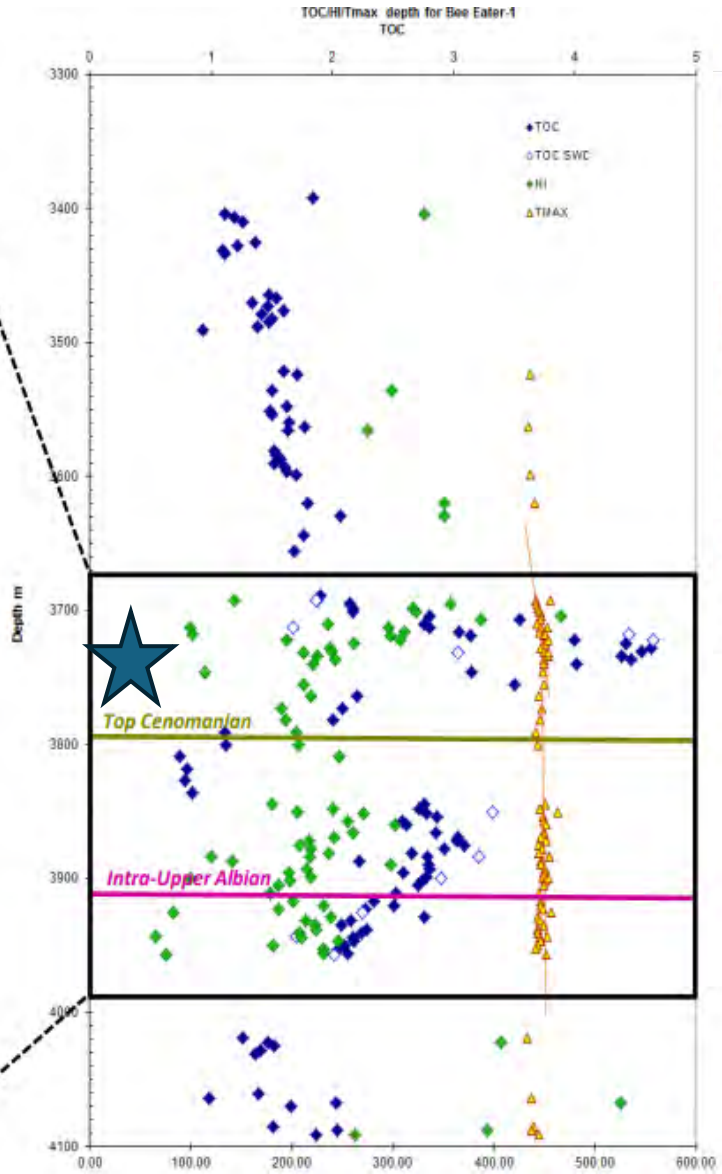
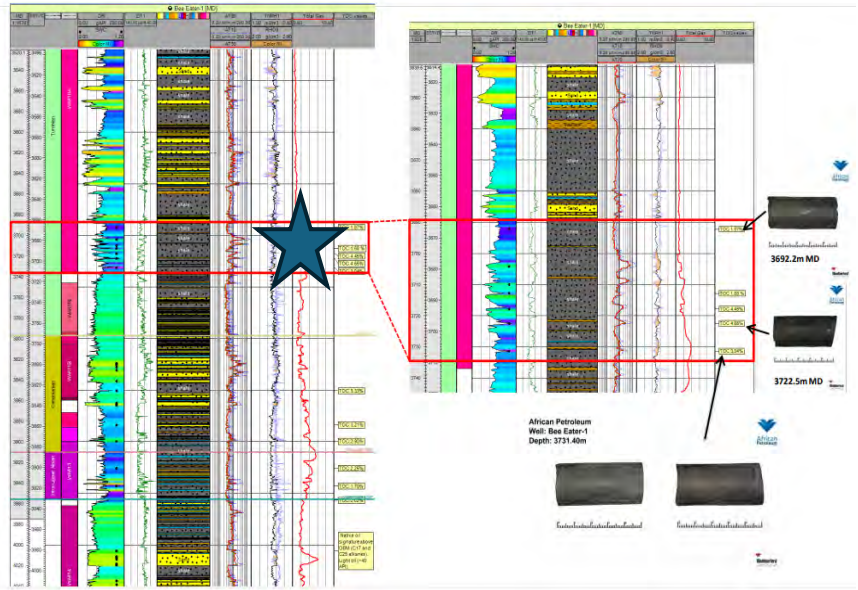
LIBERIA DEEP WATER LLC







Very high TOCs across the entire Cretaceous section in Bee-Eater-1 and also a physical sample of the mature source rock collected via SWC's (Tmax estimated at 460 degrees C)

1 November 2024

BFF Opportunities Offshore Harper Basin

Upper Cretaceous (Turonian) 'Jupiter, Neptune and Saturn Fans Laterally Stacked!

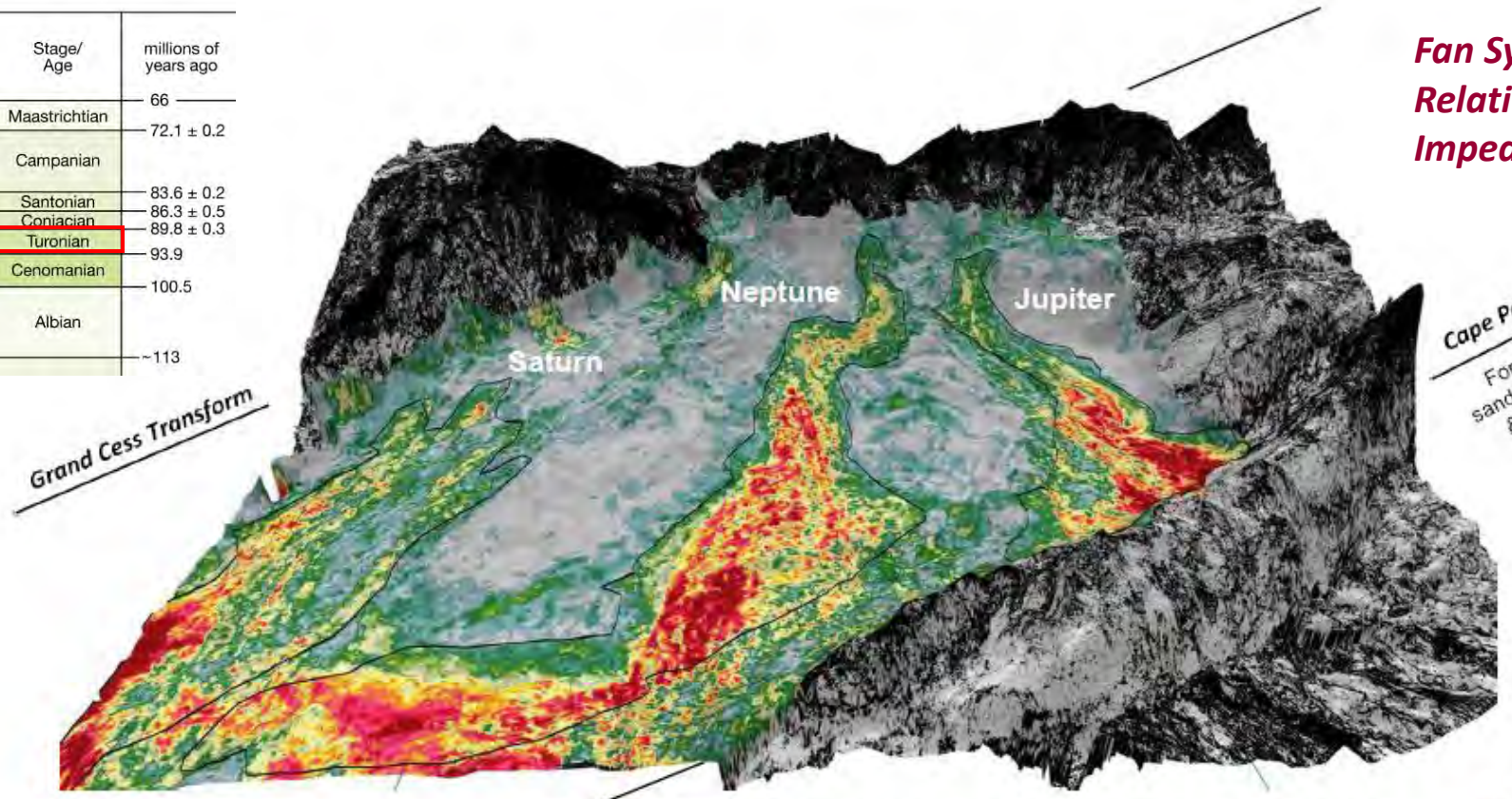
PETROQUEST
LIBERIA DEEP WATER LLC

Deep Water Fans in BluEnergies License are Well Defined by 3D Data

Cretaceous (Turonian): Saturn & Neptune Fans: **4.2 billion boe recoverable prospective resource potential*** (Jupiter as yet unassessed)

Cretaceous Period

Eonothem/ Eon	Erathem/ Era	System/ Period	Series/ Epoch	Stage/ Age	millions of years ago
Phanerozoic	Mesozoic	Cretaceous	Upper	Maastrichtian	66
					72.1 ± 0.2
				Campanian	
				Santonian	83.6 ± 0.2
				Coniacian	86.3 ± 0.5
				Turonian	89.8 ± 0.3
					93.9
				Cenomanian	
					100.5
				Albian	
					~113



Fan System with Low Relative Acoustic Impedance in Block 32!

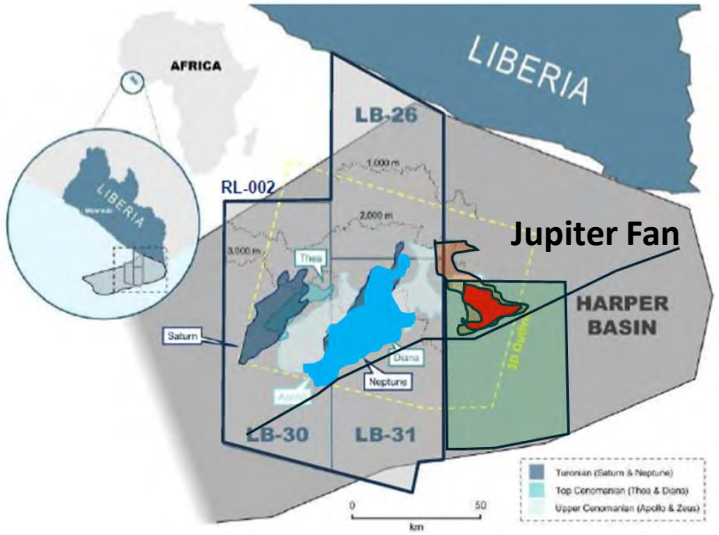
Relative acoustic impedance: Turonian

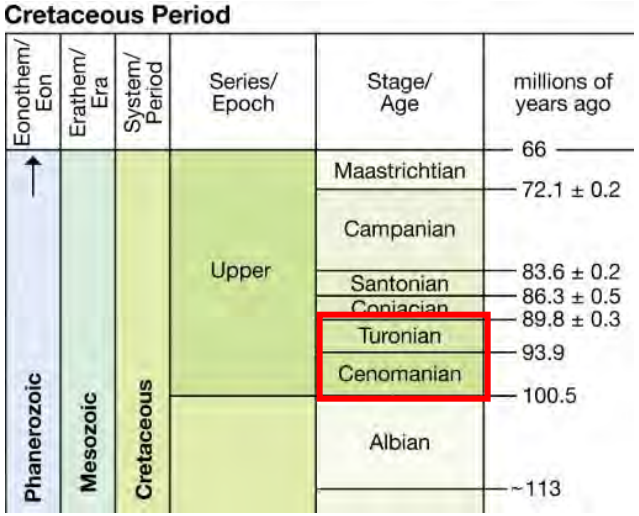
**Refer to the presentation of Oil & Gas Information at the end of this Presentation for additional infomrmation*

BluEnergies TSXV: BLU

The 'Jupiter Fan Prospect Block 32 (PQLDW)

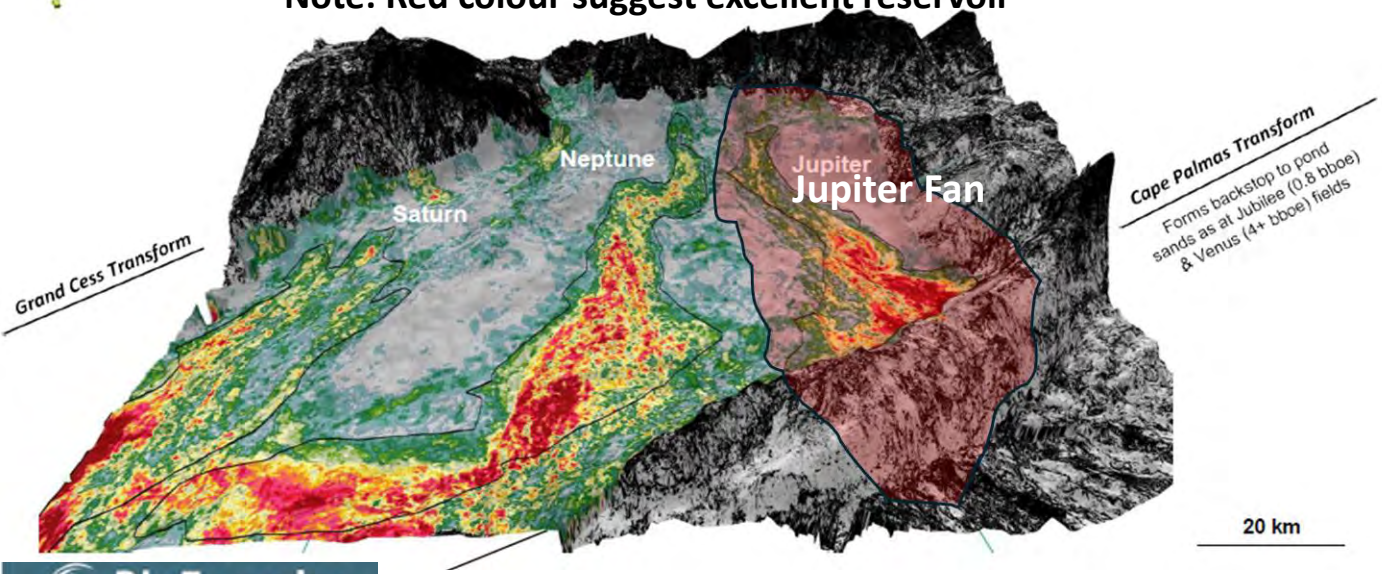
PETROQUEST
LIBERIA DEEP WATER LLC





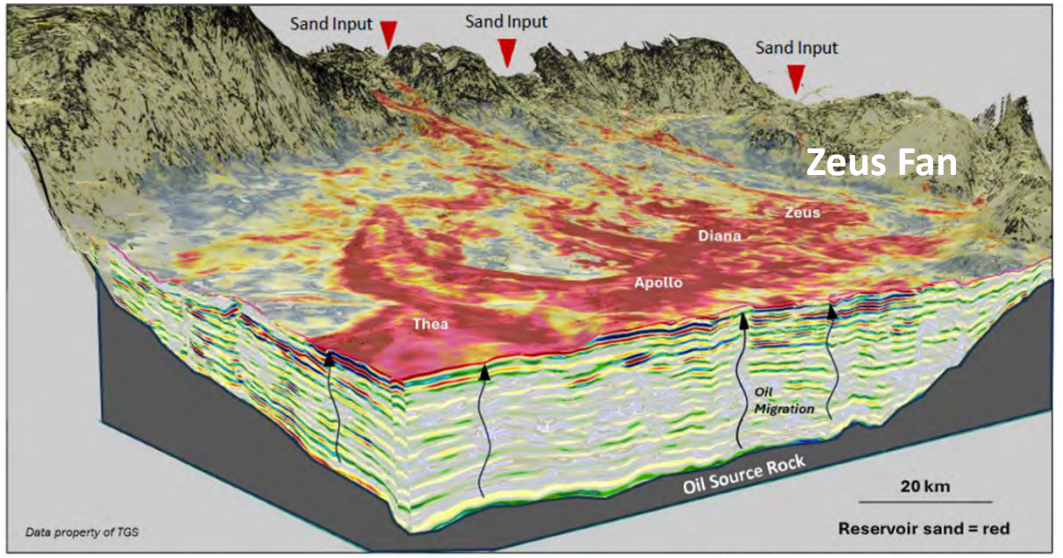
Prospects Block 32 Only	OOIP (NPV 10%) 70 USD/Barrel
Jupiter Fan	3.6 Bbls (NPV 9 Billion USD)
Zeus Fan	0.9 Bbls (NPV 3 Billion USD)

3D Seismic Acoustic Impedance Attribute
Note: Red colour suggest excellent reservoir



Turonian Aged Fans

3D Seismic Acoustic Impedance Attribute
Note: Red colour suggest excellent reservoir



Cenomanian Aged Fans

New Golden Mile?

BluEnergies

Jupiter Fan: Criteria For Prospect Validation

Geological & Geophysical Criterion

PETROQUEST LIBERIA DEEP WATER LLC

After Sloan 2025

Criterion For New Ventures BFF Drill Risk Mitigation	Yes/No
Have you ruled out a MTC or a slump deposit?	Yes
Does seismic amplitude data suggest a Trap geometry?	Yes
Is the amplitude anomaly at least > twice background RMS levels?	Yes
Is there a top soft AI response and base hard AI response?	Yes
Does the top soft response have an AVO effect present?	Yes
Is that AVO effect modelled and validated as an oil response in wells?	Yes
Does Class III AVO Conform to Trap (Top and Base) & Internally?	Yes (pers com TGS)
Are other Seismic Attribute responses consistent with oil filled BFF (EEI 27 degree Rotation)	Yes
Can internal BFF morphologies be seismically extracted?	Yes (Channels & Splays)
Is source rock present for primary migration?	Yes (OAE2 Below)
Is there an observed migration pathway to the BFF?	Yes
Are there indications of leakage/micro-leakage (Over-burden Pock-marks)?	*Seismic Review Recommended*
Are there SAR oil slicks in the sea above	*Data Analyses Recommended*
Can you identify a top seal and is it present across the feature?	Yes
Can you evoke a base/lateral seal in critical spill directions?	Yes
Can you interpret any possible combination trap feature?	*Analyses Recommended*

BFF Opportunities Offshore Harper Basin

Terrace BFFs Transform Margin Setting (Proximal-Distal (After Cronin Pers Com))

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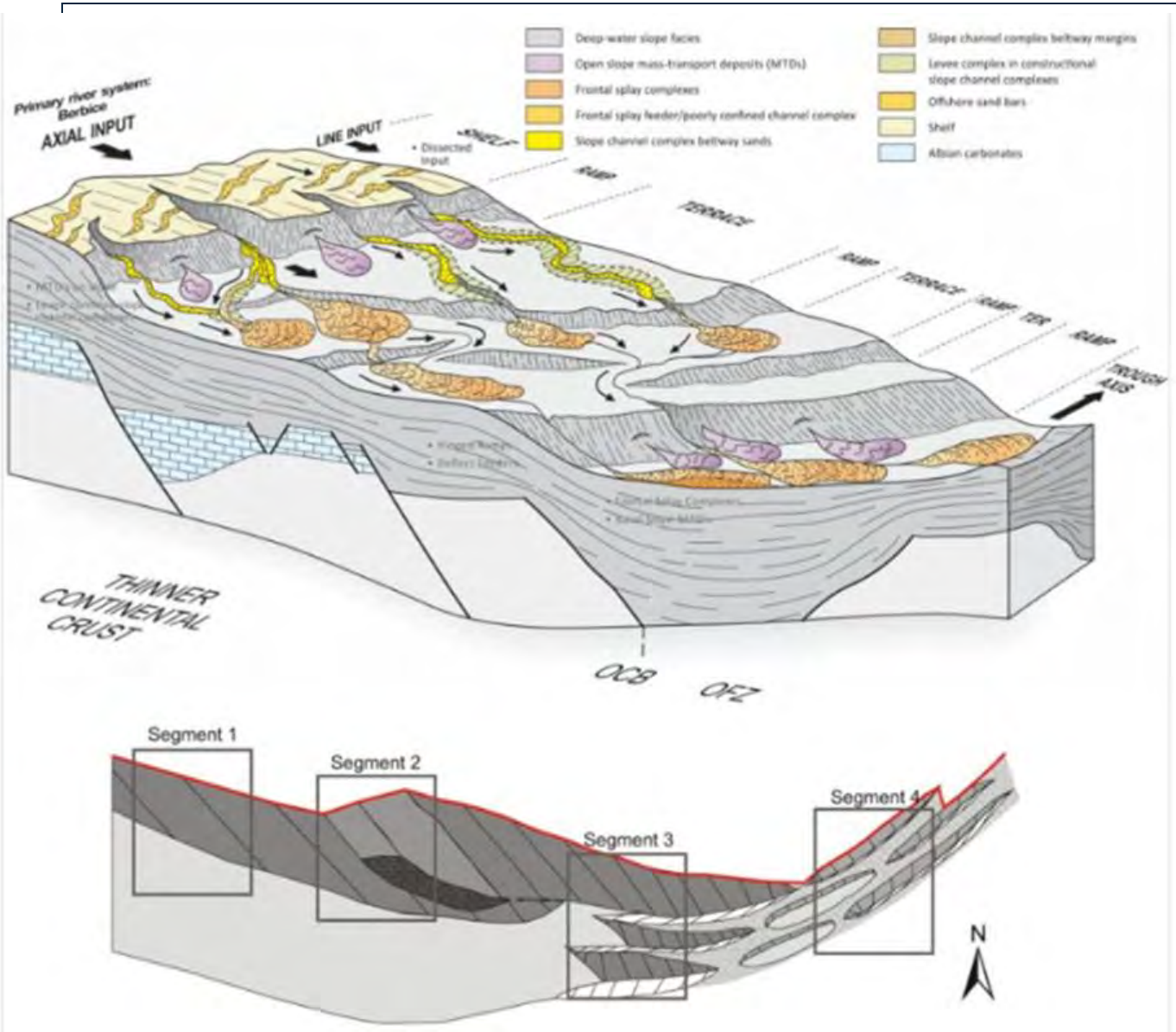

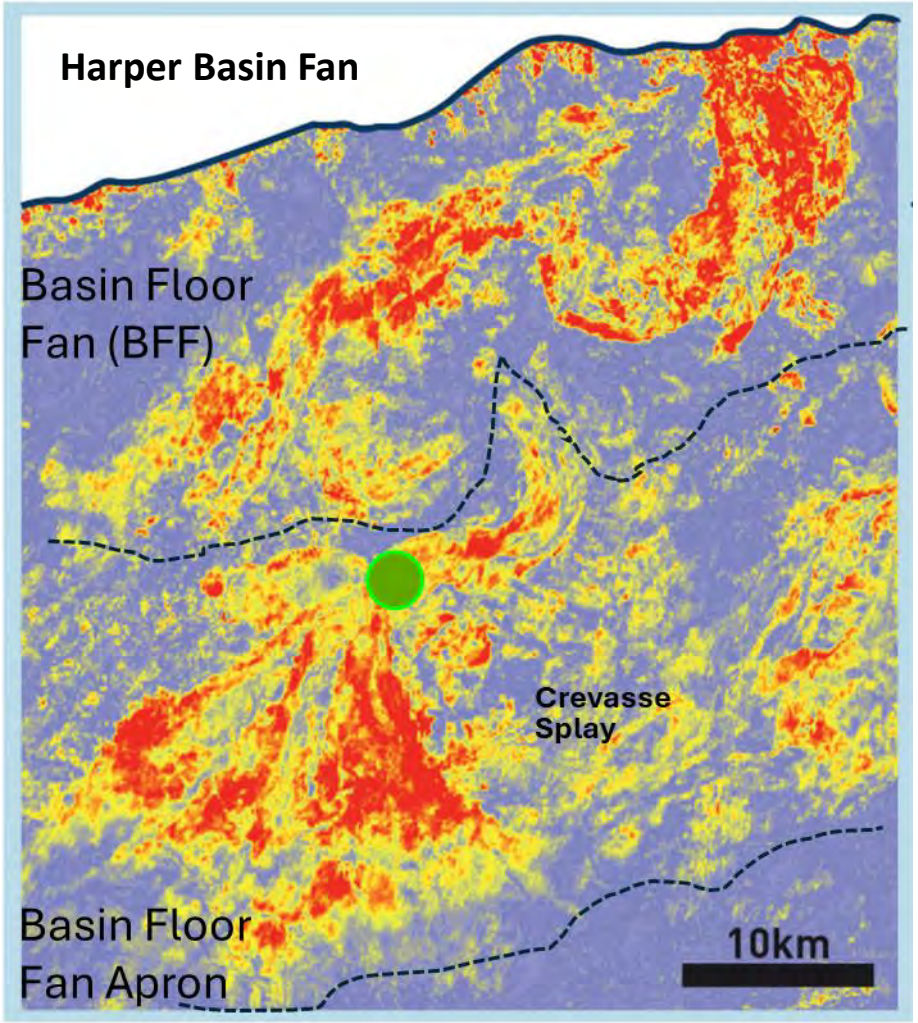

Harper/Liberian/Sierra Leone Basins Fan Systems Geometries & Fill

Sketch Diagrams After Cronin 2024 (Pers Com)

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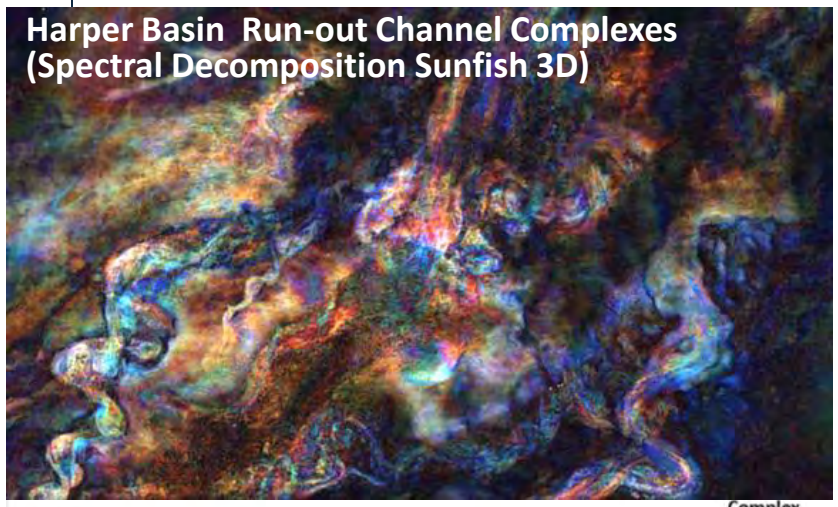

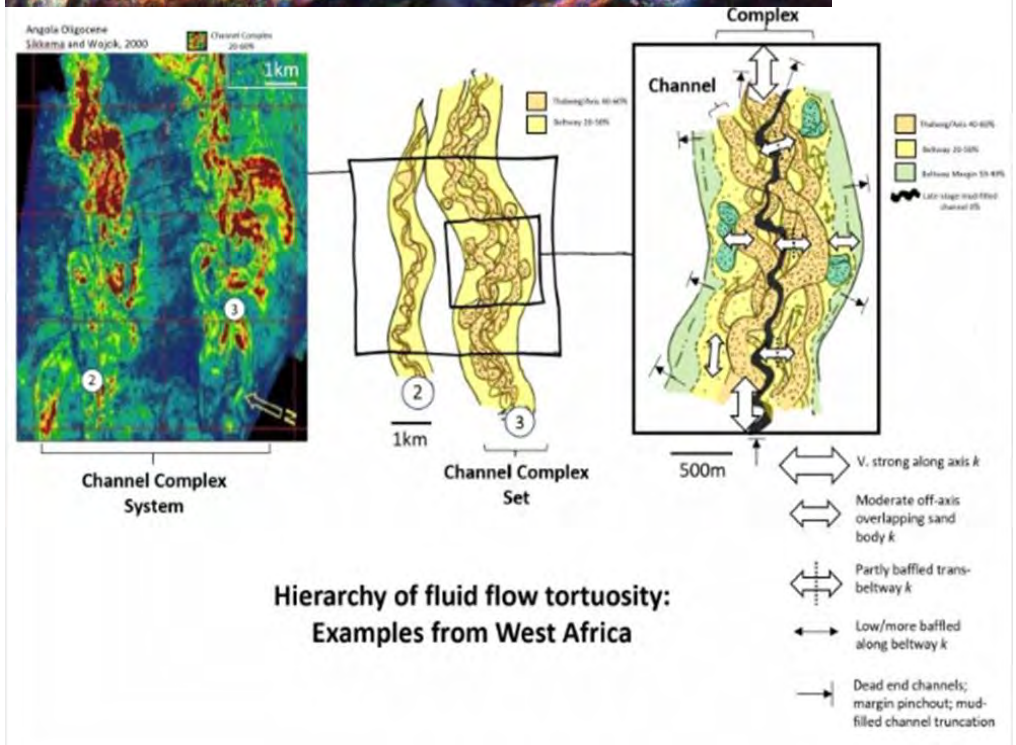

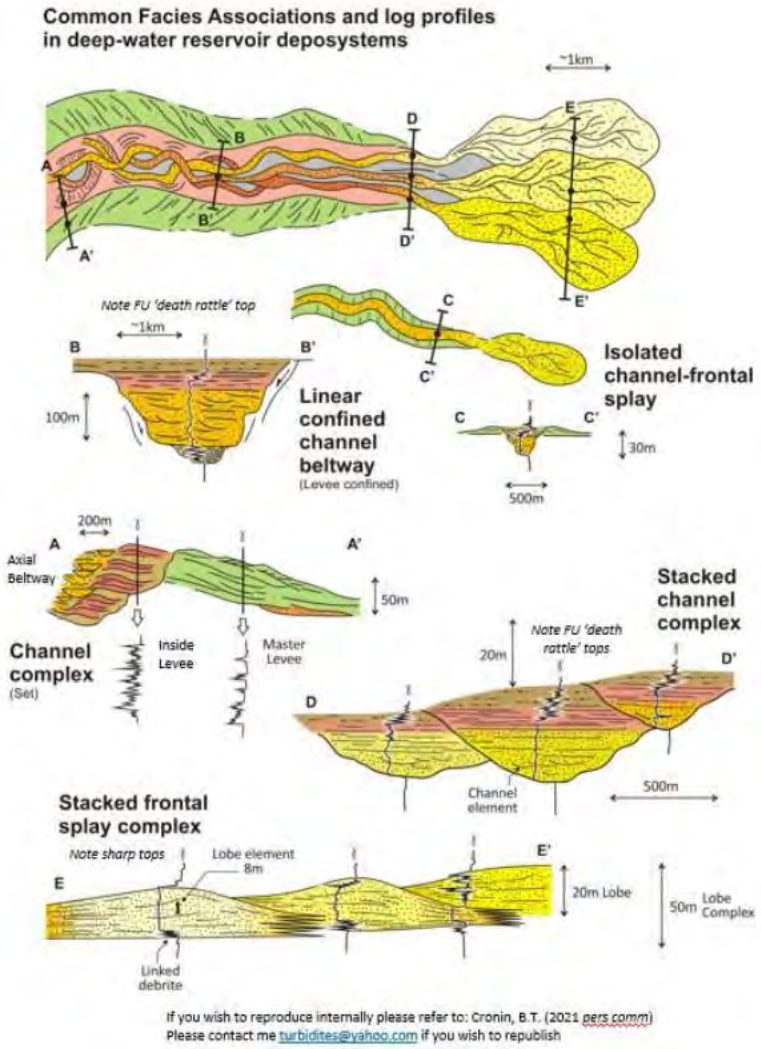

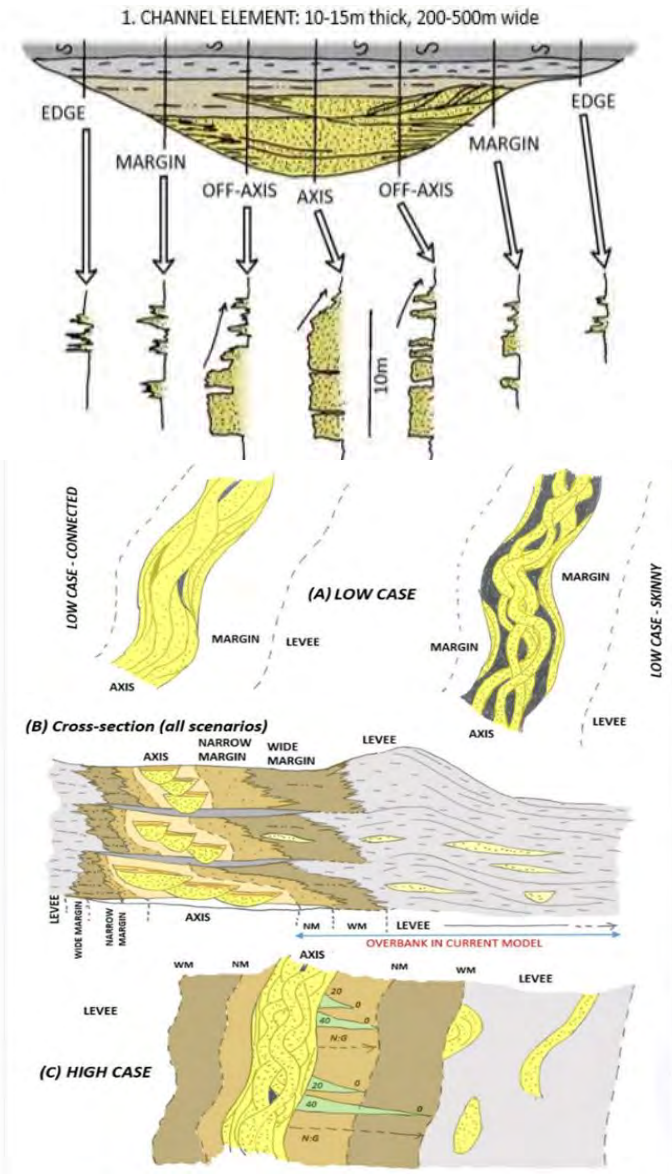

Liberian Basin: Deep Water Fan Plays Abound

But Slope Fan Facies Has Variable Reservoir Quality – Need to Look Outboard for BFF!

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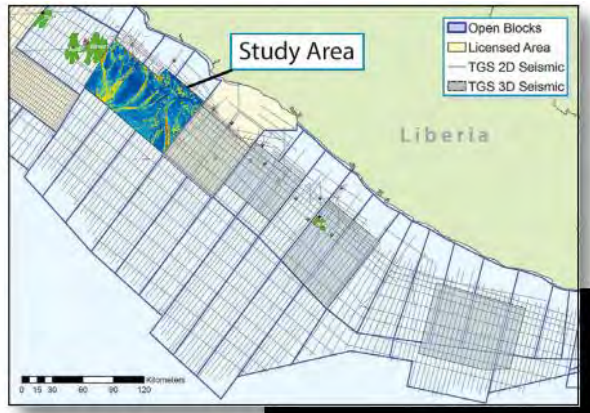
There is a full spectrum of Fans to explore for, outboard of the Paleo-Continental Slope Break, both in the Cretaceous and Lwr Tertiary. Geobodies defining SF can be extracted automatically by voxel tracking due to their distinct acoustic impedance contrasts and extensive geological connectivity. The 3D stops at SF/BBF Transition



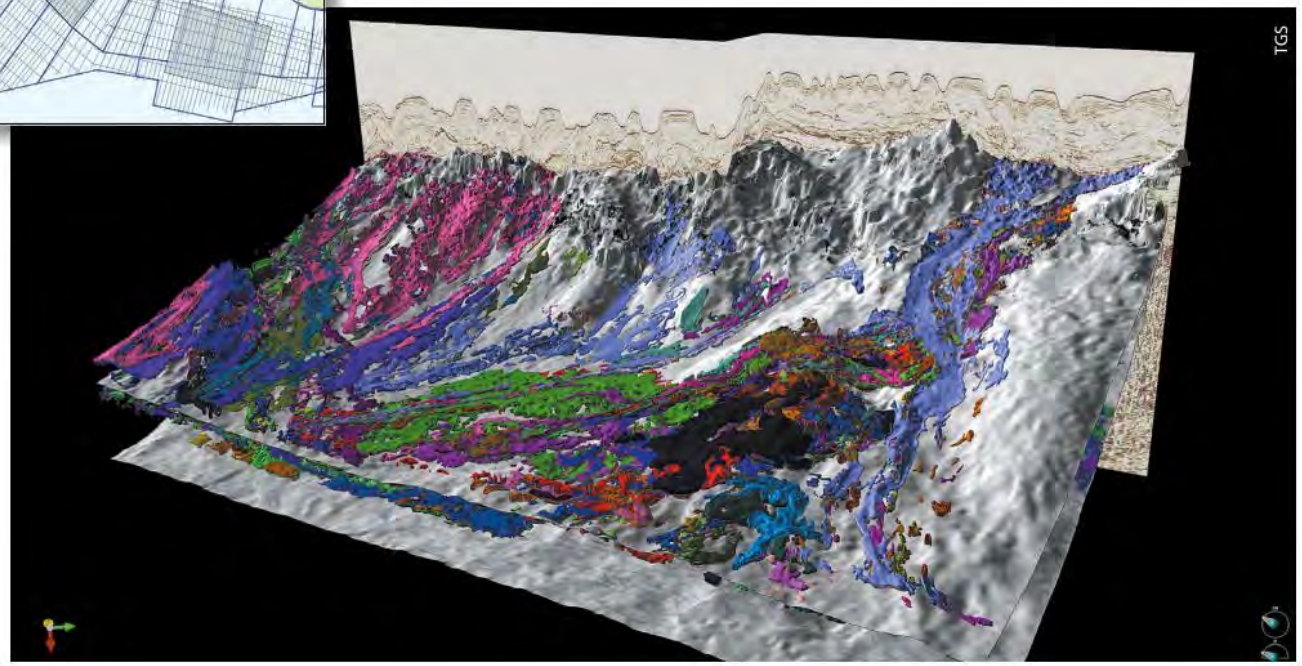


Figure 1:
A geobody extraction highlighting extensive channel complexes overlain on the Top Cretaceous surface.

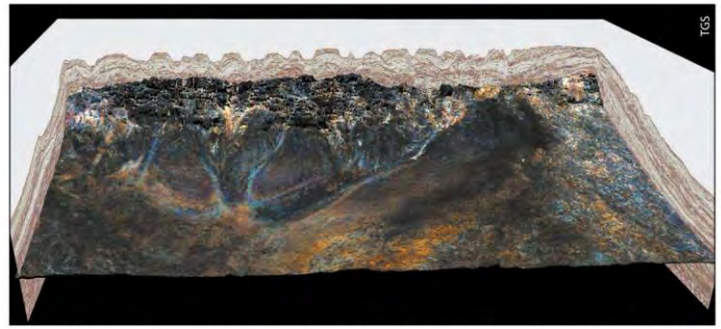
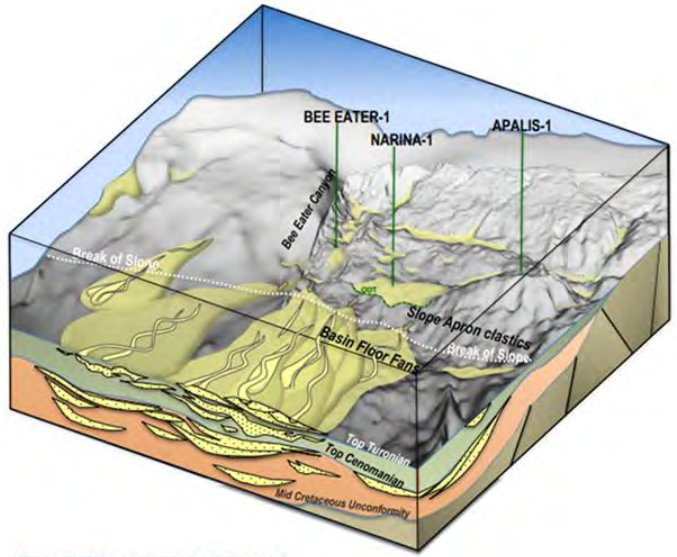


Figure 2: A spectral decompositon surface showing Late Cretaceous canyons feeding a basin floor fan.

Slope Fans feeding Basin Floor Fans Offshore Liberia



Liberia Block 9 – Submarine Fan Model.
Canyon system filled with low net-gross sediments. Steep gradients act as a bypass zone enabling sediment transfer to slope break. Basin floor fan geometries are mapped in this less confined region with Turonian, Cenomanian and Upper Albian clastic wedges onlapping the slope.

Global Soutl High Risk (1:5) slope fans feeding lower risk (1:3) BFF Seismic Image Liberia! ***Published by TGS 2017***

file:///C:/Users/markl/OneDrive/Documents/liberia/GEO%20ExPro%20V14%20n5%20Liberia-1.pdf

Volumetrics & Gcos

Formula Used in Screening Volumetrics Calculation

Oil Only Case! (No Free or Solution Gas Included)

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Example Calculations

Oil reservoir

Area = 10,000 acre

Thickness (H) = 100 ft

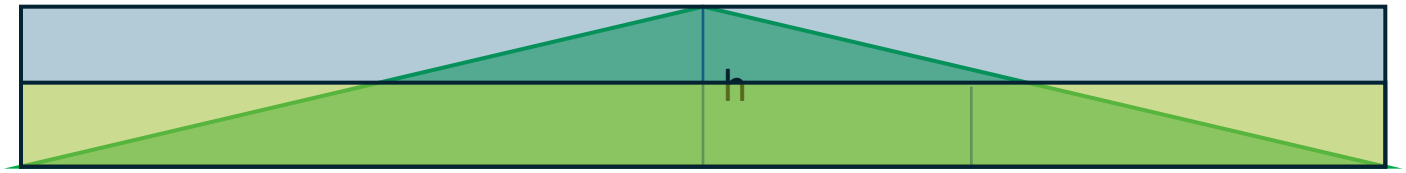
Average porosity (ϕ) = 20%

Connate Water Saturation (Swc) = 25%

Oil formation volume factor (Bo) = 1.29 rb/stb

$$STOIIP = \frac{7758 \times 10{,}000 \times 100 \times 0.2 \times (1 - 0.25)}{1.29}$$

STOIIP = 902.1 MM STB



Volume= h x Area Slab Treatment over estimates Volume

Volume = h/2 x Area Slab Treatment offsets the over prediction

https://wiki.aapg.org/Reserves_estimation

Screening Volumetrics Only

BFFs Liberian Basin – Volumetric Inputs

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	Turonian BFF	Cenomanian BFF
Inputs	**Jupiter (Block 32)**	**Zeus (Block 32)**
Area (Acres)	98842.1 (400 km2)	37065.2 (150 km2)
Acres/bls	7758	7758
Height (ft)	**(120 m) 120/2 (196)**	**100 m 100/2 (164)**
Net to gross (fraction)	0.30	0.28
Average Porosity (fraction)	0.15	0.14
Oil Saturation	0.70	0.68
Formation Volume Factor (B(oil))	1.29	1.29
STOOIP	3.6700218844 Bbls	0.974457488 Bbls
Reserves (30% RF) (.30)	1.1010065653 Bbls	0.292337246 Bbls

USGS Resource Assessments 2016 Liberian Basin vs Gulf of Guinea

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Gulf of Guinea

Total Petroleum Systems (TPS) and Assessment Units (AU)	Field type	Largest expected mean field size	Total undiscovered resources											
			Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
West African Coastal Province—Cretaceous Composite TPS														
Coastal Plain and Offshore AU	*Oil*	1,737	563	2,966	11,409	4,071	1,347	7,224	29,054	10,126	68	365	1,466	513
	Gas	10,409					3,382	17,704	68,094	24,335	87	457	1,782	632
Total Conventional Resources			563	2,966	11,409	4,071	4,729	24,928	97,148	34,461	155	822	3,248	1,145

Gulf of Guinea P50 is underestimated as two recent wells Baleine-1 and Murene-1X exceeds the USGS P50 resource estimates in a new deep-water play. Does the P5 come in to play? 11B bbl?

Liberian Basin

Province, Total Petroleum Systems (TPS) and Assessment Units (AU)	Field type	Largest expected mean field size	Total undiscovered resources											
			Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
West African Coastal Province—Cretaceous Composite TPS														
Mesozoic-Cenozoic Reservoirs AU	*Oil*	783	801	2,713	7,305	3,200	1,047	3,662	10,847	4,492	27	98	297	121
	Gas	4,695					4,862	16,202	43,437	19,137	149	506	1,374	600
Total Conventional Resources			801	2,713	7,305	3,200	5,909	19,864	54,284	23,629	176	604	1,671	721

Liberia/Sierra Leone P50, is it similarly underestimated for the same reasons, deep water play not evaluated? P5 says opportunity knocks for 7 B bbl!

USGS Distribution of Hydrocarbon Plays, Sub-Saharan Africa.

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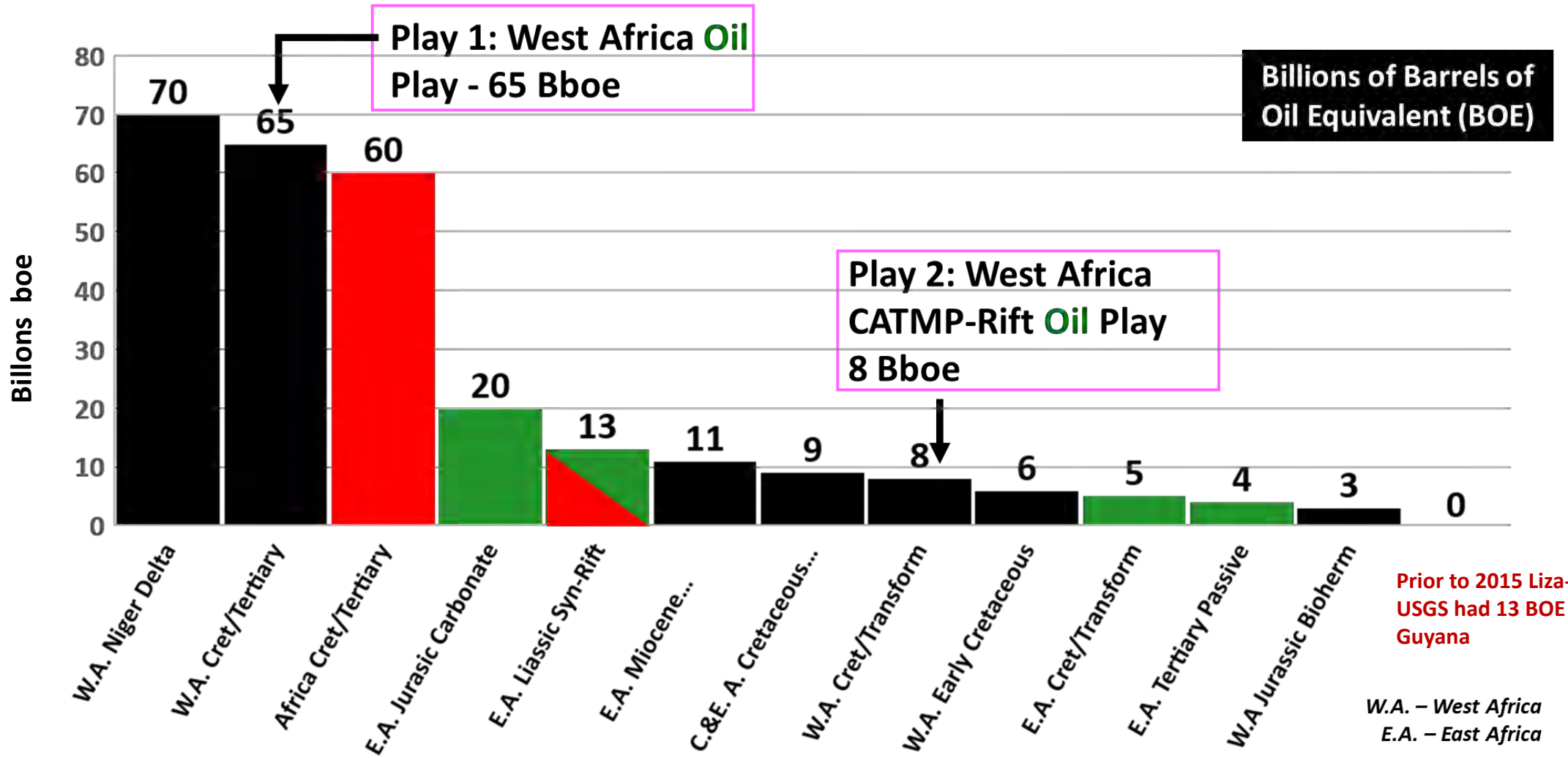

Prior to 2015 Liza-1 discovery the USGS had 13 BOE for Offshore Guyana

W.A. – West Africa
E.A. – East Africa

Gcos (Risking)

Risk Mitigation (Key Risk 1 Trap Integrity)

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- The Liberian Basin Late Cretaceous *Slope Fan* play has an '***Achilles Heel***' vis a vis *trap integrity.*
- An argument to chase the late K Liberian slope fan play for novel billion-barrel oil fields cannot be sustained.
- A robust risk mitigation strategy for *Trap Integrity* is to forego the *Slope Fan* play in favour of the *Basin Floor Fan* (BFF) Play
- Late Cretaceous (**K**) BFF fan can be readily mapped on 3D seismic, down-dip from existing oil discoveries in the Liberian Basin
- Late K BFF are low risk targets elsewhere along the *CATM* with recent Billion bbl discoveries offshore Guyana and Cote D'Ivoire.
- Late K BFF can be readily identified on 3D seismic data by the fact they are typically comprised of high-quality reservoirs which have a strong acoustic impedance contrast at the top and lateral seal boundary, making their trap geometry clear and distinct.
- Early Tertiary aged Basin Floor Fans are likewise robust exploration targets and can be readily mapped on seismic due to their near ubiquitous '*high-vis*'.
- Cretaceous Basin Floor Fan plays (Albian – Santonian/Campanian) typically have a distinct *AVO* response (*Class II/III*) that is strongly linked to their high porosity and permeability making the fluid response sometimes visible in some special cases.
- Basin Floor Fan trap geometries are also observed in the *Harper Basin* making this basin also high prospective for these low-risk high reward targets.

Play Risk Estimation Gcos (Upper Cretaceous CATM)

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Estimated Geological Risk For Upper Cretaceous Slope Fans: Liberian Basin

1) Stratigraphic Traps with live oil present have been found in 7 out of 15 well penetrations in the Cretaceous K. **(0.50 Trap Integrity Risk)**
2) Top and lateral seal presence is proven in 10 out of 15 wells with effectiveness proven by 48 m oil column late K **(0.63 Seal Risk P/E)**
3) Effective Reservoir is present in all 9 of 15 wells, but reservoir effectiveness does vary (Kaolinite cements) **(0.60 Reservoir P/E)**
4) Of the 15 wells, live oil and or oil shows have been encountered in 14 wells **(0.93 Charge & Migration)**
5) 32 to 24 API crude oil has been sampled in all the live oil accumulations indicating the preservation of saleable crude **(0.95 Preservation)**

Gcos (Geological chance of success) Cretaceous Sub-marine SF 17% or 1:6 (Sniff test: 25 wells Liberian Basin live oil is found in 6)

Estimated Geological Risk For Cretaceous Basin Floor Fans Liberian Basin

1) Stratigraphic Traps can be better defined seismically. **(0.75 Trap Integrity Risk)**
2) Presence of Top and lateral seal presence is higher probability **(0.75 Seal Risk P/E) Predicted higher quality top and lateral seals**
3) Reservoir likely present with less cementation and better poro/perms) **(0.70 Reservoir P/E) Better sorted (grain size) and less clay minerals**
4) Close to kitchen with less need for lateral and vertical secondary migration but some gas flush risk **(0.93 Charge & Migration)**
5) 32 to 24 API crude oil has been sampled from 'live' oil accumulations indicating the preservation of saleable crude **(0.95 Preservation)**

Gcos (Geological chance of success) Cretaceous Sub-marine BFF 35% or 1: 3 (Sniff test> similar to global average 1:3)

Risk Mitigation BFF Play : Addressed in the Work Program

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- In the Liberian Basin, 3D seismic based AVO analyses can be used to identify sand-prone fairways and extract directly fan-shaped geobodies for improved reservoir risk mitigation. Tight brine filled sands will have a strong Class II/IIP response and sands which are highly porous will have a class III AVO response for both the brine filled and hydrocarbon fill cases.

- AVO analyses of the seismic data can be used to infer hydrocarbon saturation in reservoirs with **extremely (inferred) favourable reservoir properties** and in the case of the CATM, such reservoirs are found in Upper Cretaceous BFFs.

- ***JiFi*** Inversion (Vp/Vs) and litho-classification via a Bayesian Scheme, has been used successfully to map the full extent of the ***Hammerhead*** oil-field offshore Guyana (conjugate margin) with the main reservoir comprising Basin Floor Fan deposits of lower Tertiary age. *Similar targets of identical age exist within both the Liberian and Harper Basins.*

- Seismic dispersion has also been used to identify hydrocarbon bearing reservoirs offshore Guyana and this technology may also be deployed with confidence offshore Liberia with dispersion results co-rendered with AVO and JiFi.

- Seismic interpretation work-flows and common risk elements mapping can be used to integrate critical geological and geophysical attributes to mitigate both reservoir presence/effectiveness and Trap Integrity risks using both AI and non-AI schemes.

- Common risk elements and play based mapping must be used to identify the sweet-spots for reservoir, seal and trap risk mitigation.

- Detailed Chemostrat analyses of all late Cretaceous reservoirs should be undertaken across all wells as a priority to differentiate areas of provenance and a detailed source to sink model constructed to highlight reservoir effectiveness sweet-spots.

- Reservoir modelling should be undertaken with a strong spatial focus to better understand the timing of cements and authigenic mineral diagenesis.

- Detailed internal Mapping of Basin Floor Fans must be undertaken to help predict where the thickest and highest quality sands are located and this must be done on both the conventional seismic and litho-classified data (where calibration is confident).

Block Acquisition & Recent News Flow

What has Changed Since Q4 '25

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1. **BluEnergies Ltd (TVSX) (BLU) June 2025 has acquired PSC's for blocks 25, 30 and 31 in the Harper Basin with NOCAL as a partner in Block 31.**
2. **TotalEnergies 15th September signed 4 PSC's Blocks 6, 11,17 and 29 and spent 15 mm USD in signature bonuses. Blocks 11 and 29 were signed with NOCAL as a partner.**
3. **Atlas Oranto Petroleum 24th September 2025 signed PSC's for Blocks 15, 16, 22 and 24, spending 12 mm USD on signature bonuses**
4. **PetroQuest Deepwater Liberia wishes to sign up Block 32 (2322 km2) containing the Jupiter Fan with NOCAL as a partner.**

5. **TotalEnergies sign MOU with BluEnergies for Block 26, 30 and 31**

TotalEnergies Just Threw a Spotlight c[illegible] gher

The stock price for BluEnergies owners of Block 30 and 31 (adjacent to block 32) is up 2,700 % YTD 2025!

Majors Are Moving! 'A Gold Rush' in Q4 2025

Over $800 mm Pledged By Oranto Petroleum & $26 mm spent on SOBs

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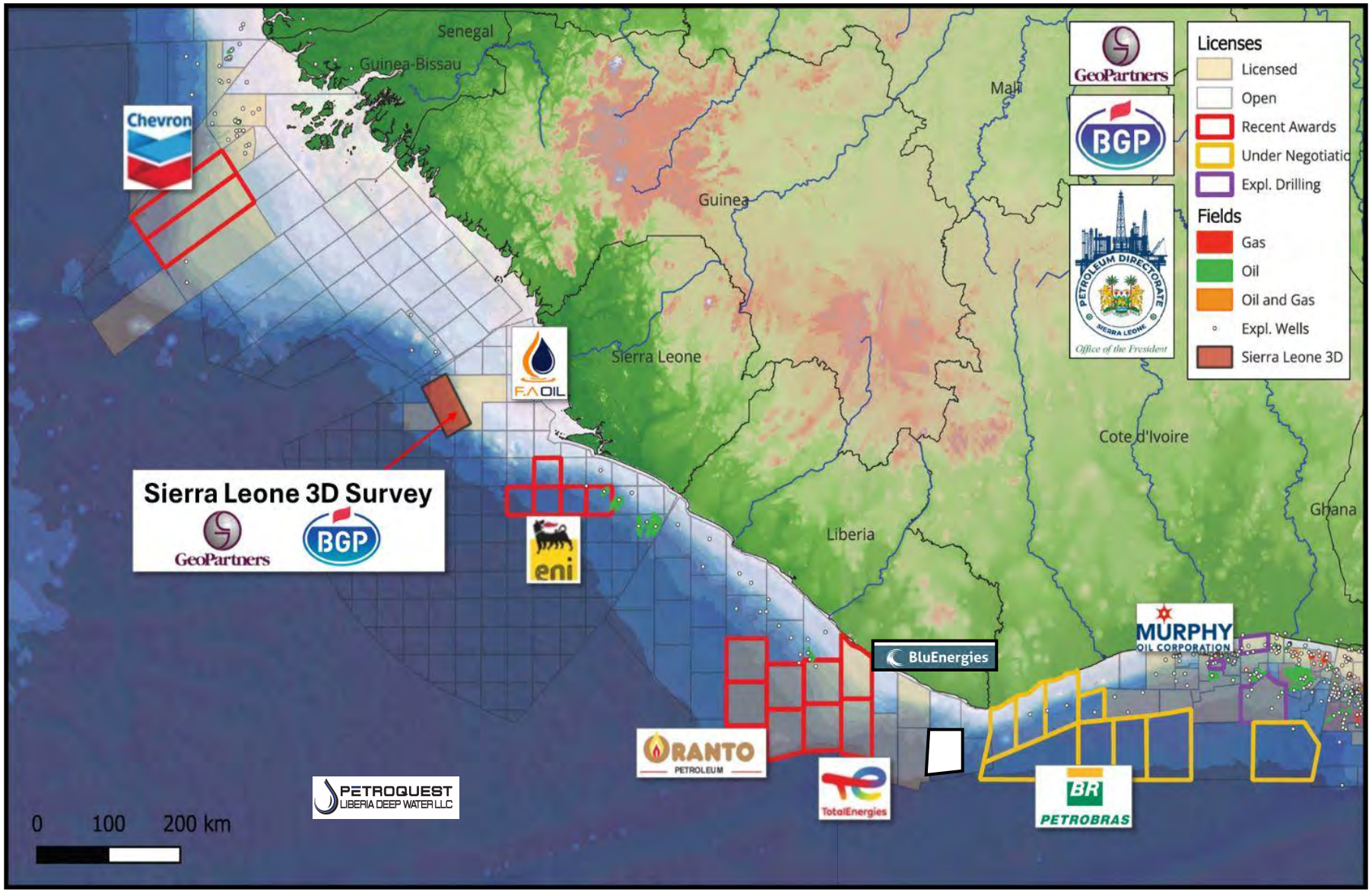
- Q4 2025 Total pick up four PSC's, LB 06 11, 17 and 29.
- Q1 2026 Total signs MOU with BluEnergies for Recon Permit RL-02 (Blocks 30 & 31)
- Chevron enter Guinea Bissau via two large permits Blocks 5B & 6B.



After BGP Offshore LinkedIn Post Nov 2025

Block Acquisitions - Below Ground Risk Mitigation

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Rationale for Acquisition of Exploration Assets Offshore Liberian & Harper Basins (Key Target Play is BFF)

- Oil prone '**CATM/WATM' Source rocks** (*OAE I & OAE II*) present across both the Liberian and Harper Basins.
- A thermally mature 'oily' **Petroleum System** exists with **Live** oil penetrations in seven legacy wells
- Clearly defined 'antecedent' river drainage systems, eroding granitic terrane (quartz (sand) rich), present in the onshore hinterland, provides a long-acting sand prone **High-Quality Reservoir** 'highway'. Some reservoir effectiveness 'issues' in slope fan facies.
- Multiple incisions are observed across the shelf, through which staged '*High-stand sands*' can be redistributed to the basin floor during active relative sea-level falls ('*low-stands*'), from the Mid Cretaceous to the Mid Tertiary.
- Abundant high-quality top and lateral **Seals** deposited out-board of the paleo-shelf during frequent 'High-stands'.
- Stratigraphic **Traps** (SF) proven as oil bearing, along the Liberian continental slope at; ***Jupiter-1, Venus-1B, Bee-Eater-1 and Narnia-1***
- Stratigraphic **Traps** (BFF) (like those offshore Guyana, Namibia and Cote D'Ivoire) are imaged on existing Liberian 2D/3D data, with many of these having associated DHI indicators for robust risk mitigation. They are in ultra-deep water, previously not accessible
- Dry Hole analyses suggest SF systems are high risk, whilst BFF targets are considered much lower risk for both trap integrity and reservoir quality.
- Block 32 has been high-graded as it has an extensive Turonian aged BFF, 'the Jupiter Fan' completely held within it and it could hold up-to 3.6 Billion bls of OOIP with an NPV worth (10% discounted)10 billion USD

Key Assumptions (Acreage Acquisition)

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Rationale for Acquisition of Exploration Assets

- Liberian Civil War ended in 2003 (over 21 years ago) with a robust *Parliamentary Democracy* in place as well as a *Truth & Justice Committee* to address past grievances and promote justice-based reconciliation. Currently no civil unrest.
- The Oil and Gas Regulatory Bodies are well established namely the *LPRA*
- A favourable *Model PSC* agreement is in place with robust and functioning regulatory legal frameworks.
- **Offshore Liberia is at this time** open for exploration through direct negotiation with the latest bid round having recently closed in mid-November 2024 in Liberia.
- **Mark Sloan** and **Liberty Petroleum Corporation** (**LPC**) have worked 'Liberia' previously, prior to the drilling of existing discoveries, back when *Kosmos Energy* were intent on acquiring *Harper Basin* acreage.
- **LPC** are familiar with the Central Atlantic Transform Margin (CATM) and successfully bid for *Block S7* offshore Guyana in 2023 with partners **Cybele Energy**. Block S7 has ***ExxonMobil*** and ***TotalEnergies*** as neighbours.
- Both **LPC** and Mark Sloan are well respected by the Government of Liberia, *LPRA and PDSL.*
- *We have secured a highly attractive exploration block (32) via the mechanism of executive allocation via NOCAL (The National Oil Company of Liberia)!*

Legacy Seismic Data

Extensive Library of both 2D and 3D data covers the entire Liberian offshore EEZ

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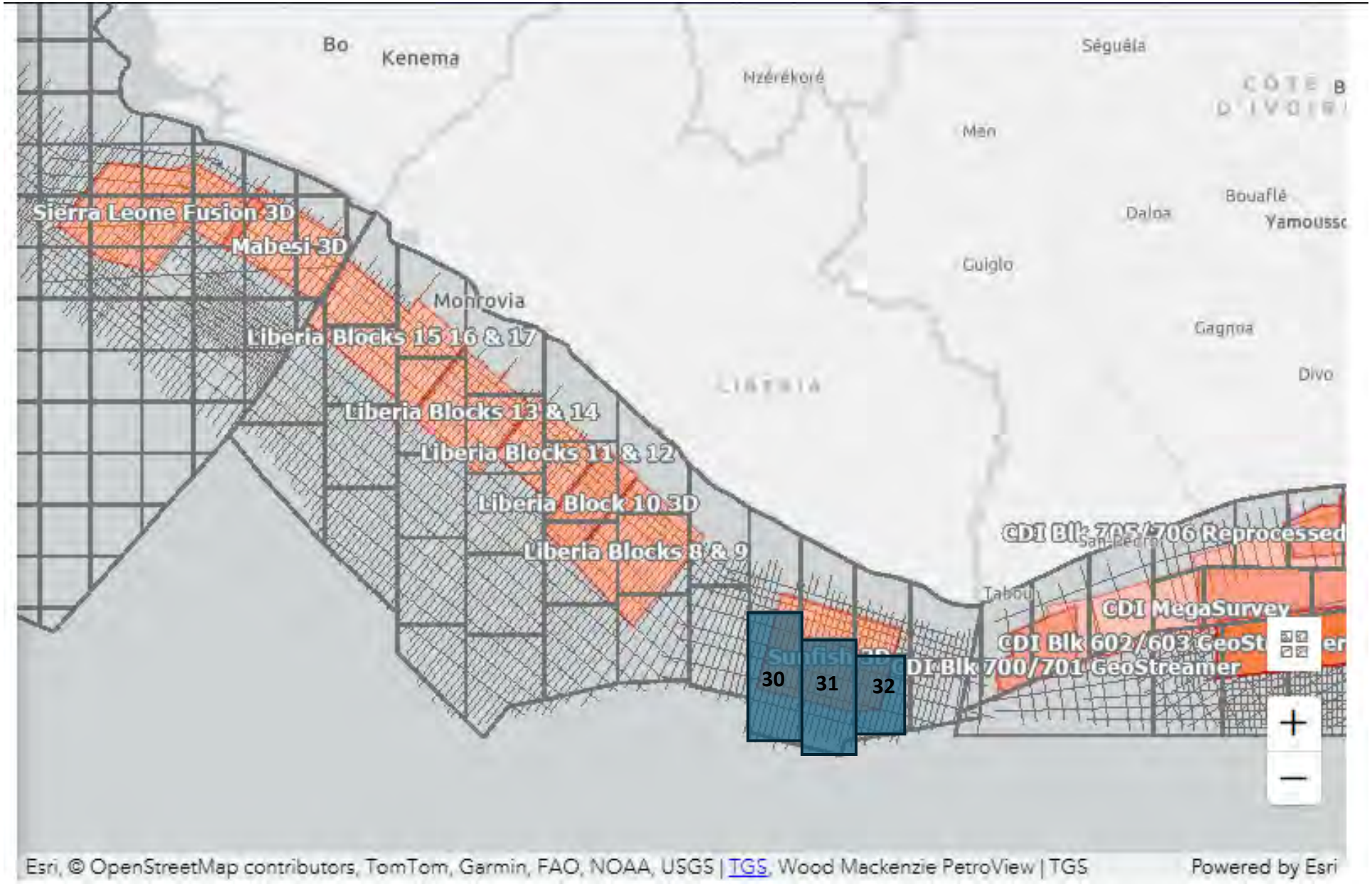
2D:
- PSTM = 24,772 km
- PSDM = 24,772 km
- Reprocessed = 12,214 km

3D:
- PSTM = 18,342 km2
- PSDM = 15,329 km2
- PSTM/PSDM = 8,582 km2
- Repro = 5,142 km2

Gravity:
- 2D = 24,772km
- 3D = 6,597sqkm



Sunfish 3D 2013 Acquisition & Processing (Harper Basin 3D)

Streamer Length 7200 m - Acquisition Constrained?

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TGS

LIBERIA SUNFISH 3D
Pre-stack Time and Depth Migration
Multi-client 3D Survey, 6166.7 km²

ACQUISITION PARAMETERS

Acquisition date:	January-May 2013
Acquired by:	M/V Polarcus Asima
Dual Source:	Clustered airgun arrays – 4240 in³
Source Interval:	50m per subsurface line
Streamer Length:	7200m x 12 x 100 m
Number of Channels:	576 per streamer - 6912 per shot
Group Interval:	12.5 m
Record Length:	10500 ms
Sample Interval:	2 ms
Multiplicity:	72 fold @ 6.25 m bin interval
Recorded Bin Size:	6.25 x 25 m
Primary Navigation:	DGPS for the vessel; RGPS for front and tail buoys
Recording Instrument:	Sercel Seal 408 v5.2
Cable Type:	Sercel Sentinel Solid
Cable Depth:	10 m +/-1 m
Filters:	2 Hz (6 dB/octave) – 200 Hz (370 dB/octave)
Gun Depth:	8 m +/- 0.5 m
Shooting Direction:	Northeast / Southwest
Navigation:	WGS84, UTM Zone 29N

TIME PRE-PROCESSING

Processed by Arcis (a TGS company), Calgary CA
Completion: June 2014

- Navigation merge (performed on vessel, output nav-merge)
- Apply start of data (SOD) correction
- Debubble and convert to zero phase
- Resample from 2ms to 4ms
- Noise attenuation (swell, linear & first break)
- True azimuth multiple elimination (TAME™) 3D SRME
- Output shot ordered TAME™ tapes
- Spatial anti-alias filter, trace drop to 25 m group interval
- Velocity analysis
- Spherical divergence gain correction
- Shot and channel amplitude compensation
- High resolution Radon de-multiple
- Cold water statics
- Q compensation (phase only)
- Residual noise attenuation
- Output pre-migration final demultiple gathers

TIME MIGRATION and POST-STACK PROCESSING

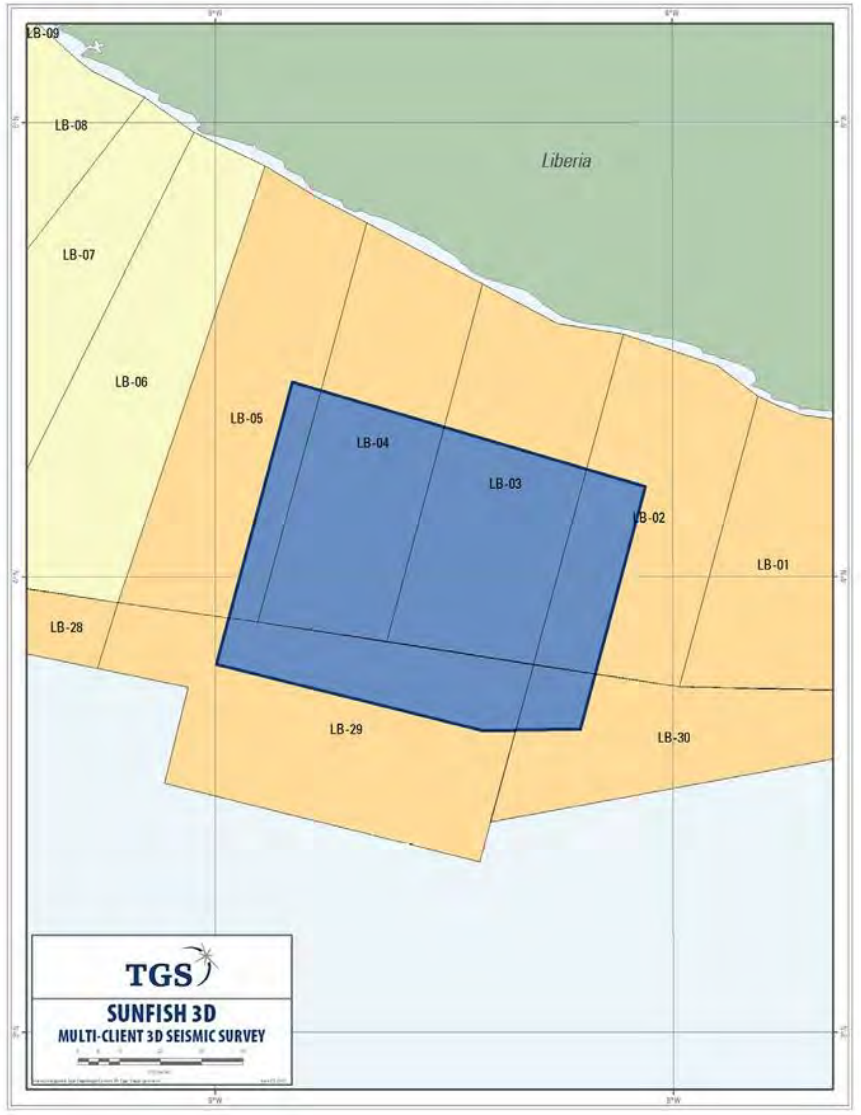
- Grid and sum data to 12.5x25 m x 72 fold
- Kirchhoff pre-stack curved ray migration velocity analysis
- Output migration velocities
- Kirchhoff pre-stack curved ray migration
- Output 3D bin sorted tapes
- Automatic second and high order moveout correction
- Output 3D velocity and ETA trace volumes
- High resolution Radon de-multiple
- Output migrated gathers with NMO & Radon
- Mute and stack
- Output raw migration
- Post-stack trace interpolation
- Output angle stacks (near 0-15°, mid 15-30°, far 30-45°)
- Noise removal, filter, scaling & interpolation
- Output processed migration

AVAILABLE TIME DELIVERABLES

- Raw field data – shot ordered
- Field data with navigation in the trace headers – shot ordered, unedited at 2ms
- TAME™ / shot ordered – 12.5x25m, 72 fold
- Pre-migration final demultiple – 12.5x25m, 72 fold
- Pre-stack time migrated CDP gathers without NMO – 25x25 m, 36 fold
- Pre-stack time migrated CDP gathers with NMO & Radon – 25x25 m, 36 fold
- Fast-track migration – interpolated to 12.5x25 m
- Raw migration – 25x25m
- Angle stacks (near, mid and far) - 12.5x25 m
- Far weighted pseudo-gradient - 12.5x25 m
- Processed migration - 12.5x25 m
- Migration velocities (ASCII) (500x500m grid)
- Stacking velocities (ASCII) (500x500m grid)
- 3D stacking velocity trace volume – 12.5x25 m (SEGY)
- 3D migration RMS velocity trace volume – 12.5x25 m (SEGY)
- 3D ETA velocity trace volume – 12.5x25 m (SEGY)
- Processed source-receiver navigation (UKOOA)
- Post stack navigation – bin center (UKOOA)
- Gravity data (ASCII)

TGS

LIBERIA SUNFISH 3D
Pre-stack Time and Depth Migration
Multi-client 3D Survey, 6166.7 km²



Available 2D/3D Seismic on a Block-by-Block Basis

Should we shoot a new detail 3D? Possibly Hybrid?

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- Given the seaward shift in the AOI to the ultra-deep water, the legacy 3D seismic is somewhat acquisition constrained.
- The legacy 3D was all acquired with relatively short cables 7200 m and no 'Broadband' in-sea solution.
- Optimum cable length is probably about 10,000 m for ultra-deep-water and imaging the Basin Floor Fan Systems.
- Data needs modern reprocessing at a minimum, possibly new 3D with 10,000m cables and in-sea Broad Band Recording!

lock	Block Area (KM^2)	Water Depth (m) Min	Water Depth (m) Max	Total 3D Seismic Data Coverage (KM^2)	Total 2D Seismic Data Coverage (KM)
LB-01	2996	10	3000	1760	677
LB-02	3431	10	2400	1491	499
LB-03	3274	10	2100	651	253
LB-04	2986	10	1200	425	170
LB-05	3187	10	1400	844	235
LB-06	3001	10	900	128	409
LB-07	2935	2000	3400	1612	971
LB-08	3419	700	3400	2711	1113
LB-09	3117	200	3300	2930	1056
LB-10	3025	100	3000	2802	990
LB-11	3023	100	2500	2687	861
LB-12	2811	2500	4000	214	817
LB-13	3088	3200	3900	0	888
LB-14	2981	3100	3800	0	859
LB-15*	3247	2400	3600	166	975
LB-16*	3134	1700	3300	1865	1006
LB-17	3276	1100	4300	418	821
LB-18	3368	3600	4100	0	633
LB-19	3404	3700	4000	0	949
LB-20	3072	3700	4000	0	851
LB-21	2205	3800	4100	0	534
LB-22*	3301	3100	3700	0	969
LB-23	3293	3000	4500	0	892
LB-24*	3314	2800	4200	0	913
LB-25	2445	10	1400	186	366
LB-26	2482	10	2500	525	464
LB-27	2300	10	2500	525	464
LB-28	2256	10	2900	0	407
LB-29	3272	300	4300	0	971
LB-30	3391	1000	4100	1547	1001
LB-31	3051	2500	4200	2250	876
LB-32	2322	1500	4200	656	753
LB-33	2332	1500	4200	0	661

Legacy 2D Seismic Data Quality & Data Acquisition Parameters

Pre Yr 2000 Legacy 2D Data is Acquisition Constrained!

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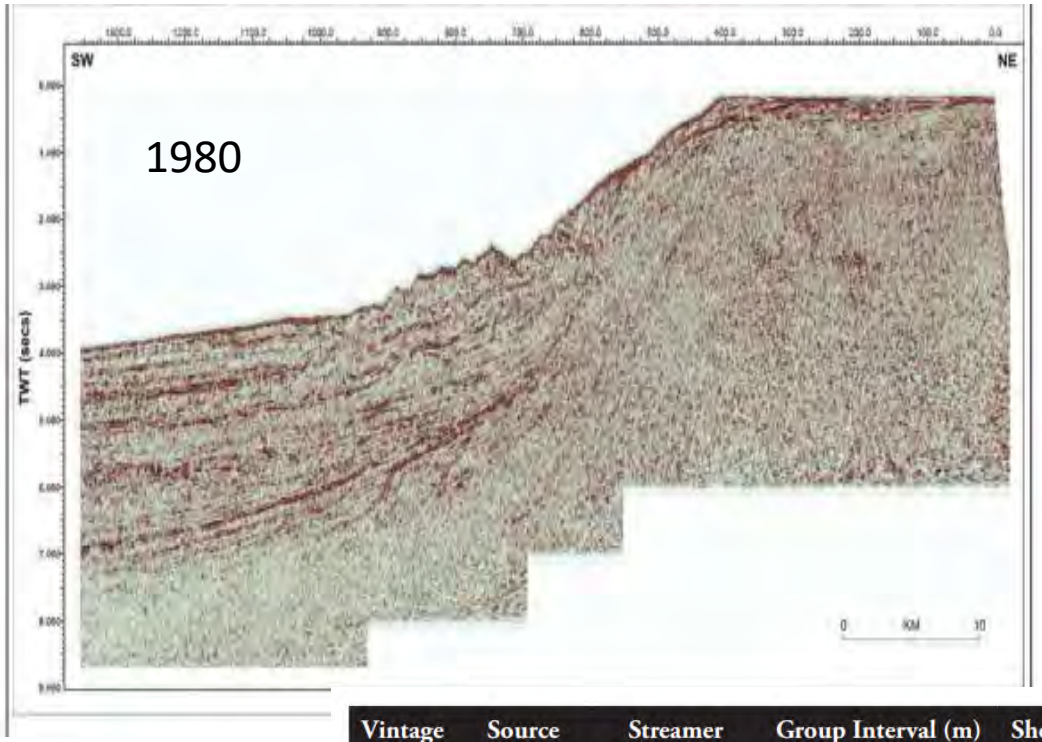

Vintage	Source	Streamer Length (m)	Group Interval (m)	Shot Interval (m)	Record Length	Fold	Xline Spacing
1976	Flexichoc	2400	50	50	maximum 9 s/4 ms	24	n/a
1980	Flexichoc	2750	50	50	maximum 8.7 s/4 ms	24	n/a
2001	Air gun, 3680 in^3	7200	25	37.5	10 s/2 ms	96	n/a
2010	Air gun, 4280/4320 in^3	7200/8100	12.5	62.5/per source	13 s/2 ms	57/64	25 m

Table 1. *Comparison of acquisition parameters from different surveys.*

Post Year 2000 Legacy 2D/3D

The Seismic Data Seismic Can Be Reprocessed!

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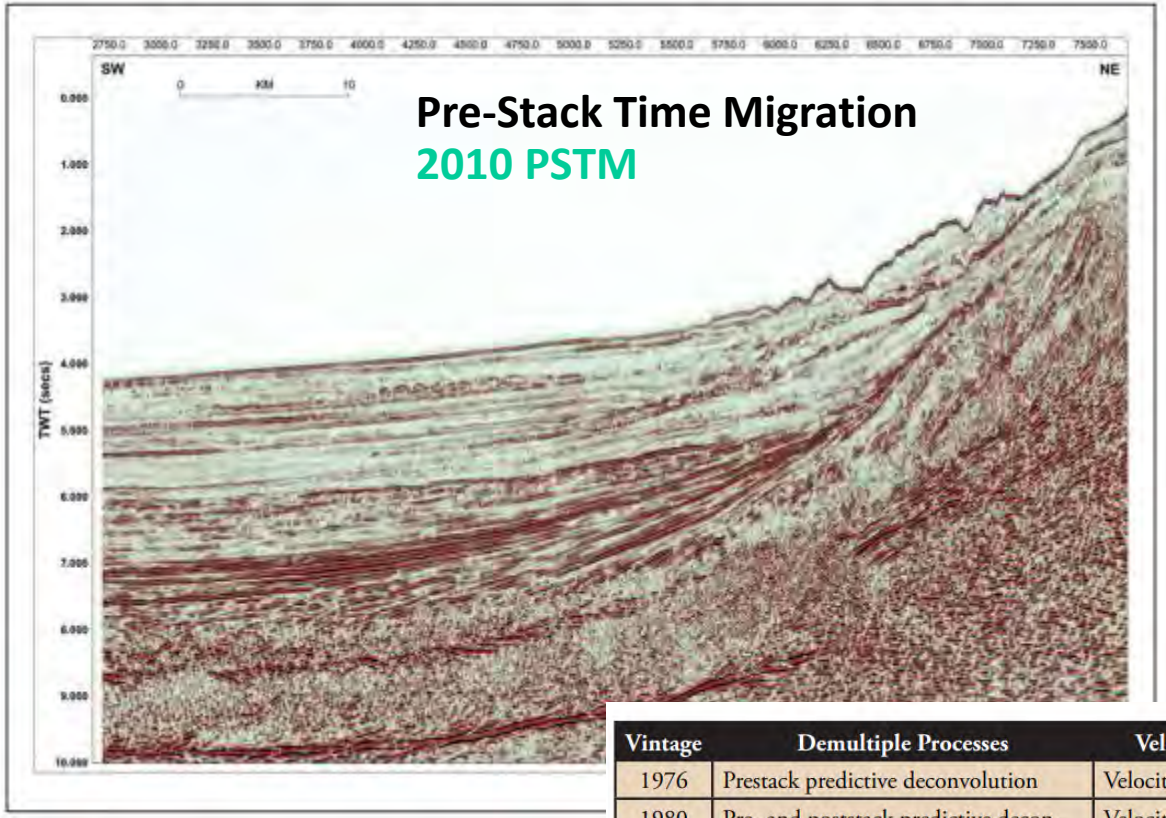

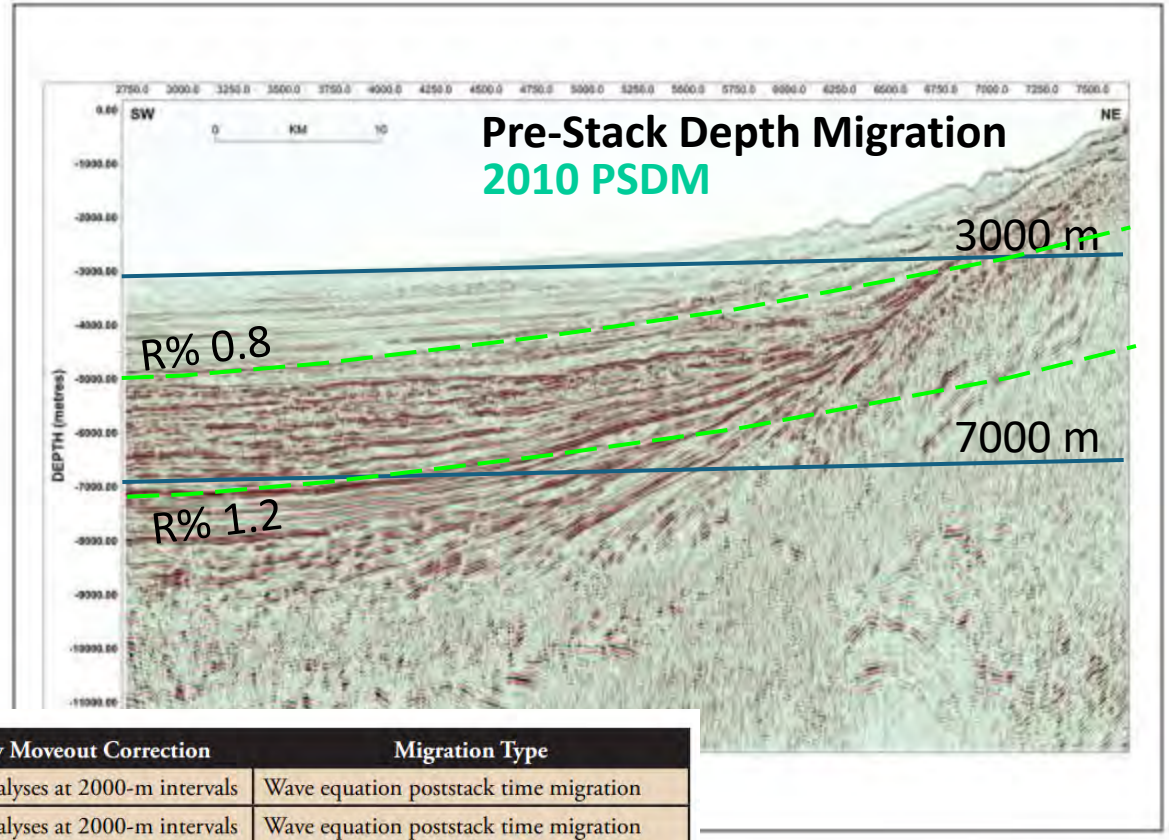

Vintage	Demultiple Processes	Velocity Moveout Correction	Migration Type
1976	Prestack predictive deconvolution	Velocity analyses at 2000-m intervals	Wave equation poststack time migration
1980	Pre- and poststack predictive deconvolution	Velocity analyses at 2000-m intervals	Wave equation poststack time migration
2001	Radon and predictive deconvolution	Velocity analyses at 2000-m intervals plus RMO	Kirchhoff prestack time and depth migration
2010	Debubble, Radon, and true azimuth SRME	Velocity analyses at 500-m intervals plus 100 × 100 × 50 m tomography	Kirchhoff 3D prestack time and depth migration

Table 2. *Comparison of processing techniques for different data vintages.*

Work Program

Exploration Work Program Time Line – 'Idealised' Block 32 (Jupiter)

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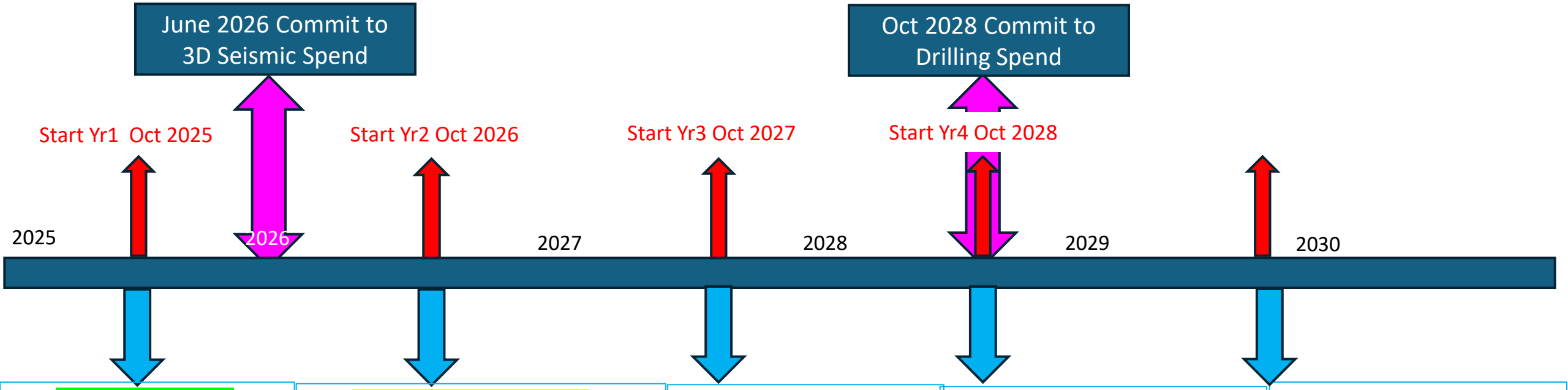
Work Program Summary Years 1-3



a) 3D seismic decision points by August 2026 commit to 3D Hybrid seismic spend

b) Drilling decision point October 2028 (End of Year 3 – Drill or Drop?)

SAR Oil Seep Study Cost Vega & Jupiter (60,000 USD) (Year 1)

PQA 1 (PSA 131) SAR Analyses Example (30,000 USD for 5000 km2)

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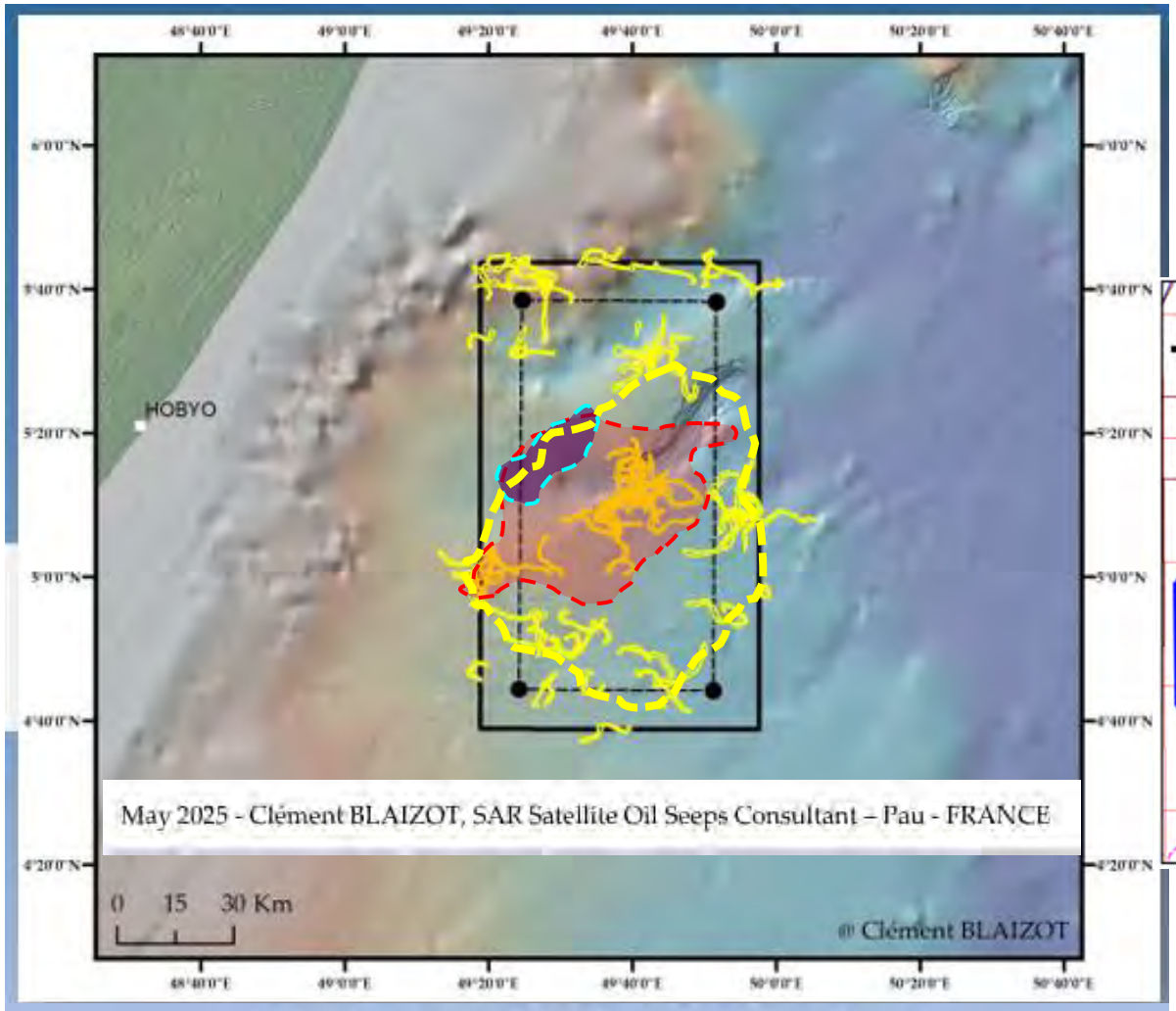
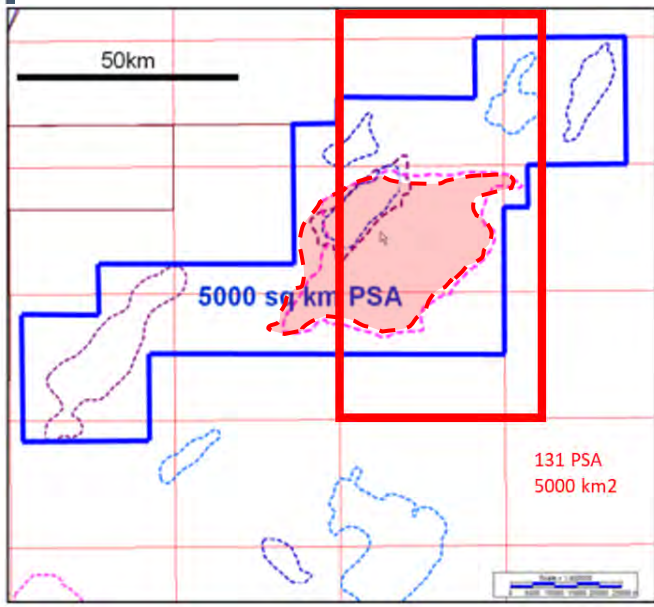
- Clement Blaizot was commissioned in June 2025 to document offshore oil Seeps via SAR Repeatability.
- 86 separate seeps mapped over block 131.
- Many seeps appear to be co-located with the RPS 2015 mapped closure of Leopard Shallow.
- The repeatability of many seeps suggests that Block 131 has a pervasive naturally occurring oil seep system.
- ***Consistent with the above is the conclusion that oil source rocks and pervasive oil charge is present over Block 131.***



Study Area (sq/kms): 5 000 km²

Coverage of SAR data: max 136, min 104, average: 87

Total number of potential Oil Seeps : 86



Source to Sink and Reservoir Study: Gastech & Core Lab (Year 1)

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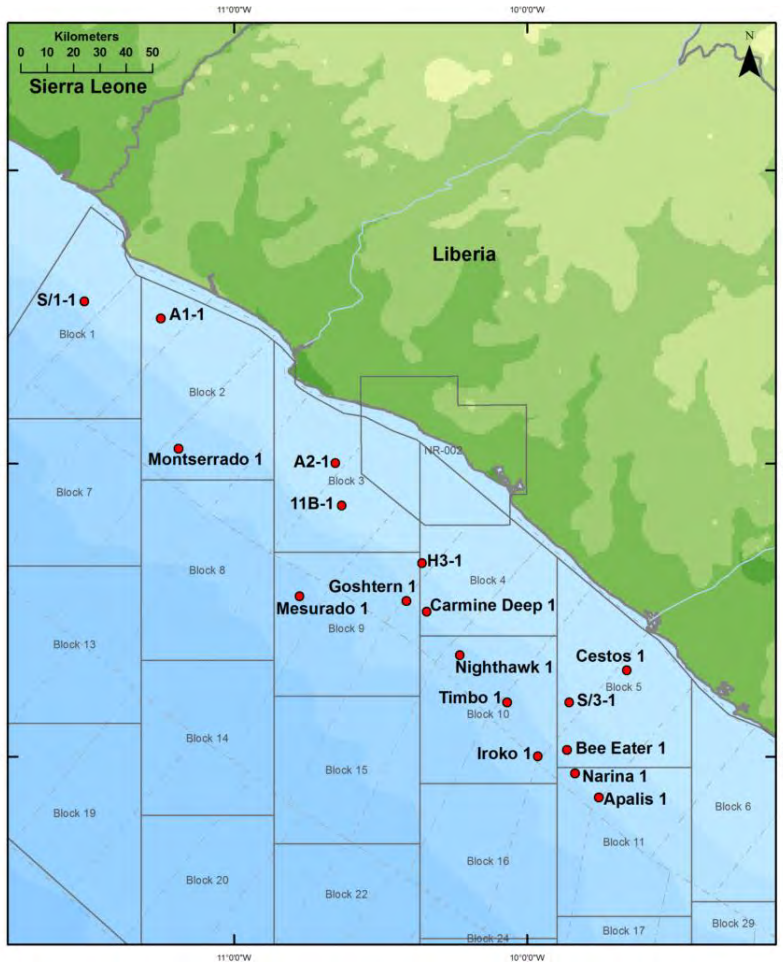
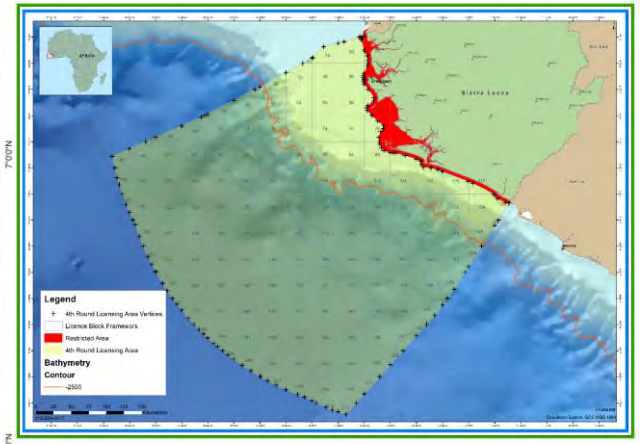
Purchase Cost Estimated 100,000 USD



Core Lab SCAL Study – Liberian 17 Wells



GasTech Hinterland Drainage Study

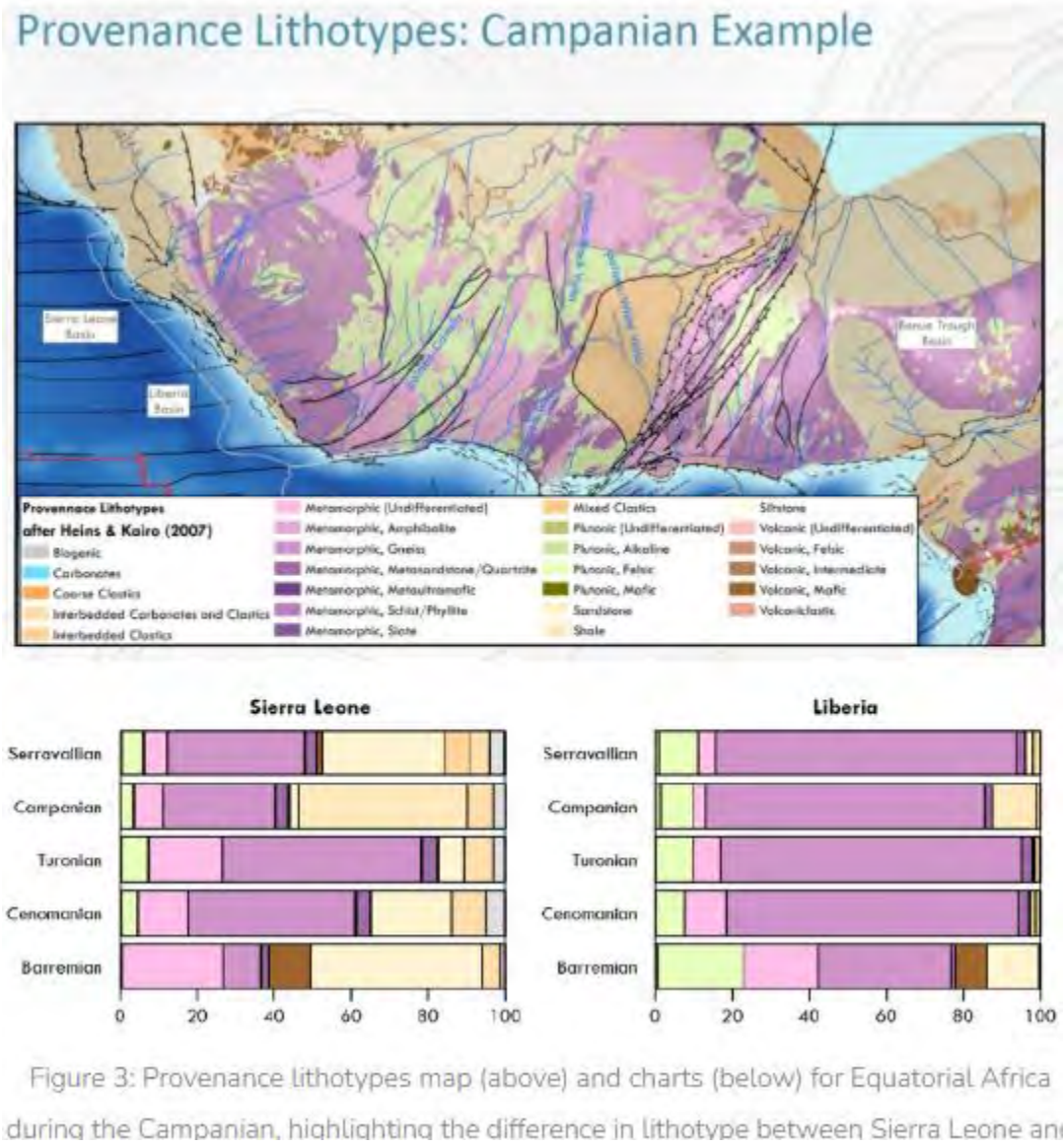


Figure 3: Provenance lithotypes map (above) and charts (below) for Equatorial Africa during the Campanian, highlighting the difference in lithotype between Sierra Leone an

GasTech Source to Sink (Campanian Epoch)

Rock Physics & AVO Study (Year 2) Drilling Mitigation

DHI's & AVO Analyses Liberian Basin 14-20 Wells as Input (Cost 100,000 USD)

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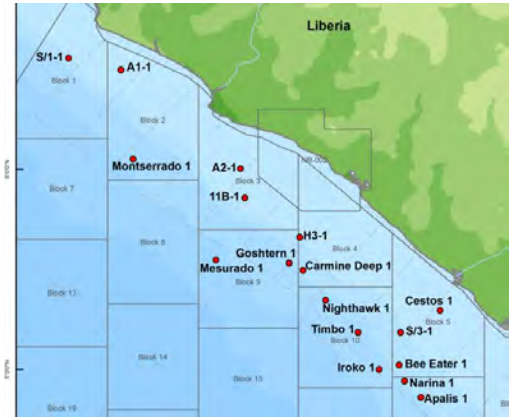
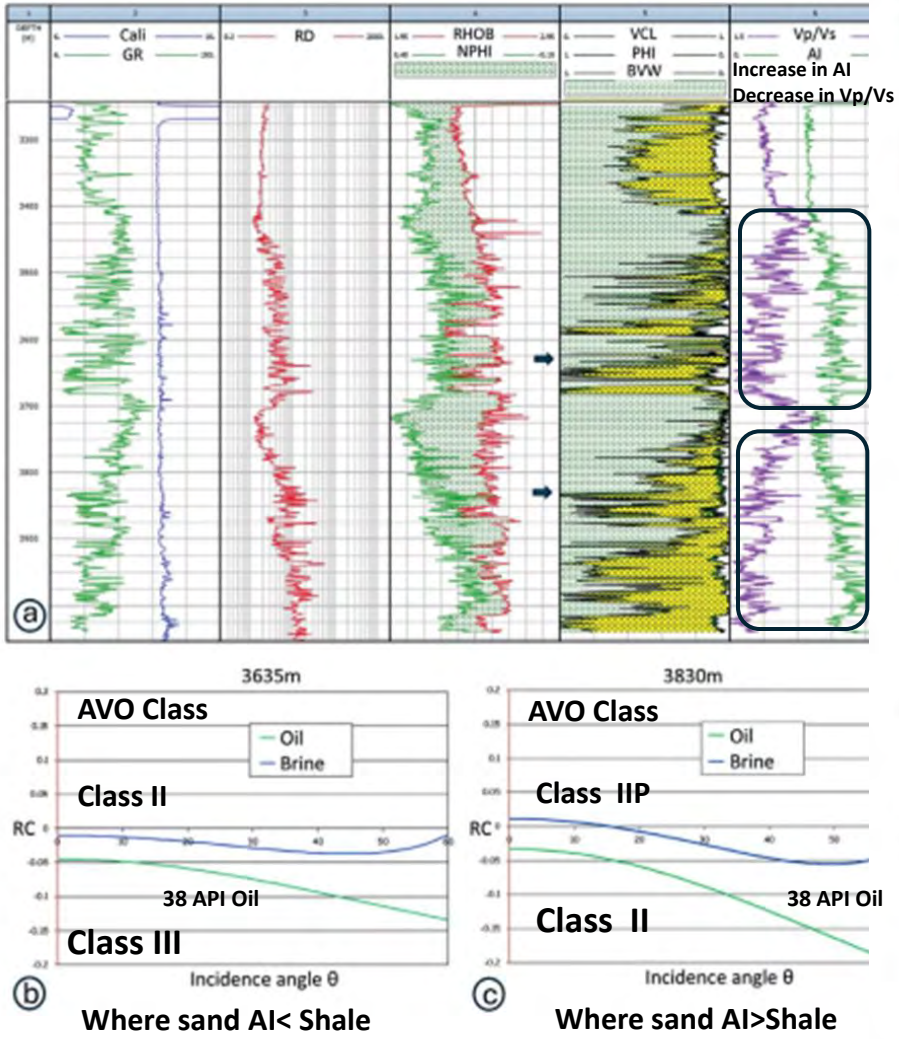
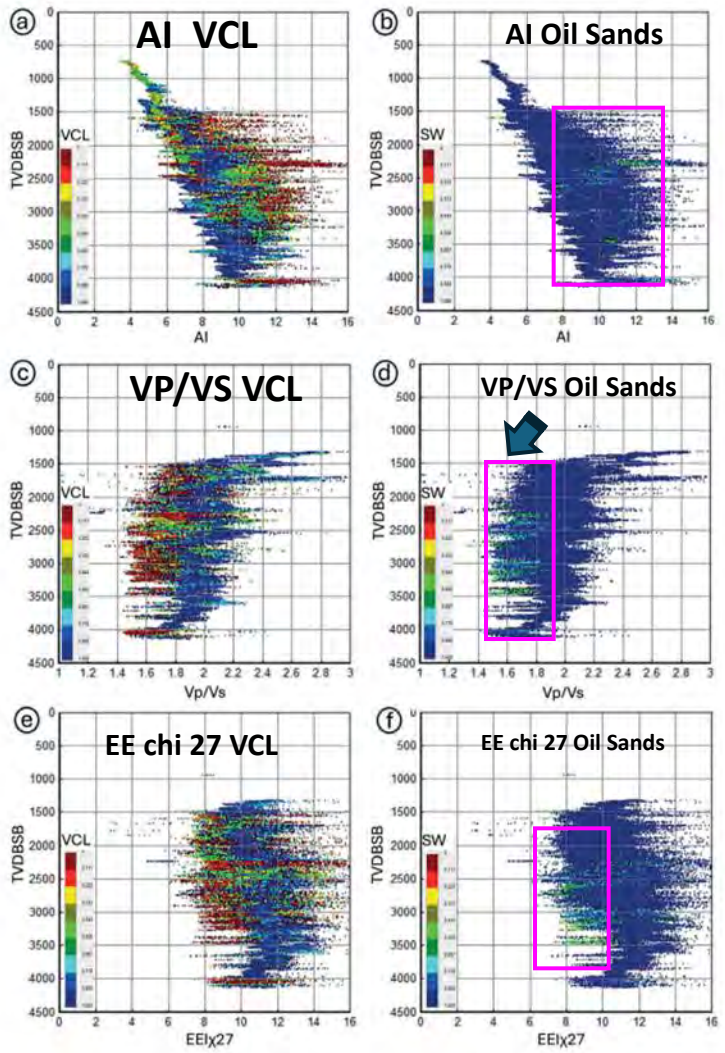


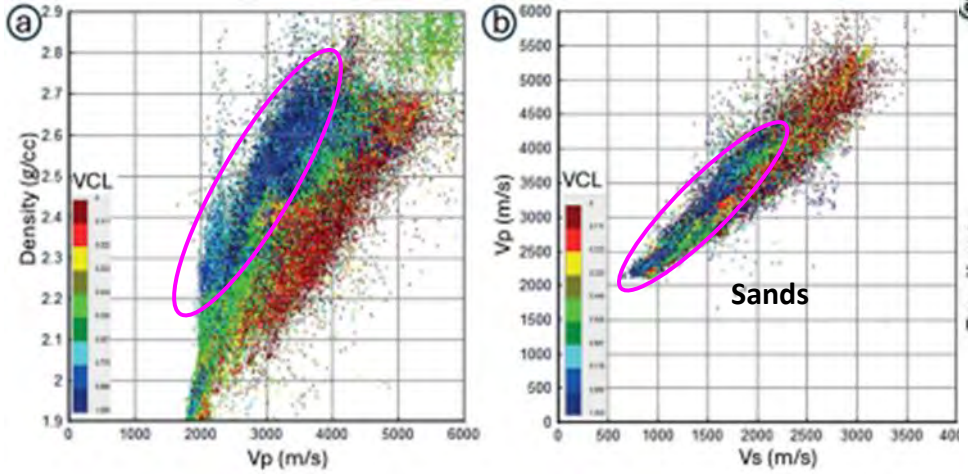
- The deep waters of the Atlantic margin have proven to be a good place to explore for hydrocarbons in recent years with large commercial discoveries having been made, for example, in Brazil, Guyana, Ghana and Namibia. Most discoveries have been made in siliciclastic plays in stratigraphic traps (e.g. Daily et al 2013, Hedley et al 2022).
- In these plays, there is typically a heavy reliance on seismic interpretation to define traps and on amplitude analysis, including amplitude variation with offset or angle (AVO/ AVA), to suggest hydrocarbon presence.
- In 2024 TGS completed a 14 well data review of AVO behavior of Cenomanian to Campanian sands offshore Liberia.
- They found that no confident prediction of hydrocarbon presence could be made without first understanding the water wet response of the Late K reservoirs



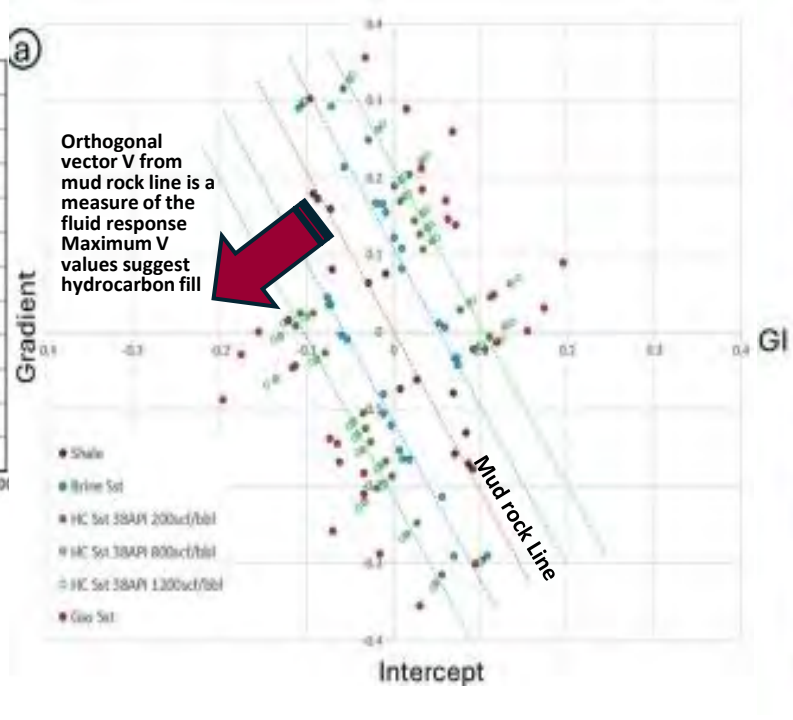


AVO Study Offshore Liberia (14 Wells) Year 2

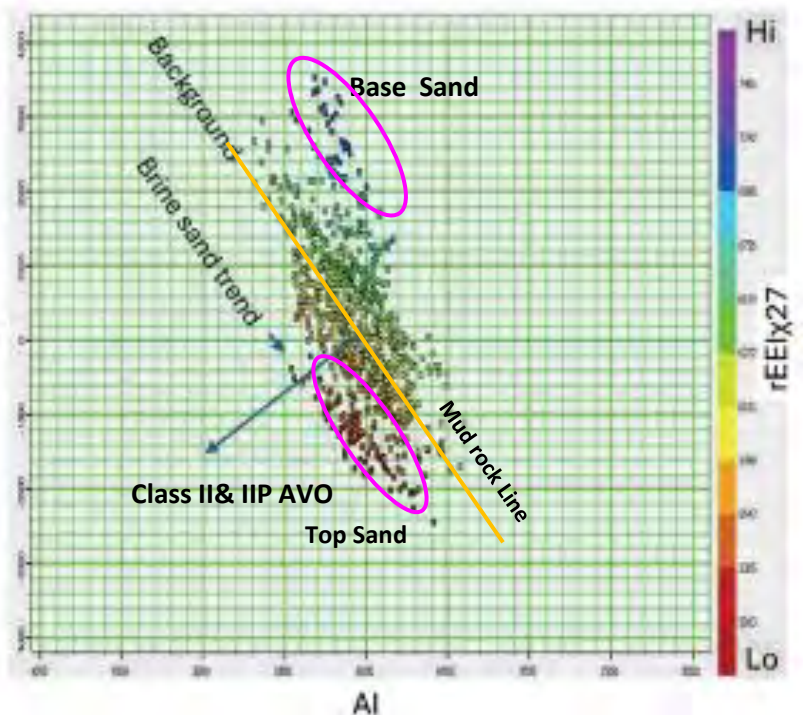
X-Plots AI vs GI (Modelled vs Actual)



X-plot of a) Density vs Vp and b) Vp vs Vs showing how porous sands plot at the lower end of Vs



Modelled Response of 1) Shale, 2) Brine Sands 3) Oil Sand & 4) Gas Sands on a X-Plot of Intercept vs Gradient. Model is from Liberian Deepwater Wells (Late Cretaceous ssts



Actual 'Dry Hole' Response of 1) Shale, 2) Brine Sands on a X-Plot of Intercept vs Gradient from Liberian Deepwater Well (Late Cretaceous Sh vs Ssts)

Example Seismic Lines rEEI (27 chi angle) Attribute Offshore Liberia

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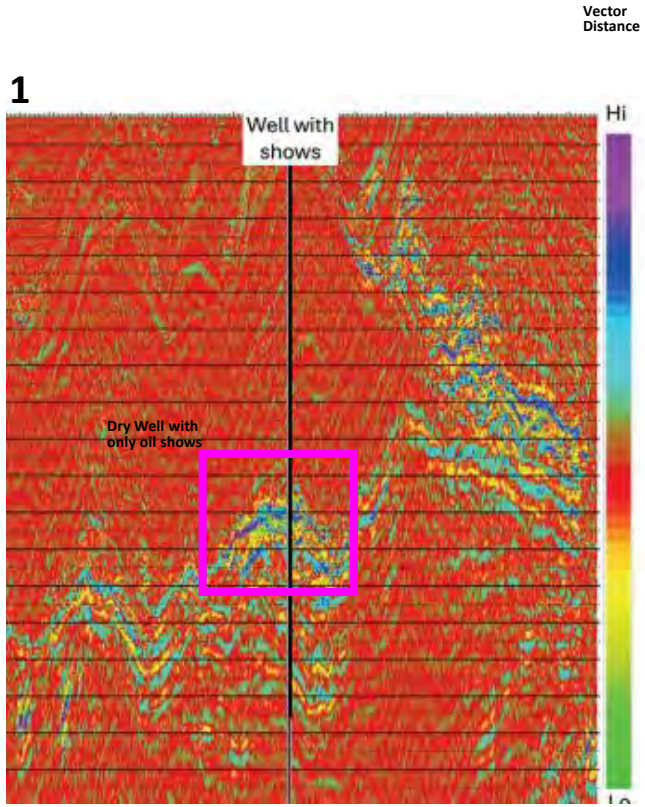
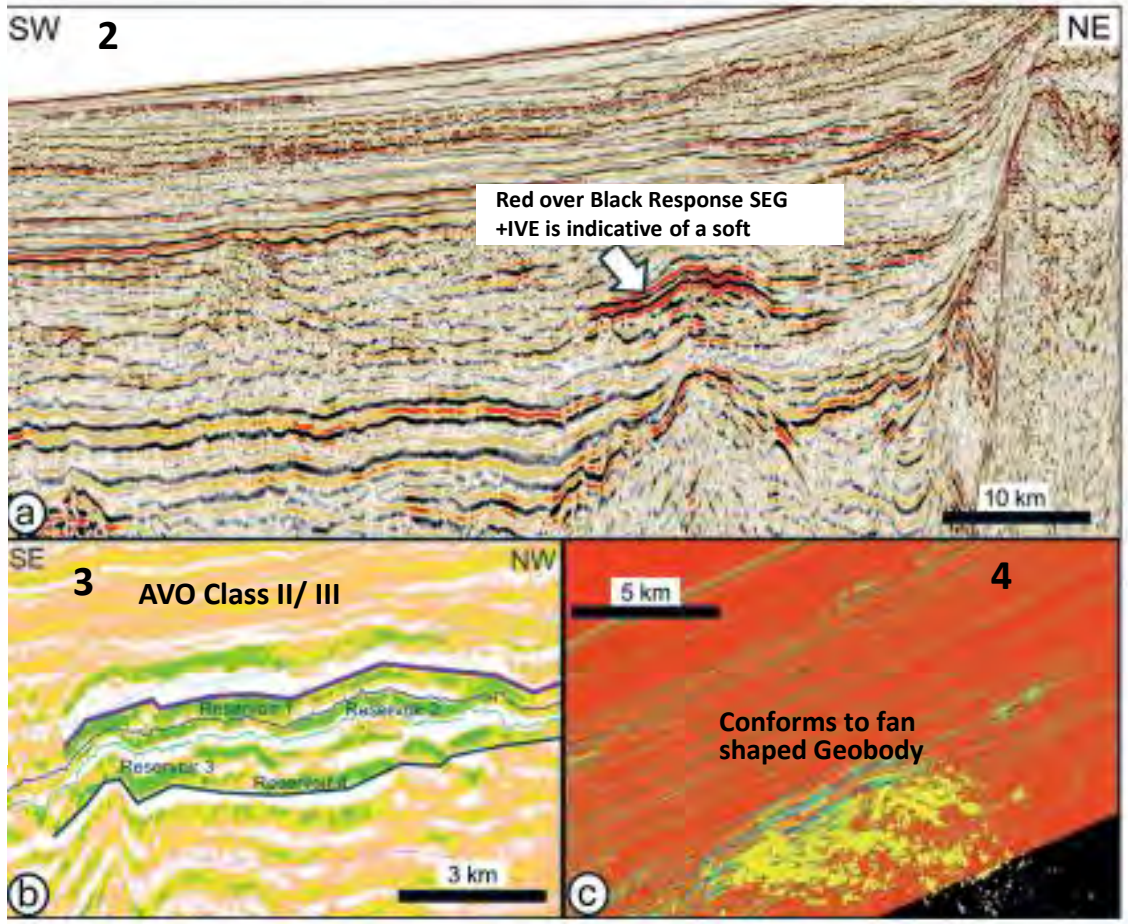
Section 1 shows the EEI (27) attribute over a dry well colour coded by vector distance from Mud rock line. Note the blues and yellows suggestive of shale over brine sand response. A hydrocarbon response would plot a greater distance from the mud rock line so would plot with purples and greens .

Section 2 is a conventional seismic amplitude section (Vp) over a detached fan showing high amplitude (Bright Spots) but do these high amplitudes represent any type of DHI?

Section 3 Co-rendered relative EEI inversion (27 chi angle) and conventional seismic amp. The dominance of greens and whites indicating very large distances away from the Mud rock line which may indicate hydrocarbon pore fluid fill!

Section 4 The EEI anomaly extends as a Geobody, suggesting that the anomaly has geological significance as a potentially hydrocarbon filled trap.





Purchase of Legacy 3D Data (Optional)

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Purchase of Legacy 3D (1.0 mm USD Block 32 (660 km2)) Optionally part of the signature bonus for Block 32

1) The existing '**Legacy 2D and 3D data**' is old and was not acquired using any modern 'in-sea' **Broad-band'** technology. Consequently, the data is 'Band-limited' at the low end and this affects imaging of the deep Aptian/Albian plays.

2) The existing legacy 2D/3D seismic was processed with algorithms which have long since been superseded. Therefore, the data needs a 're-fresh' via **advanced seismic data reprocessing or needs to be reshot!**.

3) The legacy 3D seismic data has been acquired using ' short' streamers (7200 -8100 m) that were 'fit for purpose' for imaging the Slope Fans plays but the data is definitely acquisition constrained for the **Basin Floor Fans**, which extend into much deeper water, **3000-4000 m (water-depth). At these depths 12 km streamers would be required to get the data for FWI and AVO**

4) Any new 3D acquisition should deploy the latest in-sea **'Broad-band'** acquisition technology (i.e. Dual Streamer) deployed in long offset cables, if possible, no less than 12,000 m long.

5) Processing should include advanced imaging to deal strong lateral velocity contrast in the shallow overburden from migrating fluids as well as the steeply dipping sea-bed. TS-dips should be acquired during the acquisition phase for Velocity of water estimations.

6) The cost of any new 3D seismic (1000-2000 km2) acquisition should be budgeted at **10,000 USD/km2** to include (mob-demob), acquisition (production/infill, standby, onboard processing and QC staff as well as shore-based processing).

7) If possible, the purchase of the old data should be avoided or at least minimised to enough data to allow farm-out work to start

Interpretation Work-Flows Incorporation of AI and Sequence Stat.

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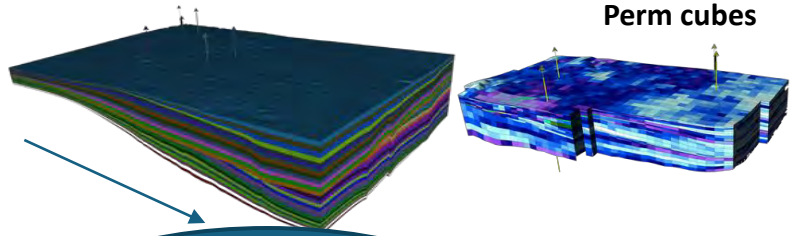
Advanced 3D Interpretation with Machine Learning Inputs, Rock Physics and Full Elastic Inversion, AI, SI, Vp/Vs and Density with Porosity and Permeability Cubes

Full Elastic AI, SI Vp/Vs and Rho. With Porosity and Perm cubes



ML Fault Picking

Probability based Fault Networks

ML Horizon picking

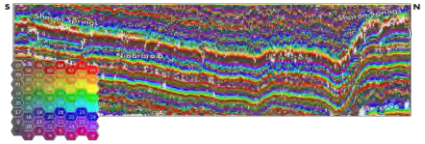
Probability based horizon interpretation

ML Wheeler Volumes

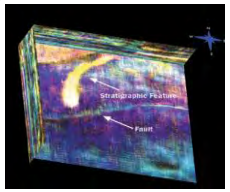
ML Elastic Volumes

ML Rock Physics & Petrophysics

Well Location Selection

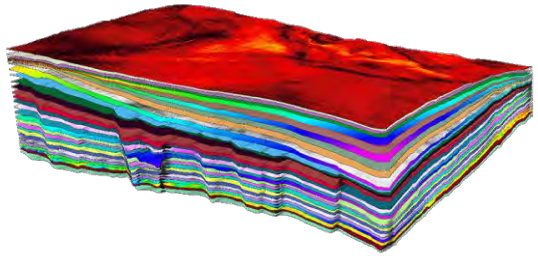


ML Spectral Volumes



Global Fault Derived Fault & Fracture Models

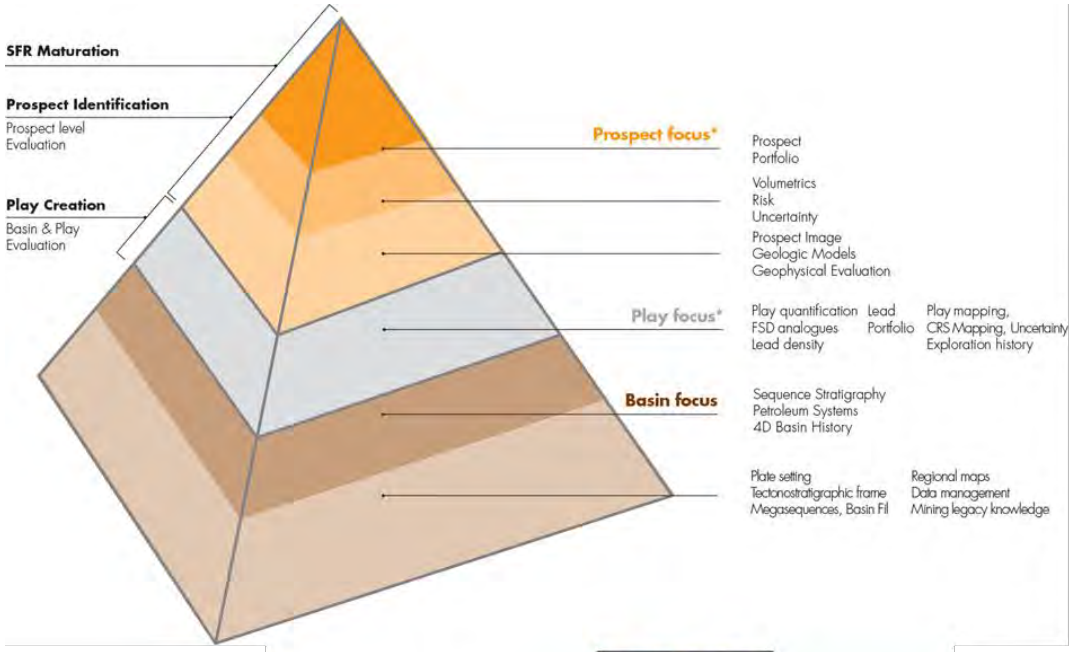
Machine Learning Based Auto-pickers

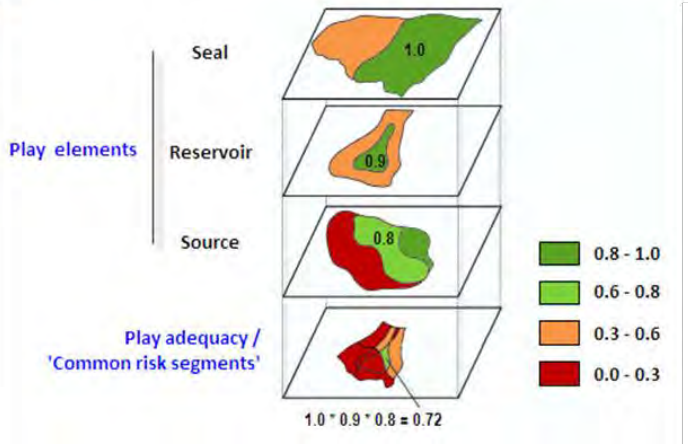


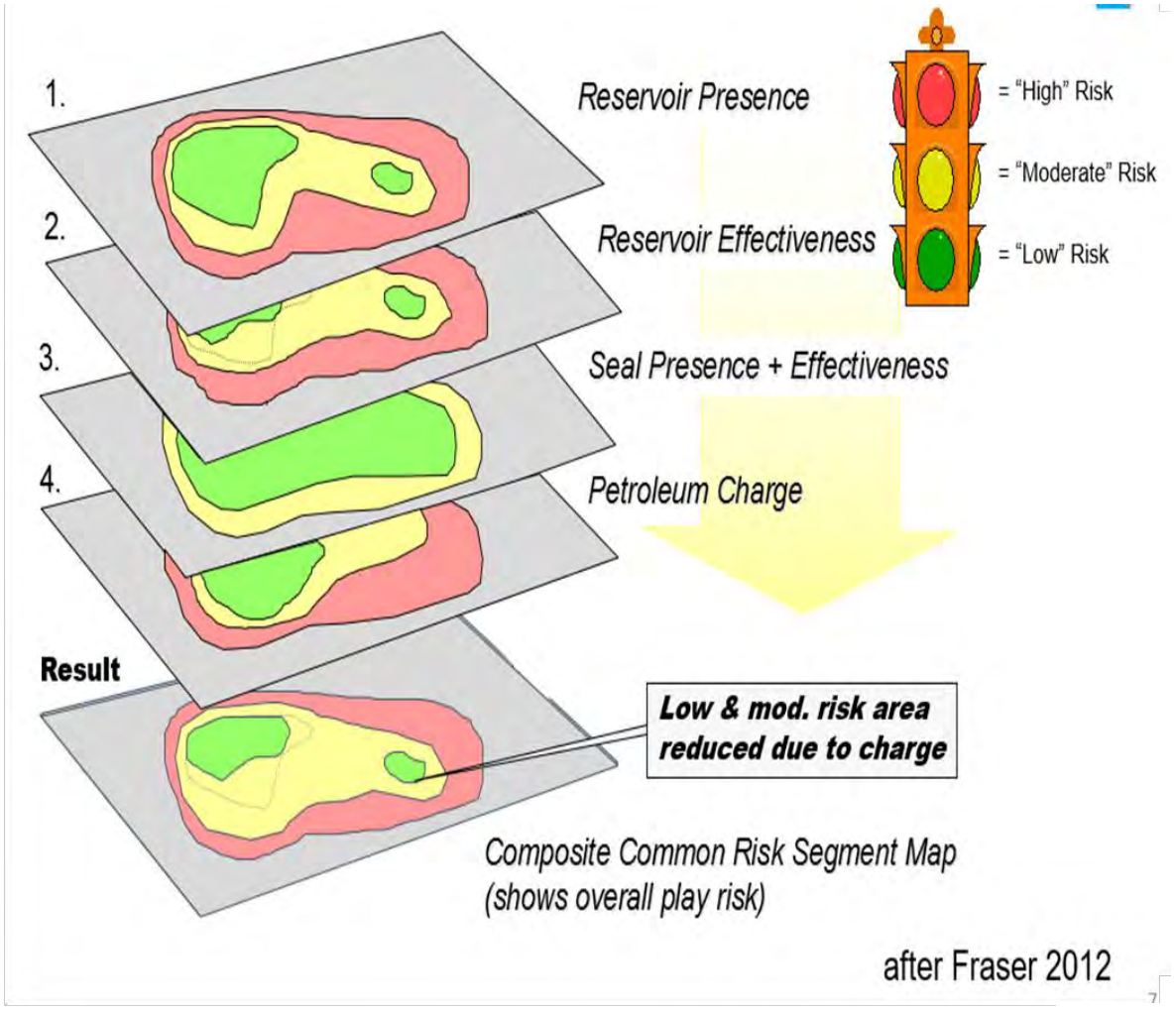
Machine Learning Based Wheeler transforms, PCA Attribute analyses leading to a depth referenced reservoir/prospect model

Mapping Work-Flows: Seismic Interpretation

Advanced Play Based Mapping – Common Risk Elements







Dispersion Work-Flows: Seismic AVO Validation

Advanced Spectral Analyses Finds Hydrocarbon filled 'reservoirs' offshore Guyana

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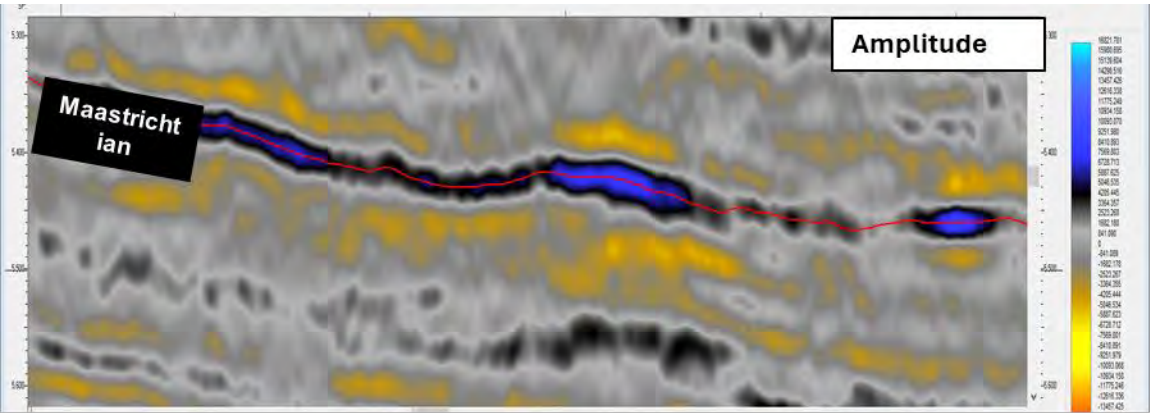

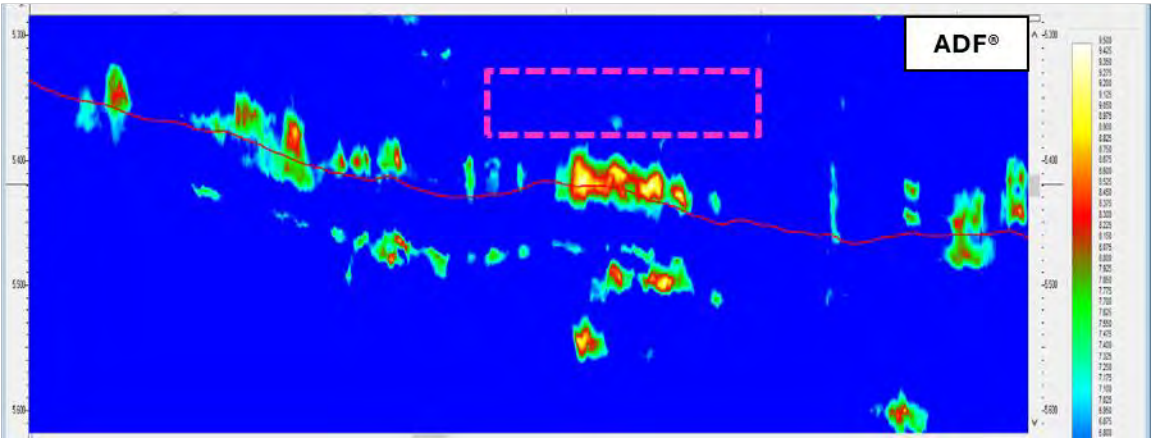

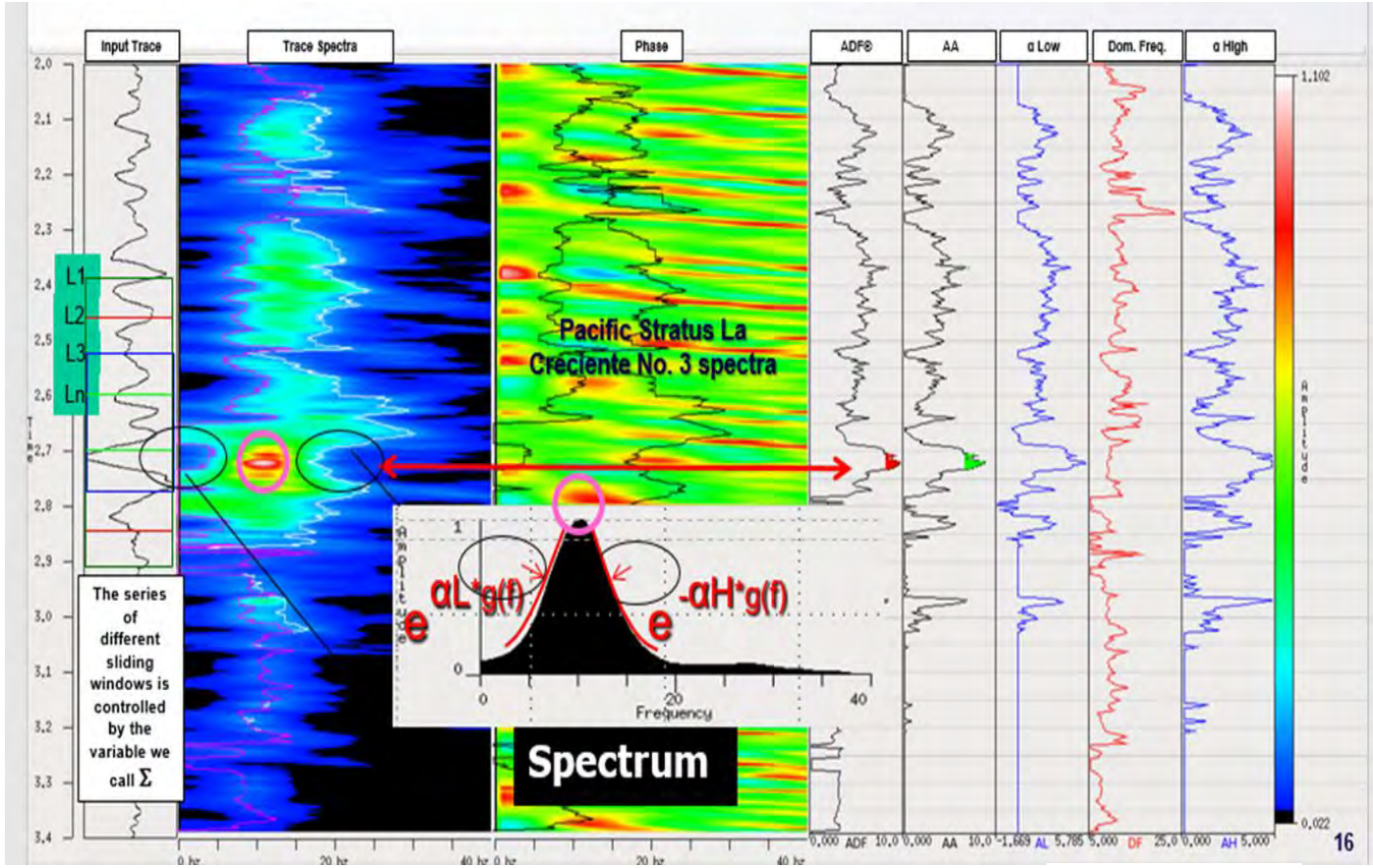

Oil slick SAR Data Clement Blaizot and Jamie Vinnels 2026

Risk: West Africa

Provenance and hinterland geology

Tectonic influence on sediment routing

Trap integrity/timing

Shelf and slope sediment bypass (understand how turbidity currents behave)

Reservoir burial depth

Access to charge

Thank You For Your Attention!

Track Record of Success

Since 1997:

- **Acquired 18 Exploration blocks world-wide**
- **$2.0 B spent by Operators on LPC sourced projects.**
- **Four Major Discoveries**
- **A team of Proven NV Explorers and 'Oil Finders'**

Liberty Petroleum Corporation & Affiliates

PETROQUEST AUSTRALIA

PETROQUEST LIBERIA DEEP WATER LLC

LIBERTY PETROLEUM CORPORATION

Somalia Affiliate

PETROQUEST AFRICA-1

PETROQUEST SEYCHELLES

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