GAMBIA LICENSING ROUND 2021

Gambia Offshore

AFRICA OIL WEEK TECHNICAL PRESENTATION

COMMISSION FOR PETROLEUM 9 November 2021

A1 SETTING





A1 EXPLORATION HISTORY PRIOR TO AWARD TO BP IN 2019

Date	Source of Information	Activity			
2003	GoTG Questionnaire	Government acquired, 500 km2 of 3D seismic in A1 block. Government has use.			
2006	Buried Hill	Buried Hill signs two licences with GoGT for the right to explore, develop and produce A1 and blocks.			
2008	GoTG	Licences extended.			
2010	African Petroleum	Buried Hill enters into a farm-in agreement with African Petroleum whereby Buried Hill retains 40 participating interest and African Petroleum 60%.			
2010	GoTG	Licences extended.			
2011	GoTG Questionnaire	TGS shoot 2,566 km2 of 3D seismic in A1,A4. Government has use.			
2011	GoTG Questionnaire	TGS shoot 612 km of 2D seismic – covers offshore Government has use.			
April 2011	African Petroleum	ERC Equipoise conduct CPR identifying "in excess of 30 significant prospects and leads" in A1 & A4			
2012	Newton Energy	Newton Energy enters into a farm-in agreement with Buried Hill over 13.33% equity (No records this).??????			
Jan. 2014	African Petroleum, Newton Energy	GoTG terminates both the licences for A1 and A4 with Buried Hill, African Petroleum, Newton Ener (African Petroleum the only licensee).			
Nov. 2014	African Petroleum	GoTG reinstates licences for blocks A1 and A4 to African Petroleum.			
March 2015	African Petroleum	ERC Equipoise conduct CPR showing 3,079 MMstb net mean prospective resources unrisked, risked at 445 MMstb; prospect breakdown attached below. CPR issued March 2015 on work since April 2014.			
Sept. 2016	GoTG Questionnaire	Africa Petroleum's licences for blocks A1 and A4 expire.			
2017	GoTG Questionnaire	TGS shoot 1445 km 2D seismic on all offshore blocks. Government owns and has access and use rights to use.			
July 2017	GoTG Questionnaire	GoTG announce that African Petroleum's licences has expired. Africa Petroleum disputes this.			



RECENT HISTORY OF A1 BLOCK

- One of 6 blocks offered in Gambia's first licensing round in 2018, (notable for its transparency and efficiency) and awarded to BP, becoming effective in July 2019
- BP fulfilled its obligations under the License to acquire and reprocess 2D and 3D data and conducted an environmental impact assessment. In early 2020, BP suspended plans to fulfil its commitment to drill an exploration well due to Covid-19.
- On the 4th August 2020 BP issued a statement that it would be pivoting from being an international oil company focused on producing resources, to an integrated energy company focused on delivering solutions for customers.
- On the 14 September 2020 BP sent notice to the Ministry stating that they were no longer able to proceed with the work commitments in relation to the A1 BP licence and that BP will exit the licence as a direct result of this change in corporate strategy. As a condition of its exit, BP agreed to a \$29.3 million settlement for failing to meet its drilling obligations in the block, the settlement was reached amicably



SUMMARY OF WORK COMPLETED BY BP

- 3D seismic data conditioning processing of 2566km2 3D
- Reprocessed 335km 2D regional line from the legacy multi-client TGS data
- Seabed and geohazards baseline review over A1
- A sub regional evaluation
- Updated depositional environment (reservoir) maps using advanced seismic products (spectral decomposition)
- Revised chronostratigraphic framework, new play concept models
- Regional porosity and permeability (reservoir quality) trends established
- New Petroleum systems basin model
- Seismic interpretation of the reprocessed 3D seismic data
- Highgraded prospects Eland and Orib.
- Completed detailed volumetrics and risking
- Prospect Eland selected as drilling candidate. Mean recoverable resources 344mmbbls oil @ 24% CoS



BP SEISMIC PROCESSING AND ANALYSIS

2D Seismic

- A1 Licence commitment: Reprocess 90km of 2D seismic data
- Single line from Senegal through Gambia to tie the DSDP 365 well
- Objective:
 - Deep basin imaging understand basin foundations

Completed 335km of 2D reprocessing (June 2020)

3D Seismic

Licence commitment: Reprocessing 1001km2 of 3D seismic data over A1 licence

- Proprietary survey reprocessed with Ion
- Objective:
 - improve structural imaging of the area
 - · Maximise resolution
 - Seismic products suitable for building a prospect inventory and selecting drill location

Completed 2566km2 of 3D reprocessing over A1 and A4

Geohazards Baseline Study

- Objective: Early identification of major issues to locating and drilling an exploration well
- Completed July 2020



GAMBIA 2D LINE REPROCESSING

Summary:

- BP was awarded A1 license block offshore Gambia in 2019
- Reprocessing the 335km 2D regional line from the legacy multi-client TGS data is part of the license commitment
- Main objective: Improve image resolution in the deep region to enhance understanding of the basin architecture
- Deliverables: Pre-STM stacks, Velocity model, AVO products
- Project timeline: Sep 2019 June 2020, by BP Seismic Delivery

Challenges:

- Strong noise (swell noise, impulsive noise, overlapping shots, multiples)
- Deep targets have weak signal and overlap with strong noise

Achievements:

- Properly zero phased images
- Improved bandwidth for both shallow and deep structures
- Improved signal to noise ratio
- Updated velocity model







SEAFLOOR HAZARDS

- Seafloor hazards are predominantly related to slope instability ٠ associated with the seafloor canyon, gullies, depressions and sediment waves.
- While massive seafloor failures are unlikely during drilling or ٠ development, small debris flows and tabular slides are possible, especially in proximity of the seafloor canyon and gullies. These are not expected to negatively impact operations.
- Seafloor scarps are the surface expression of buried faults and ٠ debris flow headscarps.
- Faults that cut the seafloor are not observed. ٠
- While seafloor amplitude anomalies that would suggest potential ٠ benthic communities are not observed, two small pockmarks overlying shallow gas and hydrate anomalies suggest benthic communities may be present.
- Seafloor soils are expected to comprise fine-grained silts and clays ٠ with coarser silts and sands associated with the seafloor canyon, depressions, gullies and sediment waves.
- Localized accumulations of coarse material in the upper 100m ٠ below seafloor may pose operational constraints to conductor installation. Otherwise soils are expected to be normally consolidated.











GEOHAZARDS BASELINE REVIEW SUMMARY

- Conditions in Block A1 are generally favorable for exploration/appraisal drilling as well as field development, though geohazardous conditions are locally present.
- Shallow hazards observed in the area are **readily identifiable** with the available data and can be mitigated through avoidance and/or standard drilling practices.
- Avoidance may impact well location, as kilometer scale seafloor and subsurface features are present.
- While the current 3D seismic data is adequate for regional and wellsite specific geohazard assessment, if field development is sanctioned, further data will need to be collected to support detailed engineering design.



GAMBIA – GEOSEISMIC CROSS SECTION





*All wells are projected to this line at locations equivalent to the systems they penetrated.

CHRONOSTRATIGRAPHIC CHART

- Jurassic to E. Cretaceous
 - Aggrading Carbonate platform
- Albian
 - Onset of major clastic deposition & development of prograding delta system transitioning offshore into deep water slope turbidites and platform fringing talus-type deposits.
- Several source rock events recognised in the region and also penetrated in DSDP well 367







DEPOSITIONAL ENVIRONMENTS



Major Shelf-edge delta system development

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- Seismic shows deeper water fan development on Eland platform overlain by flooding event acting as a major down lap surface for the toe-sets of Delta lobe 1
- The incised platform edge in A4 shows termination of clastic systems beyond which carbonate deposition continues in Albian times
- Slope setting in A1 characterless in Albian times
- Slope in A4 shows sediment waves development



3D perspective view looking from south east

PLAY CARTOON

- Basin deepening post Aptian times triggering major clastic deposition from the east
- Albian is the primary reservoir on the Shelf
 - Reservoirs range from deltaic sands (Samo-1) to slope and base of slope turbidites (SNE)
- Albian to Turonian aged reservoirs in the slope setting
 - Depositional environments range from Slope apron fans/talus (Fan South-1) turbidite fans running down the canyons to channelized facies and sediment waves (Fan-1)





COLUMN THE DAY

Albian Gross Depositional Environment

GAMBIA A1-A4 SLOPE LEAD SEISMIC FACIES

Intra Coniacian RMS Attributes





Seismic attributes showing location of main sediment feeder systems and potential leads



GAMBIA LICENCES OVERVIEW

Licence	Prospects/ Leads	Mean Recoverable Resources (mmboe)	Risked recoverable resources (mmboe)	CoS	Key Risks
A1	Eland (A1 only)	383 (325)	91	24%	CA, SC, RD
	Oribi (Albian)	392	39	10%	SC, CA, RP, RD

- SC Seal Capacity
- CA Charge Access
- RD Reservoir Developability
- RP Reservoir Presence





ELAND PROSPECT DESCRIPTION

Trap Edges

- North and South Upper cretaceous muds overlying unconformity
- East Dip
- West Pinch-out

Seal

- Intraformational flooding events – clearly seen on the seismic
- Lateral seal seismically transparent package in the north, but SE corner shows risk of juxtaposition with the marls

Reservoir

- Soft seismic event seen on the seismic
- Delta fed turbidite sand fan directly overlying the carbonate platform

Charge

- Model uncertain. Provided from the basin (mature Albian) via:
 - incised canyon?
 - onlapping permeable intervals?
 - Through carbonate platform?
- Alternate model as through fill and spill from SNE







ELAND SEISMIC AVO PRELIMINARY OBSERVATIONS

Observation

- There is a gradual brightening up dip above 3300m (brightest above -3200m_
- Upper most seismic trough event interpreted as pinch out up dip and showing thickening down dip
- Presence of extra seismic trough event up dip (on which the main event is onlapping) apparent thickening up dip.
- Model does not support gas charge from basin (primary support)
- Neary by field have gas cap (possibly from additional gas kitchen to NE)



Possible causes

- **Gas cap possible** but not supported by possible amplitude conformance at -3200m
- Cap rock SRP & velocity anomaly caused by that overburden high velocity contract
- Primary event pinching out may cause tuning & brightening above -3200m
- Lithology variation.





PLATFORM PLAY ANALOGUE – SANGOMAR



- Direct analogue for Eland is SNE
- A wide range of alternative depositional models have also been considered
- Lower Albian sands on carbonate platform
- Reservoir sands are acoustically soft- Class III seismic AVO (and amplitude conformance) possible
- Thick well developed lower sands 100m gross pay, 36m net with 32 API Oil



ELAND RESOURCES & RISK

Top reservoir Depth Map



		Reference Case					
Unrisked Re	esources	Mode	P90	Mean	P10		
	Oil MMbbls	962	209	936	1576		
In-place Resources	Gas Bcf	480	130	624	1139		
nesources	Total MMBOE	1061	233	1047	1775		
Recoverable	Oil MMbbls	356	76	344	600		
Resources	Total MMBOE	397	83	383	667		

- No Charge limitation
- Bottoms-up column heights 450-1000m

Key risks are:

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- Charge access
- Reservoir deliverability
- Seal presence and quality





ORIBI MODEL – SOUTHERN STRATIGRAPHIC CLUSTER

Stacked Albian to Coniacian reservoirs deposited in slope environment sourced from the eastern shelf. Possible salt cored (deep) antiform with multiple growth episodes during deposition

Trap Edges

- N&S Pinchout
- East Onlap along the carbonate platform
- West Dip / pinchout

Seal

- Intraformational flooding events
- Lateral seal along the carbonate platform – key risk
- Lateral seal facies pinchouts defined based on amplitudes

Reservoir

- Deep water turbidite sands
- Hard and soft events identified based on amplitudes & spectral decomposition

Charge

 Through the basin from mature Albian SR







ORIBI: STRATIGRAPHIC TRAP SOUTH COMBINED ALBIAN & LWR CENOMANIAN



Scenario	Albian		Combined Segments GoeX						
Reservoir Intervals	1 combined Albian B		Combined Lwr Ceno & Albian		& Albian	Key risks - Vary according to the interval			
Unrisked Resources		P90	Mean	P10	P90	Mean	P10	Reservoir presence	
In-place Resources	Oil MMbbls	710	1180	1690	300	1050	1720	Reservoir quality	
•	Gas Bcf	420	820	1270	190	730	1320	10% Prospe	ct
Basayarahla Basayiraas	Oil MMbbls	204	350	538	90	315	526	Seal capacity Chance of	51
Recoverable Resources	Total MMBOE	225	392	580	100	352	594	Charge access Success	

10% Prospect
Chance of
Success



SUMMARY OF THE A1 OPPORTUNITY

- On trend from the xxx MBOE Sangomar Field , first production in 2023, 'elephant country'
- Comprehensive seismic coverage
- 'State of the art' seismic processing and prospect definition by BP
- Eland Prospect represents a practically 'drill ready ' prospect , analogous to Sangomar, with a mean recoverable resource estimate of 344 MBO
- Further multi horizon potential in the Oribi Prospect



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