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MIDDLE CRETACEOUS RESERVOIR CHARACTERIZATION AND DEPOSITIONAL ENVIRONMENT OF CENTRAL ROVUMA BASIN, OFFSHORE MOZAMBIQUE USING SEISMIC ATTRIBUTES AND WELL LOG ANALYSIS

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Abstract

Rovuma Basin has huge commercial hydrocarbon discoveries in Tertiary progradational low-stand track (LST) sequence of Rovuma Delta. Oil shows were also identified at Cretaceous, Albian, LST progradational sequences, at both onshore and offshore close to study area. Cachalote-1 well at study area, discovered gas in thicker, stacked sand section with good quality reservoir in structural closure of Albian age. Buzio-1 well at same stratigraphic level, almost 27 Km away, drilled in a stratigraphic trap was dry. Both wells were drilled at high amplitudes seismic reflectors. The depositional environment of the study area was not understood and there are uncertainties about reservoir properties. The purposes of this study are to identify the sand reservoir, its spatial distribution and properties using seismic attributes and well log analysis and predict the depositional environment. To achieve the goal, 3D seismic full stack data and well data, including logs and petrographic report data were used for analysis and interpretation. Rock physics and well log analysis revealed that gas sand have low acoustic impedance than shale and brine sand. Seismic interpretation demonstrated the structural control of reservoir at southern part and stratigraphic control at northern. Seismic attributes such as similarity and RMS successfully mapped faults, channels and sand deposits. Attributes helped to better understand the deposi-tional environment. Integration of seismic interpretation with seismic attribute and well log analysis, calibrated with petrographic analyses demonstrated that the study area is dominated by progradational, LST sequence of deep water depositional environment and minor TST aggradational sequence. The sand reservoirs are mainly deposited as channel-levee systems at slope and basin floor fan as well as mouth bar distributaries at shelf edge to upper slope. These sands have good reservoirs properties, even with some thin cement stringers that may affect the flow.

Keywords: Albian sands, Rock physics, seismic attributes, horizon slices, depositional models.

1. Introduction

Rovuma Basin, NE of Mozambique, Southern Africa is one of the recent hot spot of oil and gas exploration activities, with huge gas discoveries of more than 200 tcf, mainly from Tertiary progradational deltaic sandstones of Rovuma Delta (Figure 1).

The Petroleum system of the area has been proved in stratigraphic and structural traps, with good siliciclastic (sandstone) reservoirs in several stratigraphic sections, from Cretaceous to Miocene. Hydrocarbons evidences include gas fields, oil and gas shows, oil and gas seeps in both Onshore and Offshore of Rovuma Basin, close to the study area.

The Study area is located in the Southern part of the large gas fields recently discovered in Rovuma Basin, Mozambique (Figure 1). Two exploration wells were drilled recently in the area, one of which tested gas in sandstones with good reservoir properties of Late Albian, Middle Cretaceous, with up to 40 m net pay, in two separated sand sections intercalated with shale and minor carbonates. Another well in Northern part of the study area found thicker stacked sands, also intercalated with shale and minor cemented sands and carbonates of Late Albian, Middle Cretaceous, but dry.

In both tested wells, the sandstones were found in zones with high amplitudes responses of seismic data, on and/or close to reflectors patterns related to channel feature.

The main goal of the research project is to identify the sand reservoirs, its spatial distribution and depositional evolution, as well as to characterize the identified reservoirs using seismic attributes and well log data in order to reduce the future exploration risk activities.

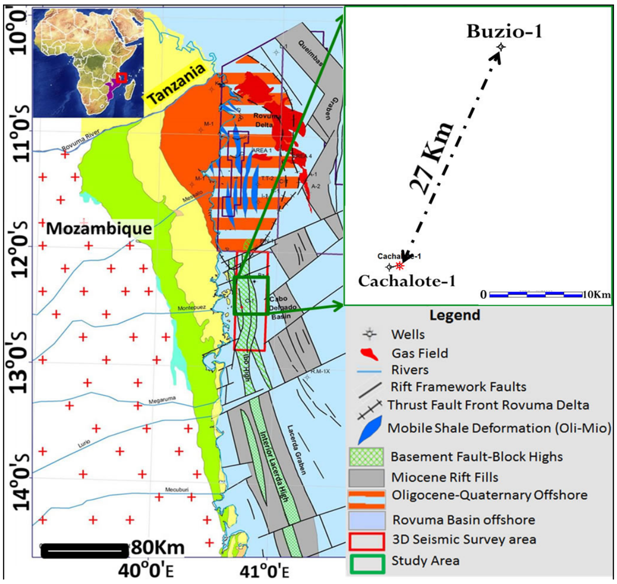

Figure 1. Location Map and database include structural setting of Rovuma Basin, 3D seismic outline area and highlighted the study area

1.1 Regional Geology and Tectonic Setting

The study area is located in Rovuma Basin, which forms the southern end of the East African passive margin basin system, which includes the coastal plains of Somalia, Kenya and Tanzania (Figure 1).

Rovuma Basin was formed as response to breakup of SE Gondwana, mainly from Jurassic.

The study interval was deposited during the Late Drift phase, when the platform received a thick sequence of open marine shales and argillaceous limestones. Throughout this sequence periods of relative sea level fall created incised channels and submarine fans (ENH & ECL, 2000), some of which found gas sand in Cachalote-1 and dry sand reservoir in Buzio-1 well of Middle Cretaceous, Albian Age.

In response to early uplift and doming that preceded rifting of the Miocene East African Rift System, Rovuma Delta began to form during Oligocene (ENH&ECL, 2000), characterized by submarine channels, submarine fans and normal faults in the study area (Figure 1).

The key geological features in the study area are Ibo High and Davies Ridge (Figure 1).

2. Methodology

2.1 Rock Physics and Well Log Analysis

Rock physics and well log analysis was done to determine the relationship between rock properties such as rock types, porosity and fluids in the reservoirs interval of interest. Cross-plots of acoustic impedance with respect to VCLGR and depth were analyzed using well log data from the available two wells. The results were used to predict the probable seismic response related reservoir properties of the study area.

2.2 Synthetic and Well to Seismic Tie

Synthetic seismograms were generated for the two wells (Cachalote-1 and Buzio-1), focused to the target Cretaceous section, to tie the logs in depth domain to seismic data in time and to investigate the lithology seismic character. Well to seismic ties were done by correlation of synthetic with seismic trace and logs by stretch and squeeze of the synthetic according to seismic trace pattern to improve the correlation coefficient and adjusting the T-D chart.

2.3 Seismic Interpretation

2.3.1 Fault and Horizon Mapping

I interpreted the faults within the zone of interest. The fault picking was aided by similarity volume attribute and time slice maps, which enhance discontinuities between adjacent reflectors. I also picked three horizons, Water bottom, Top Cretaceous unconformity and Early Aptian to understand the structural and stratigraphic evolution of study area (Figure 2). The Top Cretaceous Unconformity horizon was assumed as the key horizon, as it occurs above and near the reservoir section, from which I generated five (5) horizon slices (Table 1) that cross the top of sand sections.

2.3.2 Seismic Attribute Analysis

From the interpreted horizon and horizon slices generated, I extracted seismic attribute, such as similarity and RMS for better un derstanding lithology distribution and depositional environment. The similarity was extracted at 80 ms window, and RMS at +/-12 ms centered to the horizon (Table 1 and Figure 2)

Slice Hz	Top Sand crossed
TCU+60	Southern Area top gas sand 1
TCU+165	Southern Area top gas sand 2
TCU+186	Northern Area top dry sand 1
TCU+280	Northern Area top dry sand 2
TCU+370	Northern Area top dry sand 3

Table 1. Horizon slices created from Top Cretaceous Unconformity (TCU)

2.4 Depositional Environment Analysis

The Deposition environment interpretation was based on structural and stratigraphic evolution, enhanced by geomorphological features identified on seismic horizon attributes integrated with logs pattern and trend and petrographic analysis from the two wells.

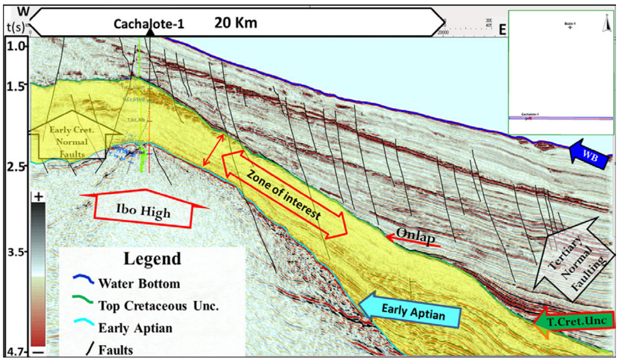

Figure 2. Representative seismic cross sections, showing the picked horizons and faults

3. Results and Discussion

3.1 Rock Physics and Well Log Analysis

In Cachalote-1 well the interval analyzed is from 1335m to 1500mn (Figure 3), and for Buzio-1 well the analyzed interval is from 2730m to 3330m (TD) (Figure 4).

Sands show higher acoustic impedance (AI) than shale on AI vs VCL cross-plot color coded by depth. AI also is depth dependent. Lithologies at greater depth have high AI (Figure
Lithologies at greater depth have high AI (Figure
3 and 4).

In Cachalote-1 well, gas sands show low AI than wet sands and shale. Wet sand have relatively high AI than shale (Figures 3A and B). The deeper sand section in Buzio-1 well shows high AI than shale (Figures 4A and B). At both wells there are spikes of high acoustic impedance, also with high resistivity (RD), density (RHOB) and low porosities (NPHI), generally in sand sections (Figure 4B and 5B). These zones may represent cemented sands and also show high AI on cross-plots (Figure 3A and 4A). The Gas sands in Cachalote-1 well also show low VP/VS ratio (Figure 3B).

The analyses suggest that sands can be distinguished from shale based on AI, as well as gas sand can be differentiated from wet sand. However, VP/VS contrast is significant for gas sand, wet sand and shale (Figure 3B). Therefore this may be useful for direct hydrocarbon detection.

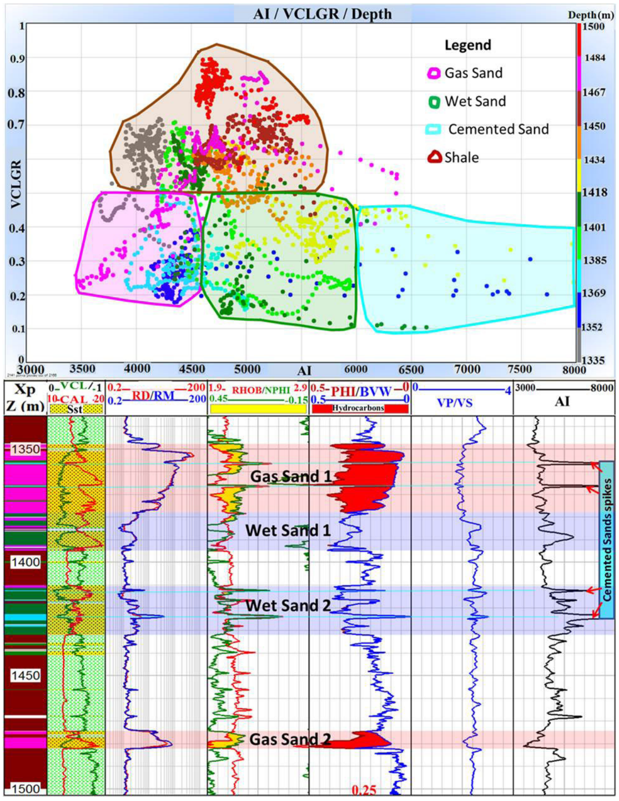

Figure 3. (A) Cross-plot of AI/VCL/depth of Cachalote-1 well. (B) Well log analysis

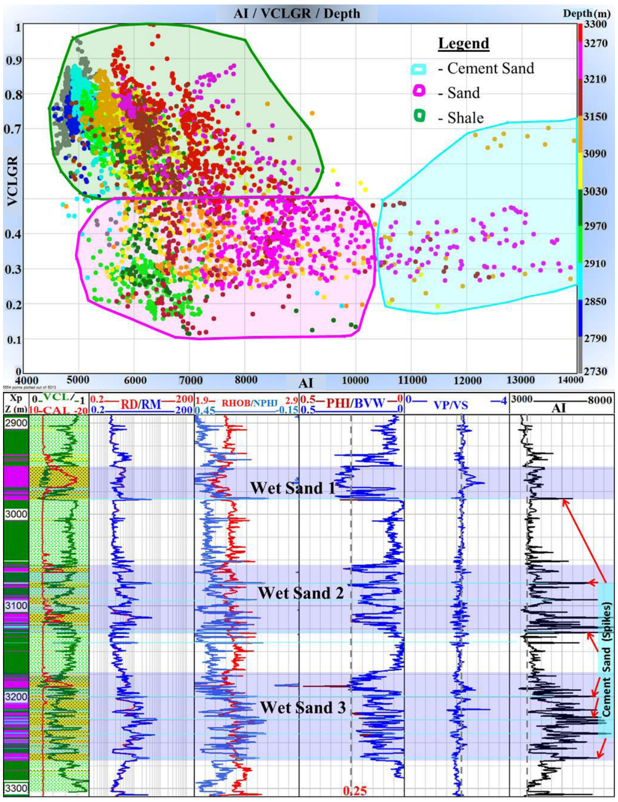

Figure 4. **(A)** Cross-plot of AI/VCL/depth of Buzio-1 well. (B) Well log analysis at zone of interest.

3.2 Well to Seismic Tie

In order to match the time domain seismic data with depth domain well data, were generated synthetic seismograms, using well log data of Cachalote-1 in the Southern part of the study area and Buzio-1 Well in the north of the area. There is reasonable match of synthetic with seismic data, especially within the reservoir section.

In Cachalote-1 well, gas sand has negative amplitude, represented as trough on the seismic section. The deeper high-amplitude reflector (Early Aptian) have very high AI compared to overlying reflectors and is represented by peak. It corresponds to hard carbonate section, reported in the well. This high AI zone also shows high density, high resistivity and low porosity in well logs.

In Buzio-1 well due to high AI of sands as compared to shale, the top of sand sections are positive amplitude (peak), while the top of shale is at trough (negative).

3.3 Seismic Interpretation

The horizons Lower Aptian, Top Cretaceous unconformity and Water bottom were mapped based on their distinctive seismic reflectors and wireline log character.

3.3.1 Early Aptian

The Early Aptian (light blue - cyan horizon) was picked at a bright and strong, continuous high amplitude peak reflector (Figure 5A and B), marked by relative decrease in GR log and high values of density, resistivity and acoustic impedance in Cachalote-1 well. This horizon is near the top of anticlinal Ibo High structure and corresponds to the base of parallel to sub-parallel continuous weak amplitude reflectors with channelized high amplitude reflectors of Aptian to Albian interval of interest (Figure 5A and B).

The structural depth map (Figure 6A) shows high in the west, dipping to the east, with a steep slope at the boundary of Ibo High Structure. It has N-S oriented structural closure in the SW part of the area. The SW area is the most faulted, with NW-SE directed faults, most of them dipping to SW in the west of Ibo High and to NE in the east of Ibo High. There is a channel feature in the Northern part, which could have eroded the Ibo High structure, revealed by contours concavity at west of structural depth map and seismic section (Figure 5B and 6A).

3.3.2 Top Cretaceous Unconformity

The Top Cretaceous Unconformity horizon (green) was picked on a relatively continuous reflector, marked by an abrupt increase in GR log. It represents the base of Tertiary channel fill and slope deposits, characterized by relatively high amplitudes and onlap reflectors against the lower Top Cretaceous Unconformity horizon (Figure 5A and B). This horizon lies above relatively weak amplitude reflectors, in toplap seismic reflector pattern and sometimes eroding the lower reflectors as erosional truncation surface (Chopra and Marfurt, 2007), referred as Pemba Formation, dominated by shale at its top (Figure 5A and B). This horizon corresponds to an erosional surface formed in association with the late major regression during the late drift phase from Middle to Late Cretaceous (Mahanjane, 2014). This horizon also is higher at west part and lower at east. It is affected by Ibo High, which creates structural closure and N-S tilted faulted blocks that works as structural traps for hydrocarbons encountered in Cachalote-1 (Figure 5A and 6B).

3.3.3 Water Bottom

The water bottom was picked at strong, continuous peak reflector very affected by canyons especially in the northern part of the study area (Figure 5B). It dips to eastern part and was influenced by Ibo High structure, which created high slope, and gave high energy to channel water flow, creating the big channel features observed on the seismic section (Figure 5B).

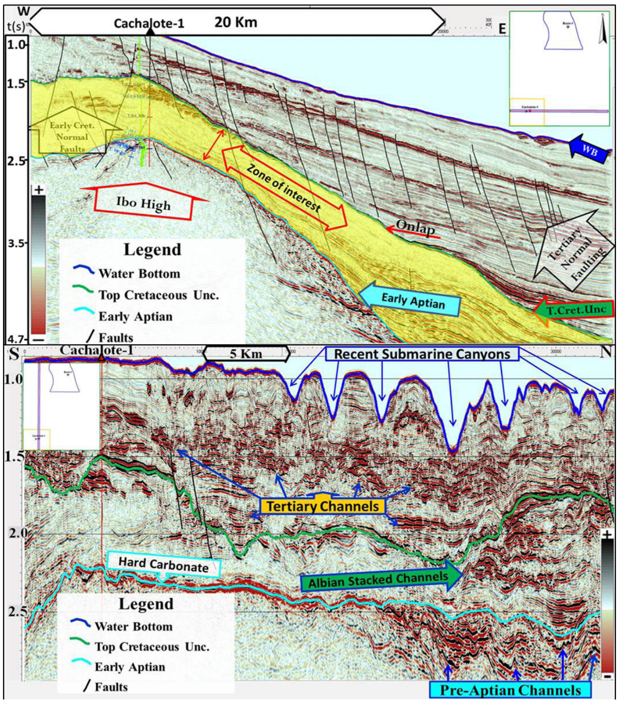

Figure 5. (A) Seismic section south-north (A-A') and (B) seismic section west-east (B-B') showing the 3 horizons interpreted regionally

3.4 Seismic attribute analysis

3.4.1 Horizon Slice 5 (TCU+370)

This is the deepest horizon slice imaged for sand distribution analyses. The similarity map (Figure 7A) shows NNW-SSE oriented

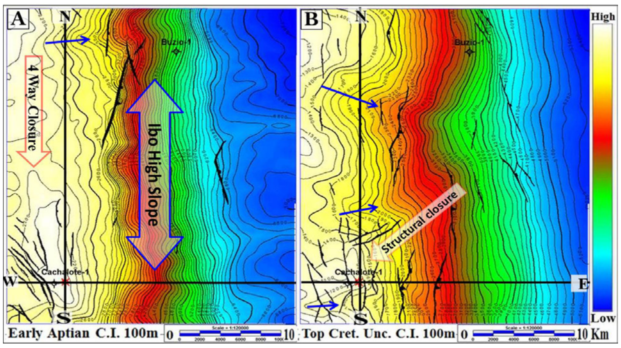

Figure 6. Structural Depth maps of Early Aptian (A) and Cretaceous Unconformity (B).

faults (low similarity) and diffuse sinuous channel features in the NW part of study area. The direction of the channel features in the NW part of study area is W-E. The channel run till the fault near Buzio-1 well and beyond the fault spray out in deep water basin floor.

The RMS attribute map (Figure 7B) also show sinuous channel feature with high amplitudes, at northern part of study area, flowing from west to east until near Buzio-1 well. These features may represent mixed sand-mud of slope deposits. From this zone to east, almost at same location of dark color-coded low similarity, the high amplitudes become scattered and could represent a mixed sand-mud or shale dominated basin floor fan.

The cross sections (Figure 8A and B) show high amplitude clinoform reflectors (sand dominated) down-lapping laterally to weak amplitude zones (shale dominated) in a "gull-wing" geometry of channel features. These seismic expressions are related to channel levee system, with sand-mud mix deposit. This lithological characteristic was encountered in Buzio-1 well as proved by serrated GR log trend of Wet sand 3 section (Figure 4B and 8B), which shows sand/shale intercalation. The basin floor fan more to east is expressed as mounded seismic feature

(Figure 8A and B), characterized internally by clinoform to parallel reflectors set.

Petrographic analysis of Buzio-1 well, near base of channel features of seismic reflectors indicate gravels to very coarse grains poorly sorted at bottom (Table 2).

The N-S high similarity and high RMS amplitude feature at the central area is related to the uplifted Ibo high that tested hard limestone in Cachalote-1 well, crossed with the phantom horizon. Most part of the central-east and southern areas show weak amplitudes (Figure 7B). These zones are related to muddy slope.

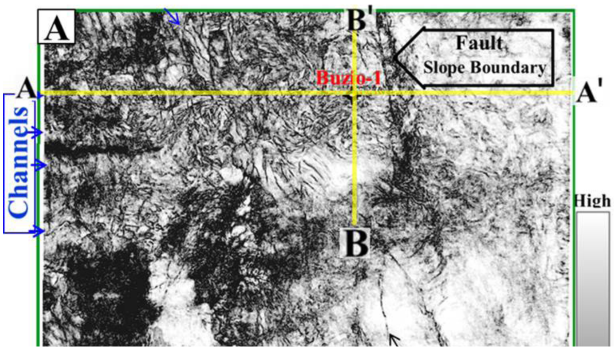

Figure 7. Similarity (A) and RMS (B) maps of horizon slice 5 (TCU+370).

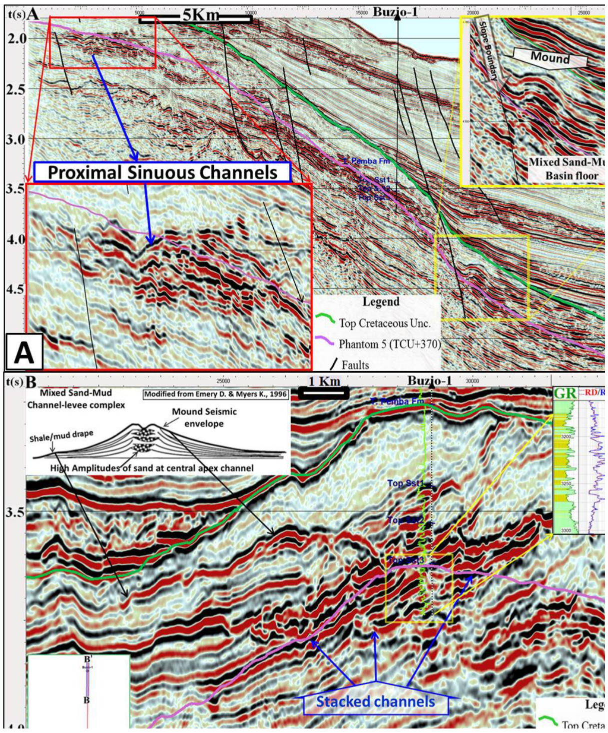

Figure 8. (A) W-E Seismic section showing high amplitude reflectors (clinoform) related to sands, and (B) show high amplitude stacked slope channel with serrated GR log trend at Buzio-1 well related to mixed sand-mud

3.4.2 Horizon Slice 4 (TCU+280)

This horizon is shows most of features like the deeper (TCU+370) horizon. It will not be discussed in detail here.

3.4.3 Horizon slice 3 (TCU+186)

The similarity map (Figure 9A) shows almost the same trend of faults, N-S to NNW-SSE. The channel features are more straight and wider, with NW – SE trend. The channel features at central and southern part become more evident, flowing from west to east. The channels deviate from and/or erode the Ibo High anticline and continue in the slope until the basin floor. The NW-SE fault that represents slope to basin floor boundary shifts to westward, at central to southern part of the study area (Figure 9A).

The RMS attribute map (Figure 9B) also shows straight and confined high amplitudes zones, NW-SE oriented at north part and SW-NE trend at central and southern part. These high amplitude zones may be related to sand dominated channel and levee sediments, deposited at slope. At east of slope boundary fault the high amplitudes become unconfined and scattered. It could be related to mixed sand-mud basin floor fan deposits.

The seismic expressions of these channels are stacked with lateral accretion and migration (Figure 10A). These stacked channels have width up to 3 Km and thickness more than 250 ms (more than 300 m gross encountered in Buzio-1 well, not reached the channel base). The TCU+186 horizon represent the shallowest channel, with high amplitude clinoform reflectors (sand dominated), that pinch-out laterally to weak amplitude parallel reflectors zone, which may represent shale (Figure 10A).

The log panel of Buzio-1 well (Figure 10B), drilled at apex of channel seismic feature shows low GR and blocky trend, high NPHI and low RHOB, that could represent clean and porous sand.

3.4.4 Horizon slice 2 (TCU+165)

This horizon is closest to the deeper one (TCU+186), and shows several similar seismic features, so it also will not be discussed in detail here.

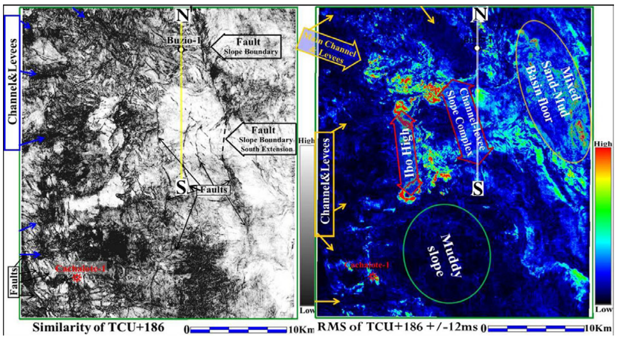

Figure 9. Similarity (A) and RMS (B) maps of Phantom horizon 3 (TCU+186).

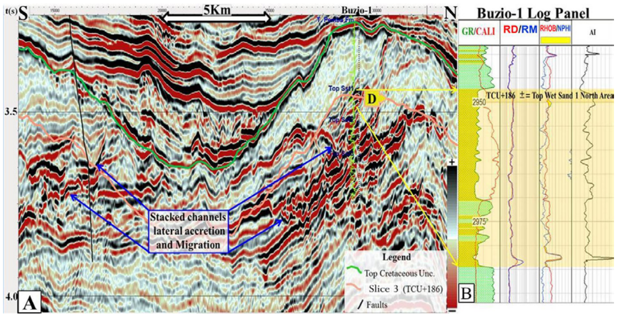

Figure 10. (A) Seismic section A-A’ showing horizon slice 3 (TCU+186) crossing channel features at Central and Northern part. (B) Buzio-1 well log panel, shows blocky low GR trend, that represent clean sand section with high porosity (high NPHI and low RHOB).

3.4.5 Horizon slice 1 (TCU+60)

This is the shallowest horizon slice imaged for sand distribution analyses. The similarity map shows almost the same N-S trend of faults like the deeper horizons. The channels have low-sinuosity to straight trend and intersect at central part from NW and SW part, then run to east on deep incised valley feature to create a deep water basin floor fan (Figure 11A). The basin floor fan can be observed clearly on RMS map with high amplitude (Figure 11B).

The RMS attribute map also shows very high amplitude response at south part, near Cachalote-1 well. This high amplitude response may be related to porous gas bearing sand, intersected by Cachalote-1

well at this stratigraphic level. Porous gas sand reduce the density of sand section, and hence the acoustic impedance, which create high acoustic impedance contrast observed on seismic section, and extracted by RMS attribute map (Figure 11B and 11C).

On seismic section (Figure 11D) the basin floor fan is expressed as mound feature, with top-lap, clinoform and down-lap reflectors. This feature may represent sand-prone, unconfined basin floor turbidities. The mound shape may represent differential compaction related to different mechanical properties of sand (strength) below plastic shale, which drape laterally over sand.

On seismic section (Figure 11C) the horizon slice cross high amplitude tilted clinoform reflectors on structural high, down-dipping to east. These high amplitude reflectors are related to good quality gas sand reservoir as demonstrated by low GR, high resistivity and NPHI/RHOB logs cross-over, with almost 30m of net pay and 46m of gross pay intersected at Cachalote-1 well (Figure 3B).

This seismic expression could be related to channels sand deposits of distributary mouth bar at shelf edge delta to upper slope.

Thin section analysis of samples shows thin sand, angular and poorly sorted, mud supported with carbonate cement (Table 3).

3.5 Depositional Environment Analysis

The Depositional system of the study area, at Albian section comprise sands sediments deposited mainly at Low stand track (LST) system with turbidites at basin floor, channel-level at slope and distributary mouth bar sands at shelf edge to upper slope in late stage of LST to early stage of Transgressive system tract (Figure 12 and 13). This interpretation was based on observation of seismic features and log trend analysis of Cachalote-1 and Buzio-1 well and calibrated with petrographic analysis of both well samples.

The sequential analysis of seismic features in RMS attributes maps reveal a shift of channel character and trend, from bottom to top horizons. The RMS high amplitudes of basin gradually shifted southward from bottom to top. The channels features of slope, at north part change from dominant sinuous with W-E trend at deeper horizons (Figure 12), to straight, NW-SE high amplitudes in the shallow horizon

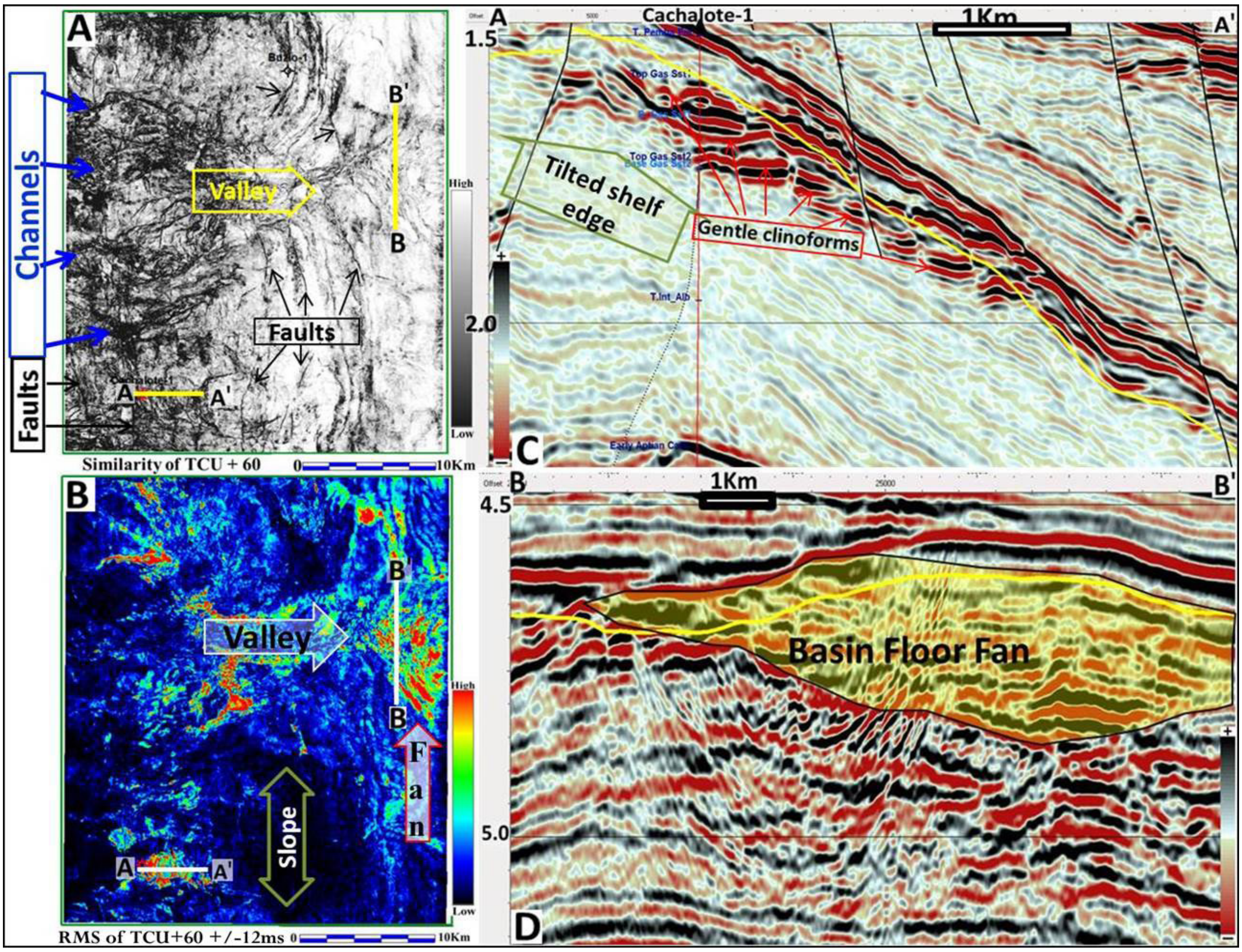

Figure 11. (A) Similarity and (B) RMS maps of horizon slice 1. (C) Seismic cross section shows the horizon crossing high amplitude tilted clinoforms reflectors, and in (D) cross high amplitude reflectors with mounded shape related to basin floor fan.

slices (Figure 13). At shallower horizons also we can observe the development of channel features in the central and southern areas, with channel-levee deposits and/or channels deposits of distributary mouth bar from shelf edge to upper slope as observed at Cachalote-1 well (Figure 13).

The Sequential analysis of similarity maps confirm these paleo-morphologic changes evidences and also shows westward shift of the slope to basin floor boundary fault orientation, mainly in the Southern part, from NW-SE to N-S.

Thin section petrographic analysis shows an overall fining upward grain trend from bottom to top (Table 2 and 3).

Sidewall cores analysis of Buzio-1 well indicate gravels to very coarse grains poorly sorted at bottom of sand-mud mixed section. The upper sand section of Buzio-1 well, have coarse to medium sand grain size, well to moderately sorted. Most of the grains are arkosic, sub-arkosic at base and arkosic at the overall upper section (Table 2).

These results of petrographic analysis of Buzio-1 well, integrated with well log and seismic attribute analysis and interpretation suggest a slope channel-levee progradational sequence in low-stand system track (LST) at slope to basin floor deep water environment.

Petrographic analysis of Cachalote-1 well show fine sand grains, well sorted with carbonate cement at base of its deeper gas sand section, with finning upward (bell shape) GR log trend (Figure 13). The top of gas sand 2 (deeper sand section) in Cachalote-1 well, corresponds to horizon slice 2 (TCU+165), its seismic character, with channelized clinoform seismic reflectors suggests continuation of LST, at this shallower stratigraphic level of southern part of study area in shallow marine depositional environment.

The upper gas sand (gas sand 1) section have moderately well sorted, fine grained sand at base to poorly sorted, fine grain sand, matrix supported at its top. The overall finning upward petrographic characteristics of this thick gas sand section is evidenced by bell shape GR log trend (Figure 13).

The top of this thicker gas sand, corresponds to the shallowest slice horizon analyzed (TCU+60). Integration of results from seismic reflectors character, seismic attribute analysis with well log and petrographic analysis suggest transition from progradational sequence of low stand track to aggradational sequence of transgressive system track in shallow marine depositional environment (Emery and Meyer, 1996).

Age	ID	Sample Depth	GrainSize Class	GrainSize mm	Sorting Class	Classification Classification	Framework grains	Cement Total	Matrix Clays	Matrix Others	Porosity Macro	Porosity Micro	Porosity Total
Albian	1	2950.5	Coarse	0.5	Moderate	Arkose	69.6	7.8	5.6	0.0	11.0	5.9	17
	2	2983.5	Medium	0.2	Good	Arkose	56.6	4.5	6.2	2.7	24.7	5.2	30
	3	3114.0	Medium	0.5	Moderate	Arkose	59.6	6.7	6.0	1.7	18.7	7.2	26
	4	3121.0	Coarse	0.8	Moderate	Arkose	65.7	9.8	8.2	0.0	9.7	6.5	16
	5	3223.0	V.Coarse	1.0	Moderate	Arkose	61.2	11.0	5.2	0.2	13.3	8.8	22
	6	3268.0	Gravel	3.0	Poor	Subarkose	76	7.0	4.8	0.0	7.0	5.2	12
Avg				1.0			64.8	7.8	6.0	0.8	14.1	6.5	20.6

Table 2. Results of Petrographic analysis of side wall core samples from Buzio-1

Cachalote-1									
Age	ID	Depth	Zone	Grain Size	Sorting	Angularity	Cement	Porosity	Avg Porosity
Late Albian	1	1357.9	Gas sand 1	Fine	poor	Angular	Calcite	27	33
	2	1394.5	Wet Sand 1	medium	Moderate	sub-angular	Calcite	35	33
	3	1485.9	Gas sand 2	medium	Good	sub-angular	Calcite	24	31

Table 3. Results of Petrographic analysis of cuttings samples from Cachalote-1

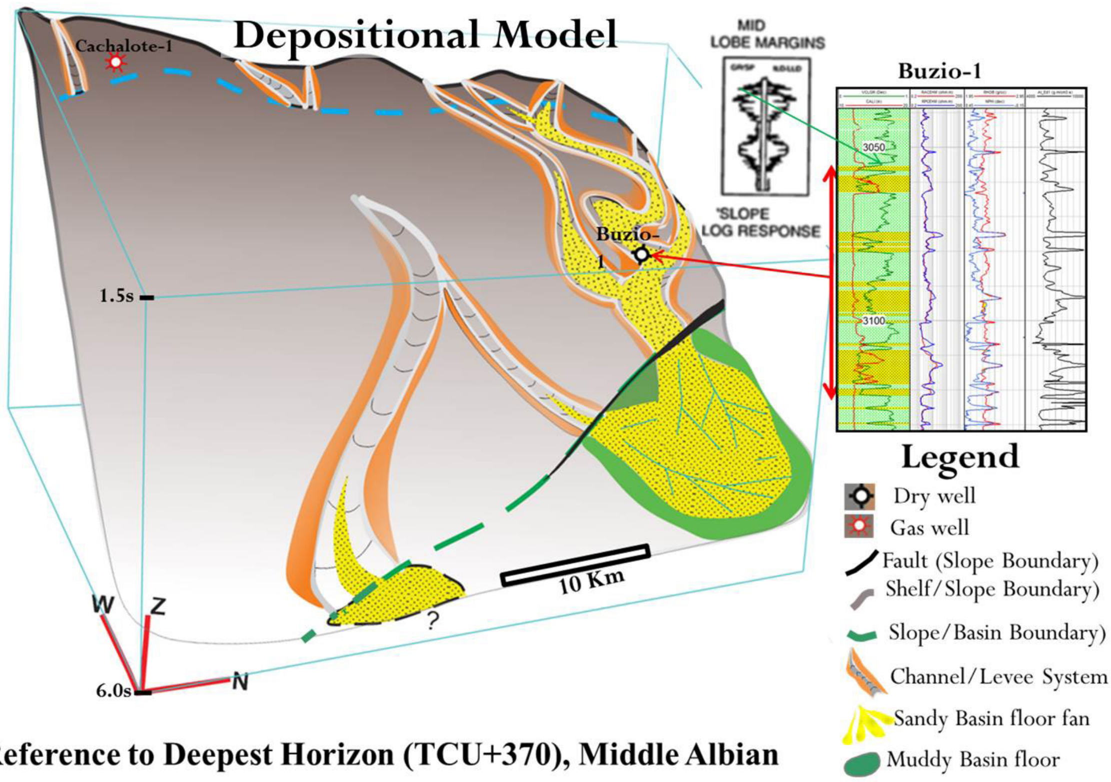

Figure 12. Schematic Depositional Environment Model with reference to deepest horizon slice 5 (TCU+370) of Middle Albian, Cretaceous, Central Rovuma Basin, Offshore Mozambique.

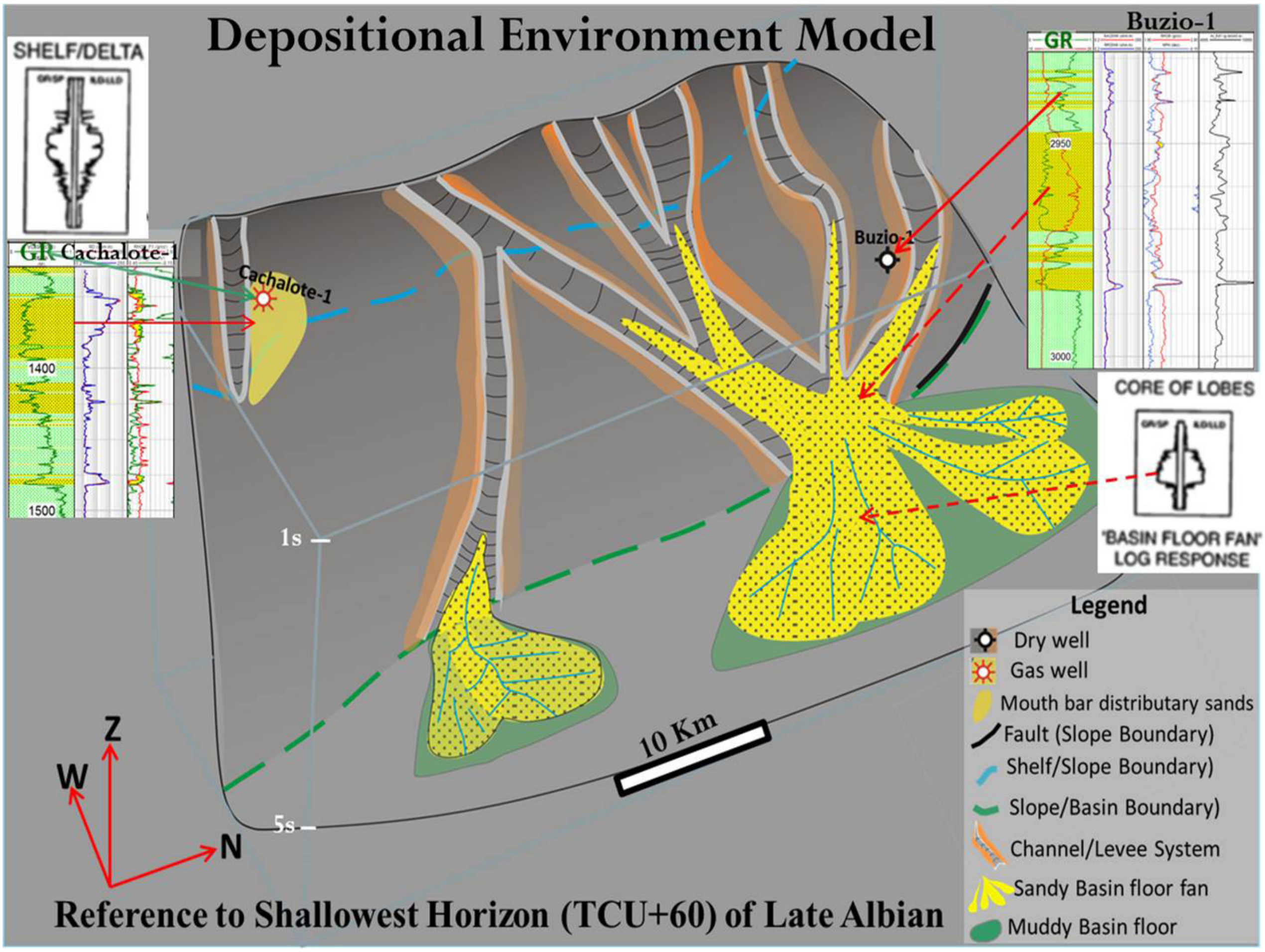

Figure 13. Schematic Depositional Environment Model with reference to shallowest horizon slice 1 (TCU+60) of Late Albian, Cretaceous Central Rovuma Basin, Offshore Mozambique

4. Conclusions

Integrating results of rock physics and well log analysis with seismic interpretation and seismic attribute analysis, calibrated with results of petrographic analysis at reservoir sections of interest, regional tectonic setting and tratigraphy, was identified the potential reservoirs areas, their spatial distribution and quality as well as the related depositional environment.

Rock physics analysis revealed that gas sands have low acoustic impedance than wet sands and shales. Hence, gas sand can be distinguished from overlying shale as well as from underlying wet sands. The very high amplitudes observed at seismic section mostly are caused by cemented sand thin layers (stringers) represented as spikes on density (RHOB) and acoustic impedance (AI) logs, as demonstrated by petrographic analysis results.

The well log analysis shows good reservoir quality, with porous sands. The NPHI log indicates average porosity of 30%, at cachalote-1 well, while at Buzio-1 well the average porosity is 24%. Moreover the petrographic analysis shows moderately to well sorted sands at channel-levee system. Hence the identified basin floor fan sand may have better quality, as it have been transported, reworked and well sorted.

Seismic interpretation revealed that the study area consists predominantly of normal faults. The dominant N-S to NW-SE trend and the western part is high, while the eastern is low. The southern part have more structural control of reservoirs, influenced by Ibo High, which created structural closure, around Cachalote-1 gas well, and also is more affected by normal faults with NW-SE trend. The northern part has more stratigraphic control of reservoirs, and is more affected by channels running from west to east.

The seismic attribute analysis show direct relationship between high amplitudes and sand reservoirs, as well as weak amplitude related to shale section, at well location. These high amplitude zones are located on geomorphological features also identified by similarity seismic attribute, preferentially on channel-levee systems and basin floor fan.

The similarity analysis was useful for identification of structural and paleo-geomorphological features, like faults, channels, fan shape that are related with sand deposition. RMS attribute analysis was useful to delineate sand body geometries, because of good acoustic contrast between sand and shale as proved by rock physics cross-plot analysis, which indicate wet sands as bright positive amplitude or negative amplitudes in the case of gas sands, whereas shales have weak negative background seismic reflectors.

The Cretaceous, Albian reservoirs were deposited in progradational low stand track (LST) system, in marine environment, mainly at deep water slope, channel-levee systems and basin floor fan. It also include aggradational transgressive mouth bar deposits, at shelf edge to upper slope.

Considering the direct relationship of high amplitudes with good quality sand reservoirs the future exploration activities may be focused to paleo-geomorphologic features that can be identified by seismic attribute analysis integrated with depositional environment studies to predict the spatial distribution and quality of these reservoirs.

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