A Quantitative Seismic AVO Response Atlas for Aganoba Deepwater Portfolio Exploration Offshore Nigeria

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ABSTRACT

Aganoba field, located in deepwater offshore on the continental slope off the coast of Nigeria is in water depths ranging from 950 meters to 1,500 meters. The field is known to have oil and gas accumulations stratigraphically / structurally trapped within mud rich unconfined turbidite channel systems of Miocene age. Regional studies around Aganoba highlighted potentials for some Near Field Exploration (NFE) Opportunities that required screening for Probability of Success (PoS) using a combination of screening criteria. Seismic Amplitude Variation with Offset (AVO) is one of the Direct Hydrocarbon Indicators used as discriminator for fluid presence in a reservoir rock. The pore fluid type in a reservoir has a measurable impact on the rock bulk density and velocity response which are key drivers of the rocks AVO response (AVO Class). Also, the depth of burial of a reservoir rock below the sea floor (mudline) introduces a compaction effect (depth trend) on the velocity and density of the reservoir thereby introducing a variation in the AVO response with change in reservoir depth below the seafloor. A successful application of the AVO response for screening Aganoba Near Field Opportunities required a good understanding of the expected AVO classes with respect to depth below the sea floor for the respective fluid fill types in the reservoir rock. This paper shows how a robust Seismic AVO response atlas was developed using regional rock property trends and deployed for screening of the identified Near Field Opportunities around the Aganoba Field.

Keywords: AVO, DHI, Screening, Rock Property, Seismic.

INTRODUCTION

Aganoba, a pseudonym used to describe a field located in deepwater offshore on the continental slope off the coast of Nigeria is in water depths ranging from 950 meters to 1,500 meters. The field is known to have oil and gas accumulations stratigraphically / structurally trapped within mud rich unconfined turbidite channel systems of Miocene age. Regional studies around Aganoba highlighted potentials for some Near Field Exploration (NFE) Opportunities that required screening for Probability of Success (PoS) using a combination of screening criteria. One fundamental screening criteria is the seismic Amplitude Variation with Offset (AVO) attribute.

Seismic Amplitude Variation with Offset (AVO) is one of the Direct Hydrocarbon Indicators used as discriminator for fluid presence in a reservoir rock. The pore fluid type in a reservoir has a measurable impact on the rock bulk density and velocity response which are key drivers of the rocks AVO response (AVO Class). Also, the depth of burial of a reservoir rock below the sea floor (mudline) introduces a compaction effect (depth trend) on the velocity and density of the reservoir thereby introducing a variation in the AVO response with change in reservoir depth below the seafloor.

A successful application of the AVO response for screening Aganoba Near Field Opportunities required a good understanding of the expected AVO classes with respect to depth below the sea floor for the respective fluid fill types in the reservoir rock. This paper shows how a robust Seismic AVO response atlas was developed using regional rock property trends and deployed for screening of the identified Near Field Opportunities around the Aganoba Field.

Deep Water Offshore Nigeria Study Area

Aganoba is in mid slope – basinal setting offshore Nigeria (Figure 1). Water depths range from 950 to 1,500m. Hydrocarbon accumulation is trapped mainly within turbiditic deposits. The known reservoirs contain mainly gas and oil in varying proportions. Regional studies

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around the Aganoba area revealed potentials for some Near Field Opportunities (NFE) which required screening for Probability of Success (PoS).

Figure 1: Aganoba Study Location Offshore Nigeria.

Theoretical Concepts

Seismic AVO attribute is one of the popular Direct Hydrocarbon Indicators (DHI) used as a discriminator for fluid presence in a reservoir rock.

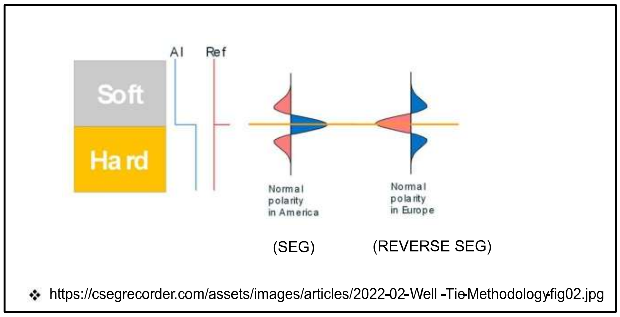
Pore fluid type in a reservoir has a measurable impact on the rock bulk density and velocity response which are the key drivers of the rocks AVO response (AVO Class).

Also, the depth of burial of a reservoir rock below the seafloor (mudline) introduces a compaction effect (depth trend) on the velocity and density of the reservoir thereby introducing a variation in the AVO response with change in depth below mudline (DBML).

The Zoeppritz equations show the link between seismic AVO response of a reservoir, the angle of incident seismic wave and the velocity and density contrast between the reservoir rock and the overburden layer.

Polarity Convention

Polarity convention is a means of representing the sign of seismic wave energy as it travels through the earth in response to acoustic contrast between two layers. Seismic wave energy traversing from an acoustically softer (lower acoustic impedance) material to an acoustically harder (higher acoustic impedance) medium is a positive reflection. The society of Exploration Geophysics (SEG) convention for displaying this positive reflection is a positive wiggle (peak). Conversely, the European convention (REVERSE SEG) would display it as a trough. Figure 2 illustrators the polarity conventions for SEG and REVERSE SEG for seismic energy traversing from an acoustically softer medium to an acoustically harder medium.

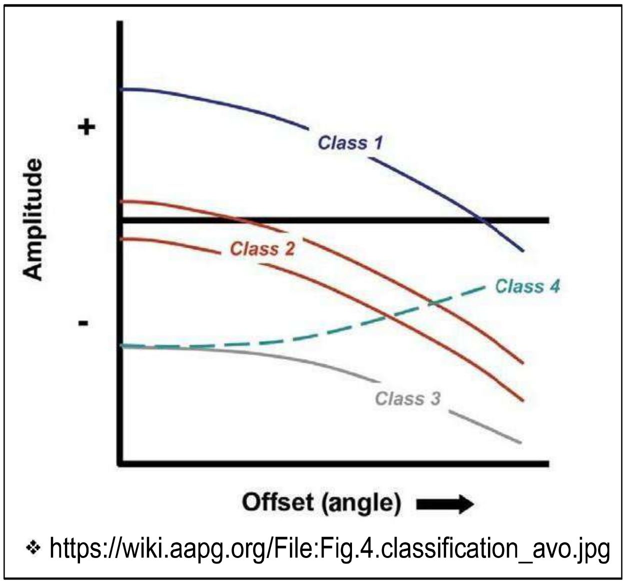


❖ https://csegrecorder.com/assets/images/articles/2022-02-Well -Tie-Methodology-fig02.jpg

Figure 2: Seismic Polarity Conventions

AVO Class Reference

Seismic reflectivity amplitude varies with the offset distance from the energy source to the receiver. Seismic Amplitude versus Offset (AVO) is a useful technique in for rock pore fill discrimination. Four types of AVO response pattern have been categorized based on near-offset amplitude, polarity and far offset amplitude as Class I, Class II, Class III and Class IV. Following the Society of Exploration Geophysics (SEG) polarity convention, Class I AVO typically has a large positive amplitude which falls with increasing offset. Class II AVO has a small near-offset amplitude which falls with increasing offset. Depending on the polarity of the near offset amplitude, the Class II AVO can further be subdivided into Class II and Class IIP where the 'P' indicates a change in polarity at the farther offsets. The Class II AVO has a small negative near offset amplitude and a large negative amplitude at the far offset. The Class IIP AVO has a small positive near-offset amplitude which falls and subsequently flips to negative polarity with increasing offset. Figure 3. shows a graphical illustration of the amplitude profiles with offset for the 4 AVO classes.

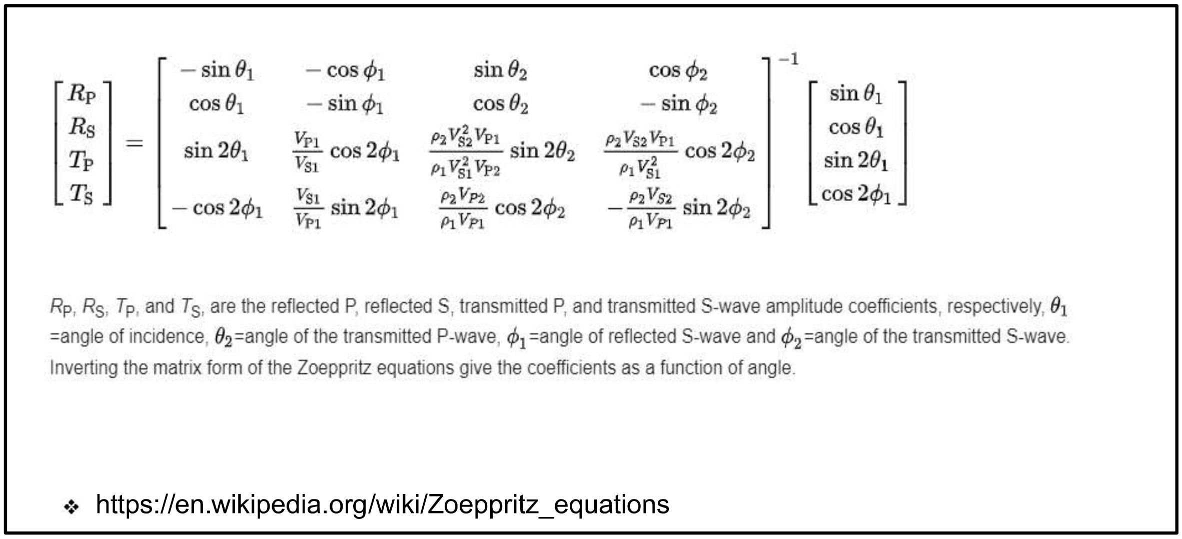


❖ https://wiki.aapg.org/File:Fig.4.classification_avo.jpg

Figure 3: Classes of AVO Responses.

Zoeppritz Equations.

The Zoeppritz equations are four mathematical expressions that describe the relationship between seismic wave energy propagation (transmission and reflection) through the boundaries of rocks with different materials. The Zoeppritz equations are detailed and accurate, however due to its complexity, and high computational requirements, it is very challenging to implement without simplification. Figure 4 shows the Zoeppritz equations.



$$\begin{bmatrix} R_\text{P} \\ R_\text{S} \\ T_\text{P} \\ T_\text{S} \end{bmatrix} = \begin{bmatrix} -\sin\theta_1 & -\cos\phi_1 & \sin\theta_2 & \cos\phi_2 \\ \cos\theta_1 & -\sin\phi_1 & \cos\theta_2 & -\sin\phi_2 \\ \sin 2\theta_1 & \frac{V_\text{P1}}{V_\text{S1}}\cos 2\phi_1 & \frac{\rho_2 V_\text{S2}^2 V_\text{P1}}{\rho_1 V_\text{S1}^2 V_\text{P2}}\sin 2\theta_2 & \frac{\rho_2 V_\text{S2} V_\text{P1}}{\rho_1 V_\text{S1}^2}\cos 2\phi_2 \\ -\cos 2\phi_1 & \frac{V_\text{S1}}{V_\text{P1}}\sin 2\phi_1 & \frac{\rho_2 V_\text{P2}}{\rho_1 V_\text{P1}}\cos 2\phi_2 & -\frac{\rho_2 V_\text{S2}}{\rho_1 V_\text{P1}}\sin 2\phi_2 \end{bmatrix}^{-1} \begin{bmatrix} \sin\theta_1 \\ \cos\theta_1 \\ \sin 2\theta_1 \\ \cos 2\phi_1 \end{bmatrix}$$

R_P, R_S, T_P, and T_S, are the reflected P, reflected S, transmitted P, and transmitted S-wave amplitude coefficients, respectively, θ_1 =angle of incidence, θ_2=angle of the transmitted P-wave, ϕ_1=angle of reflected S-wave and ϕ_2=angle of the transmitted S-wave. Inverting the matrix form of the Zoeppritz equations give the coefficients as a function of angle.

- https://en.wikipedia.org/wiki/Zoeppritz_equations

Figure 4: Zoeppritz Equations

Shuey 3-Term Equations

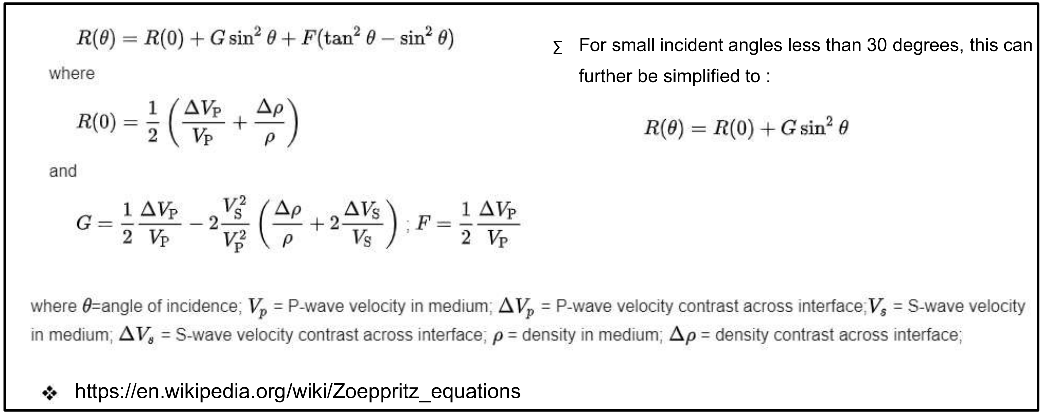
The Shuey equations of are a simplified form of the Zoeppritz equations. The Shuey equations are an approximation for incident angles less than 30 degrees. Though less accurate when compared to the Zoeppritz equations, their simplification makes it easier to apply. Figure 5 shows the Shuey equations.

METHODOLOGY

Regional Rock and fluid property models were built using well and reservoir data from across the Aganoba area. Brine trends for compressional velocities (Vp), shear velocities (Vs) and density (Rho) as a function of depth below mud line (DBML) were generated using the respective rock property model equations. The modelled brine trends were subsequently substituted to the different scenarios for oil and gas by means of the Gassmann equations and compared with actual log data from representative wells. AVO responses were subsequently modelled for angle ranges from 0 to 45 degrees for the respective fluid scenarios with respect to depth below mudline. A tabulation of expected AVO responses for the different fluid scenarios at respective depth intervals was done to serve as quick reference guide for AVO screening of the Aganoba Near Field Opportunities.

2D Cross Plot and Modelling Assumptions

Compressional Velocity (VP), Shear Velocity (Vs) and Density (Rho) Rock Property trend with respect to true



$$R(\theta) = R(0) + G\sin^2\theta + F(\tan^2\theta - \sin^2\theta)$$

where

$$R(0) = \frac{1}{2}\left(\frac{\Delta V_\text{P}}{V_\text{P}} + \frac{\Delta\rho}{\rho}\right)$$

and

$$G = \frac{1}{2}\frac{\Delta V_\text{P}}{V_\text{P}} - 2\frac{V_\text{S}^2}{V_\text{P}^2}\left(\frac{\Delta\rho}{\rho} + 2\frac{\Delta V_\text{S}}{V_\text{S}}\right); F = \frac{1}{2}\frac{\Delta V_\text{P}}{V_\text{P}}$$

where θ=angle of incidence; V_p = P-wave velocity in medium; ΔV_p = P-wave velocity contrast across interface; V_s = S-wave velocity in medium; ΔV_s = S-wave velocity contrast across interface; ρ = density in medium; $\Delta\rho$ = density contrast across interface;

∑ For small incident angles less than 30 degrees, this can further be simplified to :

$$R(\theta) = R(0) + G\sin^2\theta$$

- https://en.wikipedia.org/wiki/Zoeppritz_equations

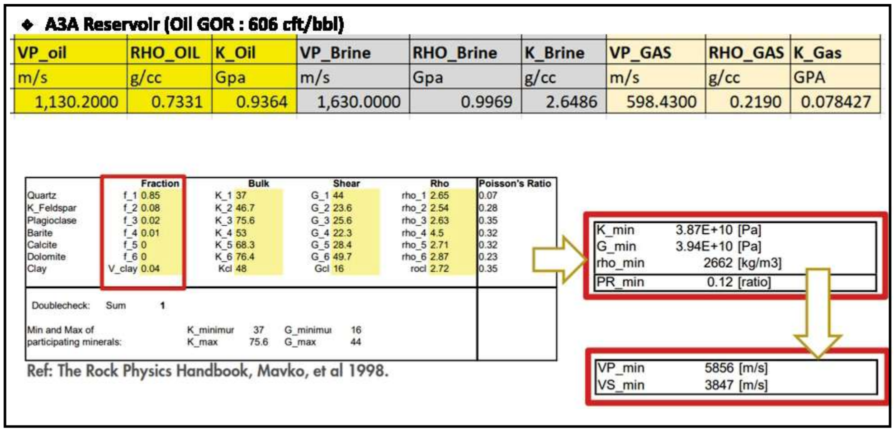
Figure 5: Shuey Equations.

vertical depth below mudline (TVDBML) were taken from existing 2010 /2011 Aganoba Rock Property models. These models were built using quality checked regional data from 20 wells distributed across the Aganoba region. The Vp trend model was built as a function of true vertical depth below the mudline. The density trend model was built as a function of compressional velocity while the shear velocity model was built as a function of compressional velocity.

The input data for the property model were measured from depths ranging from ~1500m (TVDBML) to ~3000m (TVDBML). The rock models are therefore ~1500m to ~3000m TVDBML to avoid errors arising from extrapolation outside calibration data area.

Three sand facies type present in the Aganoba area are the channel axis, channel margin and the thin beds. This study focused on channel axis property trends for sand based on facies 428 (Channel Axis) being the best quality sands and more predominant in the area. The channel axis is also the main flow pathway for sediment transportation and deposition.

Acoustic fluid properties namely, compressional velocity, modulus and density are based on FLAG14 (Fluid Application of Geophysics) outputs from a comprehensive 2015 rock and fluid model work. The Aganoba A3A reservoir oil property which has a gas-oil-ratio (GOR) of 606 cft/bbl was used as representative sample for the modelling. Figure 6 shows the representative fluid and mineral set values for Aganoba region.



◆ A3A Reservoir (Oil GOR : 606 cft/bbl)

VP_oil	RHO_OIL	K_Oil	VP_Brine	RHO_Brine	K_Brine	VP_GAS	RHO_GAS	K_Gas
m/s	g/cc	Gpa	m/s	Gpa	g/cc	m/s	g/cc	GPA
1,130.2000	0.7331	0.9364	1,630.0000	0.9969	2.6486	598.4300	0.2190	0.078427

		Fraction		Bulk		Shear		Rho	Poisson's Ratio
Quartz	f_1	0.85	K_1	37	G_1	44	rho_1	2.65	0.07
K_Feldspar	f_2	0.08	K_2	46.7	G_2	23.6	rho_2	2.54	0.28
Plagioclase	f_3	0.02	K_3	75.6	G_3	25.6	rho_3	2.63	0.35
Barite	f_4	0.01	K_4	53	G_4	22.3	rho_4	4.5	0.32
Calcite	f_5	0	K_5	68.3	G_5	28.4	rho_5	2.71	0.32
Dolomite	f_6	0	K_6	76.4	G_6	49.7	rho_6	2.87	0.23
Clay	V_clay	0.04	Kcl	48	Gcl	16	rocl	2.72	0.35

Doublecheck: Sum 1

Min and Max of participating minerals:		
K_minimur 37	G_minimui 16
K_max 75.6	G_max 44

Ref: The Rock Physics Handbook, Mavko, et al 1998.

K_min	3.87E+10	[Pa]
G_min	3.94E+10	[Pa]
rho_min	2662	[kg/m3]
PR_min	0.12	[ratio]

VP_min	5856	[m/s]
VS_min	3847	[m/s]

Figure 6: Representative Fluid and Mineral Set Values for Aganoba Region.

Rock Trend Models For Aganoba Regional Sands

The trend models built for the respective facies made use of data samples measured from depth intervals ranging from 1500m – 3000m true vertical depth below mudline (TVDBML).

Facies 428: Channel Axis
Compressional Velocity = +1.411651 * True Vertical Depth Below Mudline + 866.1643

Facies 454: Channel Margin
Compressional Velocity = +1.231326 * True vertical Depth Below Mudline + 1635.007

Facies 460 : Thin Beds
Compressional Velocity = +1.127827 * True Vertical Depth Below Mudline + 2024.313

Bulk Density = 0.1216588 * VP ^ 0.316231

Shear Velocity = +0.915457 * Compressional Velocity – 3840.955

Rock Trend Models For Aganoba Regional Shales

End Member Bounding Shales (1500m – 3000m TVDBML)

Compressional Velocity = +244.6249 * True Vertical Depth Below Mudline ^ 0.406124

Bulk Density = 0.05824702 * VP ^0.408312

Shear Velocity = + 0.8087493 * Compressional Velocity – 3022.498

A plot of acoustic impedance (AI) versus TVDBML sands and shale data points showed appreciable depth trends both for the sands and the shales (figure 7). The trend models for channel axis (Facies 428) were fluid substituted for brine, oil and gas fill cases. The brine substituted trends were compared with brine substituted logs form three representative wells, each located at different parts of the region.

The modelled acoustic impedance versus TVDBML regional trend aligned closely with the Aganoba-SW-01 well end member brine sands for depths within the 1500m – 3000m TVDBML range. Similarly, the regional brine sand trends are in close agreement with the Aganoba-001and Aganoba-21 well end member brine sands respectively. The substituted gas trend appeared to have some errors at depths beyond 2800m TVDBML for Aganoba-001 well. Figures 8 to 10 show the AI versus TVDBML trends for Aganoba-SW-1, Aganoba-001 and Aganoba-21 wells respectively.

In general the evaluated trends indicate that brine sands are softer than shales for depths less than 1700m TVDBML and become harder than shales for depths greater than 1700m. Oil sands are softer than shales for depths less than 2000m TVDBML and become harder for depths greater than 2000m TVDBML. Gas sands are softer than shales for depths less than 2200m TVDBML and become harder for depths greater than 2200m TVDBML. A summary of reservoir acoustic impedance versus depth response is shown in figure 11.

AVO Versus TVDBML Models From Regional Trends

Models based on rock property trends for Shale/Brine sand, Shale/Oil sand and Shale/Gas sand reservoir configurations predicted the expected AVO pattern with respect to depth below mud line.

At a depth of 1500m TVDBML, a Class III AVO is expected for both brine and oil scenarios. A Class II AVO pattern is expected for the brine case. Fluid type discrimination can be done on stack (up dip / down dip) response. Fluid type discrimination is not definitive on AVO response. Figure 12.

At a depth of 2000m TVDBML, a Class III AVO is expected for gas case while the oil case would be expressed as a Class II AVO. A Class I AVO would be expected for the brine case. Fluid type discrimination can be done on stack (up dip / down dip) response as well as on AVO response. Figure 13

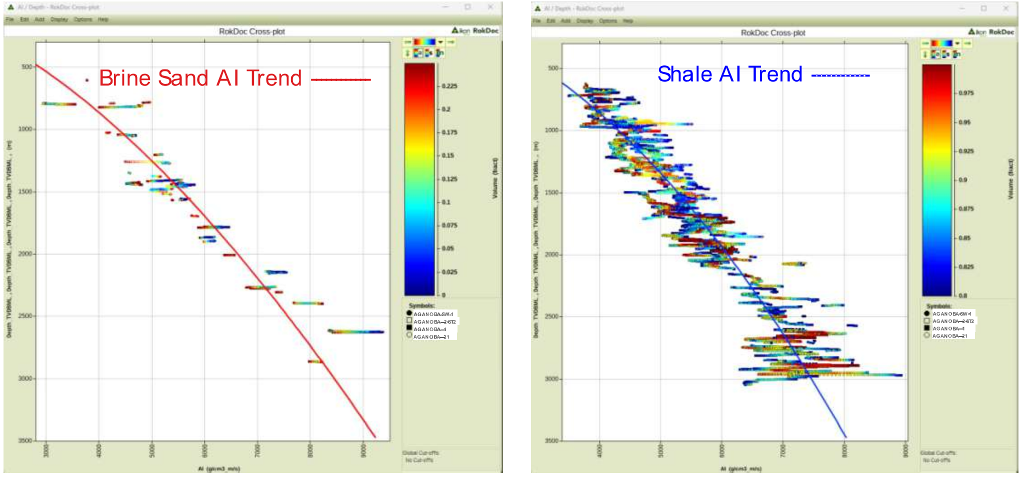
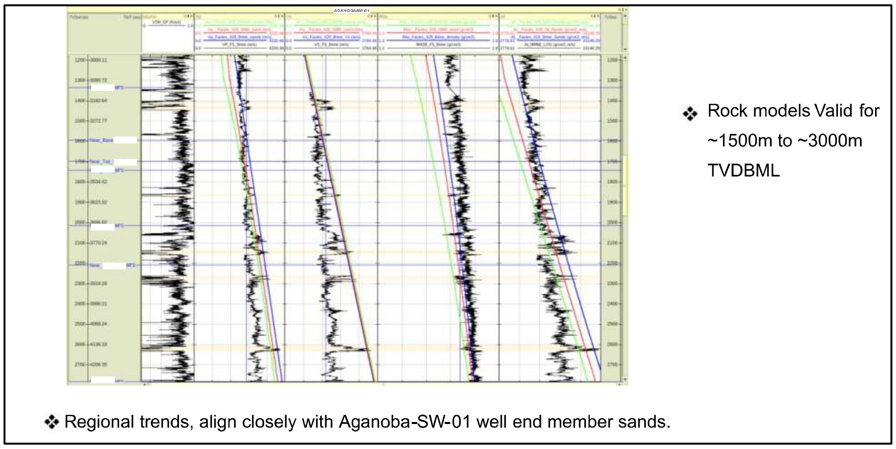


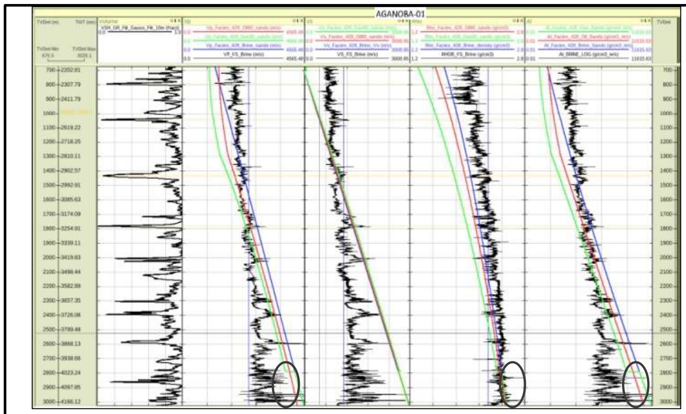
Figure 7: AI Versus TVDBML for Brine Sands (left) and Shales (right) showing the depth trend in acoustic impedance values.



❖ Rock models Valid for ~1500m to ~3000m TVDBML

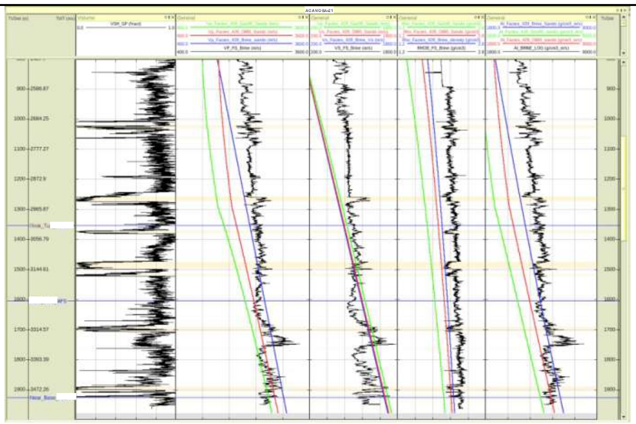
❖ Regional trends, align closely with Aganoba-SW-01 well end member sands.

Figure 8: Aganoba-SW-1 AI-TVDBML Regional Trend for Brine Oil and Gas Sands.



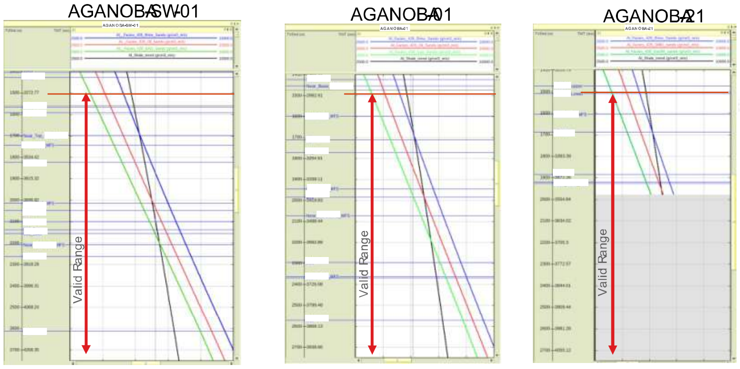
- ❖ Rock models Valid for ~1500m to ~3000m TVDBML
- ❖ Regional trends, align closely with Aganoba-01 well end member sands.

Figure 9: Aganoba-01 AI-TVDBML Regional Trend for Brine Oil and Gas Sands.



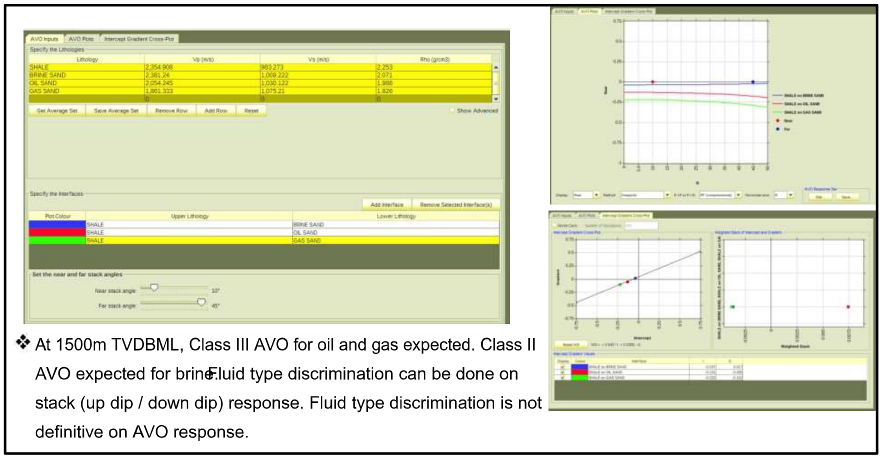
- ❖ Rock models Valid for ~1500m to ~3000m TVDBML
- ❖ Regional trends, align closely with Aganoba-21 well end member sands.

Figure 10: Aganoba-21 AI-TVDBML Regional Trend for Brine Oil and Gas Sands



- ❖ Rock models Valid for ~1500m to ~3000m TVDBML
- ❖ Brine sands are softer than shales for depths less than 1700m TVDBML and become harder than shales for depths greater than 1700m
- ❖ Oil sands are softer than shales for depths less than 2000m TVDBML and become harder for depths greater than 2000m TVDBML.
- ❖ Gas sands are softer than shales for depths less than 2200m TVDBML and become harder for depths greater than 2200m TVDBMl

Figure 11: Summary of Reservoir Acoustic Impedance Versus TVDBML Response.



Specify the Lithologies

Lithology	Vp (m/s)	Vs (m/s)	Rho (g/cm3)
SHALE	2,354.908	983.273	2.253
BRINE SAND	2,381.24	1,009.222	2.071
OIL SAND	2,054.245	1,030.122	1.988
GAS SAND	1,861.333	1,075.21	1.826
	0	0	0

Specify the Interfaces

Plot Colour	Upper Lithology	Lower Lithology
🟦	SHALE	BRINE SAND
🟥	SHALE	OIL SAND
🟩	SHALE	GAS SAND

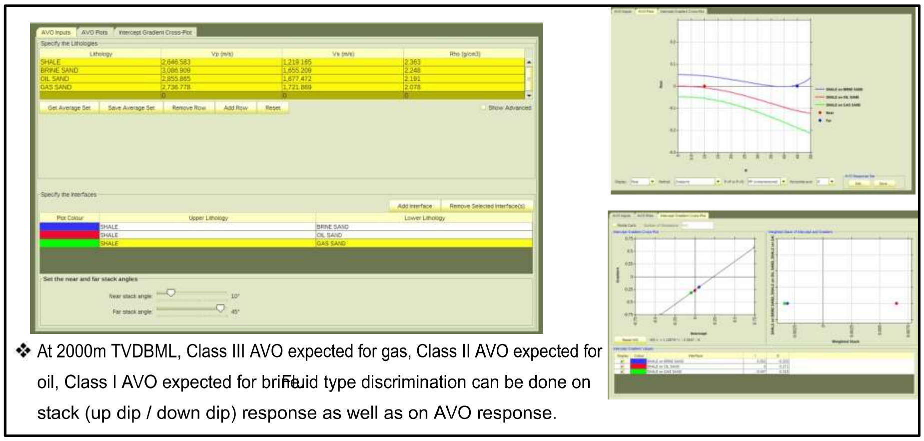
Set the near and far stack angles

Near stack angle: 10°

Far stack angle: 45°

❖ At 1500m TVDBML, Class III AVO for oil and gas expected. Class II AVO expected for brine. Fluid type discrimination can be done on stack (up dip / down dip) response. Fluid type discrimination is not definitive on AVO response.

Figure 12: Aganoba AVO response prediction model for brine, oil and gas scenarios at 1500m true vertical depth below mudline.



Specify the Lithologies

Lithology	Vp (m/s)	Vs (m/s)	Rho (g/cm3)
SHALE	2,646.583	1,219.165	2.383
BRINE SAND	3,086.909	1,655.209	2.248
OIL SAND	2,855.865	1,677.472	2.191
GAS SAND	2,736.778	1,721.869	2.078
	0	0	0

Specify the Interfaces

Plot Colour	Upper Lithology	Lower Lithology
🟦	SHALE	BRINE SAND
🟥	SHALE	OIL SAND
🟩	SHALE	GAS SAND

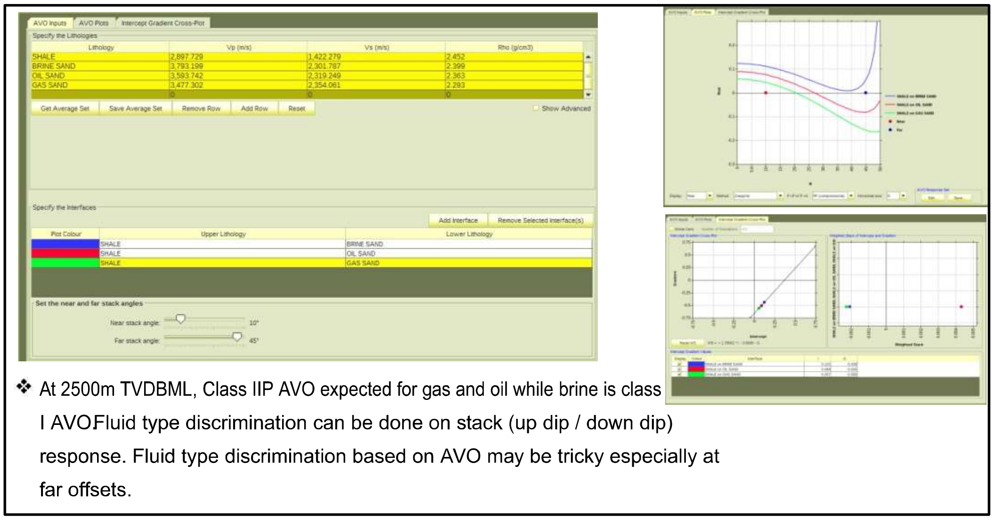
Set the near and far stack angles

Near stack angle: 10°

Far stack angle: 45°

❖ At 2000m TVDBML, Class III AVO expected for gas, Class II AVO expected for oil, Class I AVO expected for brine. Fluid type discrimination can be done on stack (up dip / down dip) response as well as on AVO response.

Figure 13: Aganoba AVO response prediction model for brine, oil and gas scenarios at 20000m true vertical depth below mudline.



Specify the Lithologies

Lithology	Vp (m/s)	Vs (m/s)	Rho (g/cm3)
SHALE	2,897.729	1,422.279	2.452
BRINE SAND	3,793.199	2,301.787	2.399
OIL SAND	3,593.742	2,319.249	2.363
GAS SAND	3,477.302	2,354.061	2.293
	0	0	0

Specify the Interfaces

Plot Colour	Upper Lithology	Lower Lithology
🟦	SHALE	BRINE SAND
🟥	SHALE	OIL SAND
🟩	SHALE	GAS SAND

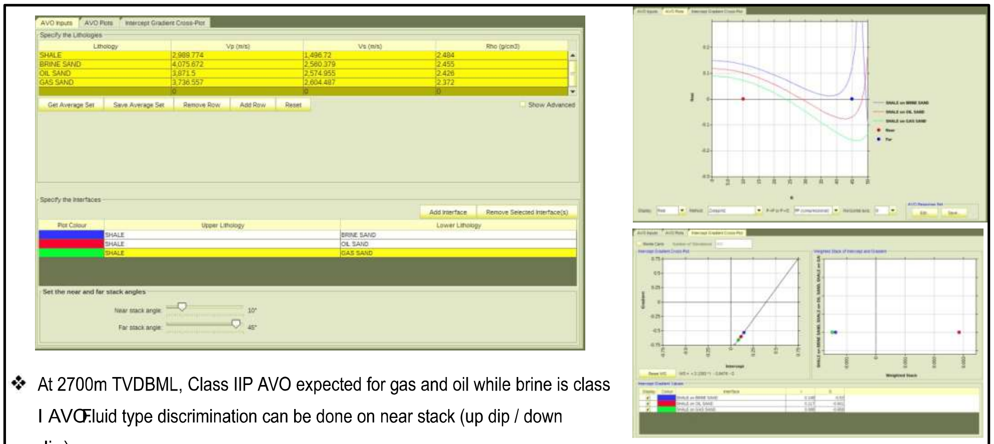
Set the near and far stack angles

Near stack angle: 10°

Far stack angle: 45°

❖ At 2500m TVDBML, Class IIP AVO expected for gas and oil while brine is class I AVO. Fluid type discrimination can be done on stack (up dip / down dip) response. Fluid type discrimination based on AVO may be tricky especially at far offsets.

Figure 14: Aganoba AVO response prediction model for brine, oil and gas scenarios at 25000m true vertical depth below mudline.

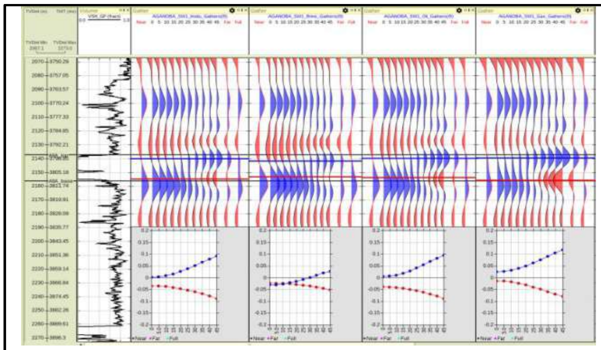


Lithology	Vp (m/s)	Vs (m/s)	Rho (g/cm3)
SHALE	2,989.774	1,496.72	2.484
BRINE SAND	4,075.672	2,580.379	2.455
OIL SAND	3,871.5	2,574.955	2.426
GAS SAND	3,736.557	2,604.487	2.372
	0	0	0

Plot Colour	Upper Lithology	Lower Lithology
🟦	SHALE	BRINE SAND
🟥	SHALE	OIL SAND
🟩	SHALE	GAS SAND

- At 2700m TVDBML, Class IIP AVO expected for gas and oil while brine is class I AVO. Fluid type discrimination can be done on near stack (up dip / down dip) response.

Figure 15: Aganoba AVO response prediction model for brine, oil and gas scenarios at 27000m true vertical depth below mudline.



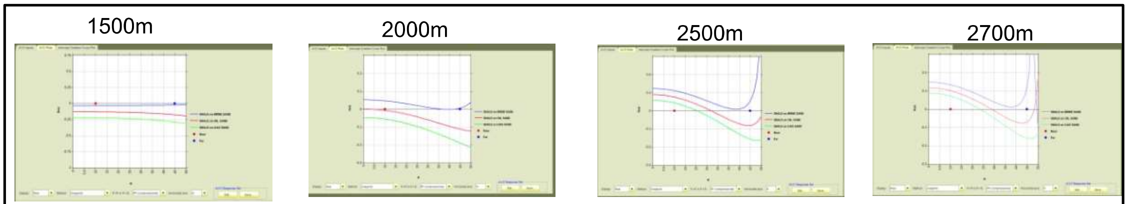
- Depth ~2136m TVDBML
- Insitu response: Class II
- Brine response : Class IIP
- Oil response Class II
- Gas response: Strong Class II

Σ *Note: Attribute measurement done on seismic interface character by maximum peak (soft) response on seismic reflectivity (reverse polarity).*

- Blind test of the regional AVO catalogue for Aganoba SW-01 A8A oil reservoir matched the *in-situ* Class II response for Oil and the strong Class II/ III for the gas case. The brine case modelled from well suggested a Class IIP which is quite close to the Class I model based on the catalogue.

Figure 16: Aganoba-SW-1 AVO Response Blind Test Using A8A Reservoir.

1500m 2000m 2500m 2700m

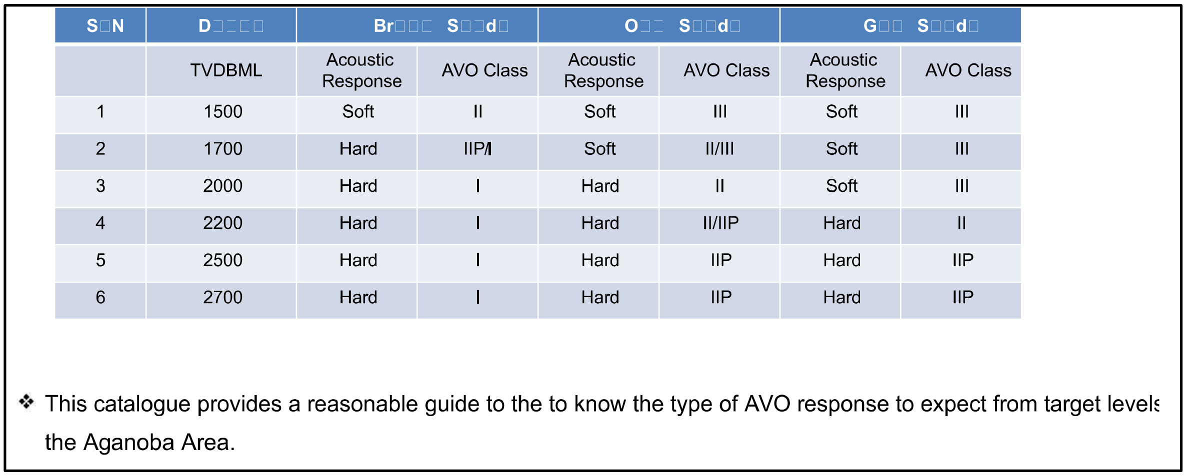


Depth:	1500m	2000m	2500m	2700m
Brine:	Class II	Class I	Class I	Class I
Oil:	Class III	Class II	Class IIP	Class IIP
Gas:	Class III	Class III	Class IIP	Class IIP

- This catalogue provides a reasonable guide to the to know the type of AVO response to expect from target levels the Aganoba Area.

Figure 17: Catalogue of Expected Aganoba AVO Responses Per Depth TVDML (m).

Table 1: Table of Expected Aganoba AVO Responses Per Depth TVDML (m)



S/N	Depth	Brine Sand		Oil Sand		Gas Sand	
	TVDBML	Acoustic Response	AVO Class	Acoustic Response	AVO Class	Acoustic Response	AVO Class
1	1500	Soft	II	Soft	III	Soft	III
2	1700	Hard	IIP/I	Soft	II/III	Soft	III
3	2000	Hard	I	Hard	II	Soft	III
4	2200	Hard	I	Hard	II/IIP	Hard	II
5	2500	Hard	I	Hard	IIP	Hard	IIP
6	2700	Hard	I	Hard	IIP	Hard	IIP

- This catalogue provides a reasonable guide to the to know the type of AVO response to expect from target levels the Aganoba Area.

At a depth of 2500m TVDBML, Class IIP AVO expected for gas and oil while brine is class I AVO. Fluid type discrimination can be done on stack (up dip / down dip) response. Fluid type discrimination based on AVO may be tricky especially at far offsets. Figure 14.

At a depth of 2700m TVDBML, Class IIP AVO expected for gas and oil while brine is class I AVO. Fluid type discrimination can be done on near stack (up dip / down dip) response. Figure 15.

A blind test using the in-situ forward model for A8A oil bearing reservoir which is at a depth of 2136m TVDBML gave a Class II AVO response matching the prediction results from the catalogue. The modelled responses for A8A brine and gas cases gave a Class IIP and a Class II/III response respectively for brine and gas. This results is also in close alignment with the prediction results from the catalogue. Figure 16. Figure 17 and Table 1 show at a glance, a catalogue of expected AVO responses with respect to depth below mudline for identified opportunities in the Aganoba area.

CONCLUSION

A comprehensive catalogue for expected AVO response for different fluid scenarios was successfully built using regional rock property and fluid models for Aganoba. A calibration test of the regional rock property trends against actual well data for Aganoba-SW-01, Aganoba -01 and Aganoba -21 wells was successful. A blind test using the in-situ forward model for Aganoba SW-01 A8A oil bearing reservoir which is at a depth of 2136m TVDBML gave a Class II AVO response matching the prediction results from the AVO catalogue. The Aganoba AVO catalogue provides a quick guide to know what type of AVO response is expected from target levels within the Aganoba Area and should be used for AVO screening of the various opportunities identified at the respective target levels around Aganoba.

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