Facies Classification Using Stochastic Inversion Method for Carbonate Oligo-Miocene in Pangkah, North East Java Basin

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ABSTRACT

The offshore Northeast Java Basin is one of the largest basins in Indonesia and one that contains complete hydrocarbon systems from Middle Miocene Tuban formations to Pre Tertiary basement formations. The offshore East Java Basin is located on the southeast margin of Sundaland and is dominated by a series of Northeast trending basement highs and intervening half – grabens that formed during Late Cretaceous to Tertiary times along the Southeast margin of the Sunda Plate (Manur and Barraclough, 1994).

In Pangkah Field, Carbonaete Oligo-Miocene has a diversity property of reservoir. Challenges to identified characterisation resevoir using stochastic inversion method. Within this method enhance our detail in classification distribution of carbonate facies. East Java projects using deterministic seismic inversion has been successfully executed, but need additional data and analysis for better visualization of reservoir, caused by heteregeneous reservoir due to various property and thickness. Some of the benefits of these methods are inverted impedances rock properties calibrates with well data, seismic inversion process reduces the wavelet and tuning effects estimating the thickness of a thin bed to improving the understanding of the reservoir geology for exploration strategy and development. We used a stochastic inversion methodology, which simulates many possible realizations, to better discriminate the thickness and real extent of the carbonate/shale layers, and estimate the uncertainties of carbonate volumes (P10, P50 and P90) in the Kujung I play and CD Carbonate Play of the Pangkah PSC.

Key words: hydrocarbon, sthocastic, carbonate, facies, realization

INTRODUCTION

The offshore Northeast Java Basin is one of the largest basins in Indonesia and one that contains complete hydrocarbon systems from Middle Miocene Tuban formations to Pre Tertiary basement formations. The offshore East Java Basin is located on the southeast margin of Sundaland and is dominated by a series of Northeast trending basement highs and intervening half - grabens that formed during Late Cretaceous to Tertiary times along the Southeast margin of the Sunda Plate (Manur and Barraclough, 1994).

JS-1 ridge, as a part of North East Java Basin, is a highland with NE-SW trending ridge orientation. This area is well known having hydrocarbon bearing accumulation proven in Kujung I and Pre-Kujung I play.

The late Oligocene to Miocene was a period widespread carbonate deposition in SE Asia (Epting, 1980; Fulthorpe and Schlanger, 1989; Ehrlich *et al.*, 1993; Saller *et al.*, 1993; Gucci and Clark, 1993; Sun and Esteban, 1994). Many of these period carbonate in East Java Basin have been the target of hydrocarbon of exploration with numerous oil and gas reservoirs being discovered. Consequently, secondary porosity distribution and development play significant role for exploration on it.

Early Miocene Kujung I play is well known play for East Java Basin. Diagenesis and karstification occur regionally on Kujung I. This is proven by left deflection of density and full diameter core. Early Oligocene CD carbonate is another proven reservoir which is controlled by local paleohigh karstification and fracturation.

Too many carbonates layer as overburden sediment causes complexity to seismic interpretation for Early Oligocene CD formation which results poor seismic imaging and its features.

The purpose of this study is lateral continuity distribution of Carbonate Oligo-Miocene lithology and fluid units penetrated by wells by using pre-stack seismic data.

METHOD AND RESULTS

This study is built by 3D reprocessed and merged that covered entire area. The seismic data was preconditioning for improved reservoir characterization and log data which is calibrated with petrophysic and sidewall core data. The used seismic was reprocessed of broadband and covered entire study area.

The sensitivity analysis from log data, was performed to corroborate the existance of natural correlation between acoustic and petrophysical variables. The purpose of this analysis is to find physical properties that can separate the prospect zone with non prospect zones, in this case we make some prdictions about lithology and porosity properties of the carbonates which is filled by hydrocarbons.

The log data were edited and carefully tied to the seismic data. The horizon interpretation was refined based on the inversion result. A geologic model was created and used as input into the geostatistical inversion. The advantage of using a geological model isi that different geostatistical distributions can be assigned to the different geological layers and that the geostatistical analysis and simulation can follow the depositional defined by the geological model.

RESULT AND CONCLUSION

The crossplot well usually a cluster source rock data. The High value of P-Impedance is tight zone reservoir and low value of P-Impedance is porous zone, as shown in the figure below.

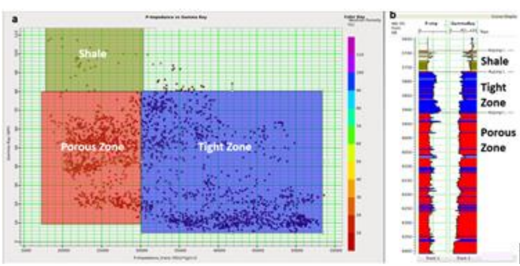

Figure 1. (a)Cross-plot of P-impedance Vs Gamma Ray The x-axis is P-Impedance and the y-axis is Gamma Ray.(b) Attribute cross section P-Impedance Vs GR cross-plot for T Well. It shows the tight zone, porous zone and shale

By Stochastic inversion integrating with seismic data and well logs to assess the lateral continuity and fluid unit by a well logs, with simulates many possible realization to discriminate between the carbonate and shale layer to predict the reservoir characterization and properties of pay zone. The inversion result direved by stochastic model.

		Average		TKBY-2_FINAL_geosi		TAMBAKBOYO-1_geosi	
		Ip	Is	Ip	Is	Ip	Is
Correlation Coefficient	All Model	0.87		0.86		0.97	
	Grid_Kujung-I_crossing -> Grid_Kujung-IZ2_crossing	0.86		-0.30		0.98	
	Grid_Kujung-IZ2_crossing -> Grid_Kujung-IZ3_crossing	1.00		1.00		0.99	
	Grid_Kujung-IZ3_crossing -> Grid_Kujung-II_crossing	0.86		0.86		No Data	

Figure 2. Well statistic stochastic model of correlation coeffitient

The correlation coeffitient based on model of well shows a good correlation value with average value is 0.87.

Figure 3 shows the result of an acoustic impedance estimation that was generated by stochastic inversion.

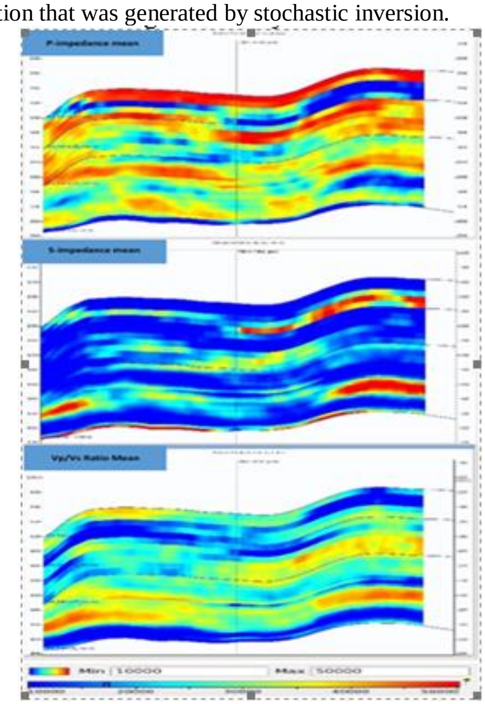

Figure 3. The acoustic impedance of T well inversion results. the upper is P-impedance mean, the middle is S-impedance mean, and the bottom is Vp/Vs Ration Mean

Geostatistical inversion is powerful quantitative reservoir characterization and capable of integrating wells, seismic data, and geologic data in the form of spatial distributions to produce properties map with high resolution and low uncertainty using all of the input data.

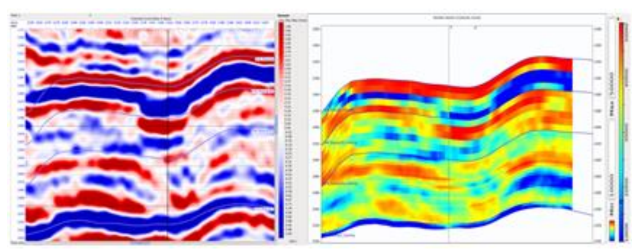

Figure 4. Comparasion between seismic and geostatistical inversion estimate on T well location

CONCLUSIONS

As a result of geostatistical inversion driven by well logs and variogram to asses distribution of acoustic impedance better vertical resolution than 3D post stack seismic data. High value of impedance corelate to Tight reservoar and low impedance value is porous reservoar. Based on detailed analysis geostatistical inversion, good reservoir property can separate between tight and porous reservoar have been well identified. This study has high impact for determining next exploration well with low risk.

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