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INTEGRATED SEISMIC INVERSION, FLUID INDEX ANALYSIS AND STRUCTURAL FEATURE FOR OUTSTEP AREA AT BATURAJA FORMATION IN KARANGKOMPLEKS STRUCTURE, JATIBARANG FIELD, NORTH WEST JAVA BASIN

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Abstract. Karangkompleks Structure is one of PT. PERTAMINA EP oil and gas producing in Jatibarang Field, North West Java Basin. One of the hydrocarbon producers of this structure are Carbonate reservoir in Baturaja Formation. The features of carbonate reef build up from PSTM data outside the existing wells area are still quite widely spread. PSTM data combined with Relative Acoustic Impedance attribute are able to map in detail several potential outsteps. To select the best area, Acoustic Impedance Inversion (Absolute) was applied for the distribution of properties and Fluid Index to analyze the presence of Hydrocarbon. AI inversion is carried out using post stack time data using a model based method. The fluid index uses pre stack/gather data with AVO analysis first to get the same response for the existing area with outstep. Finally, the results of the combination of these analyzes has been validated for existing area and identifying new prospect area.

INTRODUCTION

Karangkompleks structure is one of PT. PERTAMINA EP oil and gas producing field in Jatibarang, North West Java Basin. Based on Regional Geology, it lies at Cipunegara Low and it is part of South Arjuna Basin bordering Bogor Through. This Low is surrounded by fault system which separates Pamanukan High at West and Kandanghaur-Gantar High at East (**Figure 1**) [1]. One of the hydrocarbon producers of this structure are Carbonate reservoir in Baturaja Formation, it was deposited in Early Miocene. Based on the latest drilling well, MXX-10 in 2019, it produced a cumulative oil of 41.26 Mbbl and gas 0f 0.719 Bscf to date.

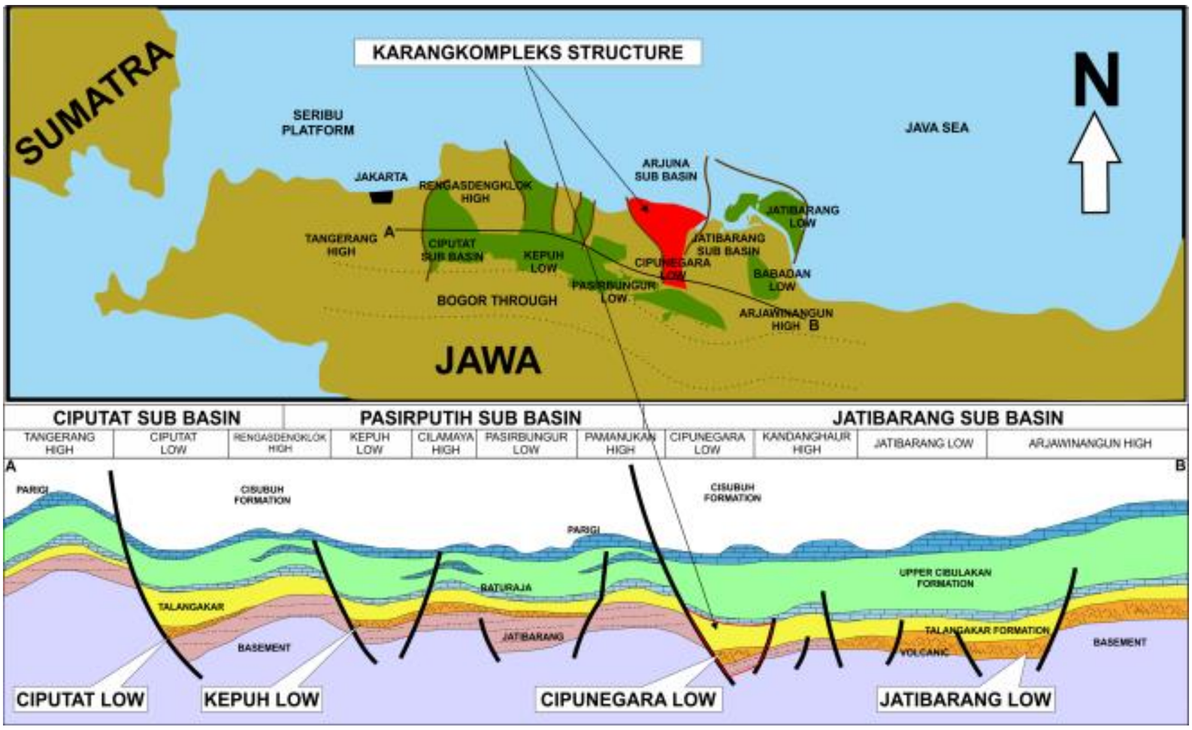


Figure 1. Regional Structure of North West Java Basin (Modification from Reminton and Pranyoto, 1985) [2]

From the 3D seismic data, it turns out that MXX-10 is part of carbonate reef MXX-04. It can be seen that MXX-04 produces 706 Mbbl and 1.56 Bscf, in other place, KXB-01 produces 520 Mbbl and 1.85 Bscf. This is the basis for mapping carbonate reefs more broadly. The features of carbonate reef build up from PSTM data outside the existing wells area are still quite widely spread. To support this interpretation, Relative AI attribute is applied for facies distribution, AI inversion (absolute AI) for properties distribution and fluid index for HC presence analysis.

SEISMIC INTERPRETATION

Seismic interpretation has been carried out regionally using 3D Seismic Melandong, especially in the Early Miocene or Baturaja Formation. The study area is clearly located between the Pamanukan High and Kandanghaur High and proven to have hydrocarbon on the carbonate reef. The character of the carbonate reef seismic facies is mounded and chaotic on the inside. The outer side of the mound shows the appearance of clastic sediment onlap (**Figure 2**).

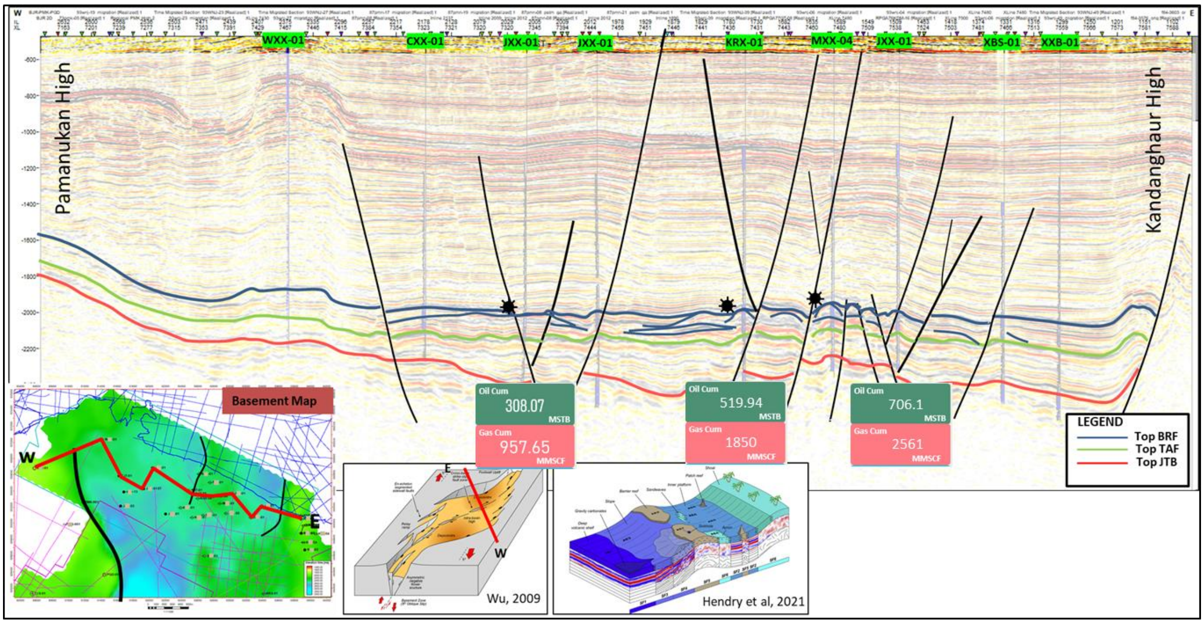


Figure 2. Regional seismic section of the Cipunegara Low on 3D Seismic Melandong data. There are several appereances of carbonate build up in the form of patch reef which is proven with the presence of hydrocarbons.

Based on seismic facies mapping from PSTM combined with Relative AI attribute there are several carbonates build up that identified. The result of the seismic facies mapping then validate by wells. The well data confirmed the patch reef facies always have thick (>40 m) carbonate rock and blocky Gamma ray log. **Figure 3** & **figure 4** show that the presence of carbonate build up is reinforced by the high amplitude value of Relative AI (yellow – red color) compared to its surroundings. The results of the interpretation of the volume attribute (Relative AI) were then sliced along the top horizon of Baturaja to obtain a lateral distribution of carbonate build up.

Acoustic Impedance Inversion (Absolute) was applied for the distribution of properties. Petrophysical analysis was carried out first to obtain a cut off porosity. The crossplot between Vshale vs PHIT from MXX-04 & MXX-10 obtained a cut off porosity with value 0.065. The cut off value is taken to the corrplot density vs PHIT which gets a density value of 2.62 gr/cc (**Figure 5**).

The results of cut-off the density and PHIT were applied to the acoustic impedance parameter and obtained values <14,000 gr/cc m/s (red to green color) as the porous zone and >14,000 gr/cc m/s (ocean blue to purple color) as the tight zone. Acoustic impedance inversion has been done using a model based method which is then sliced along the horizon Top-BRF to obtain a lateral distribution.

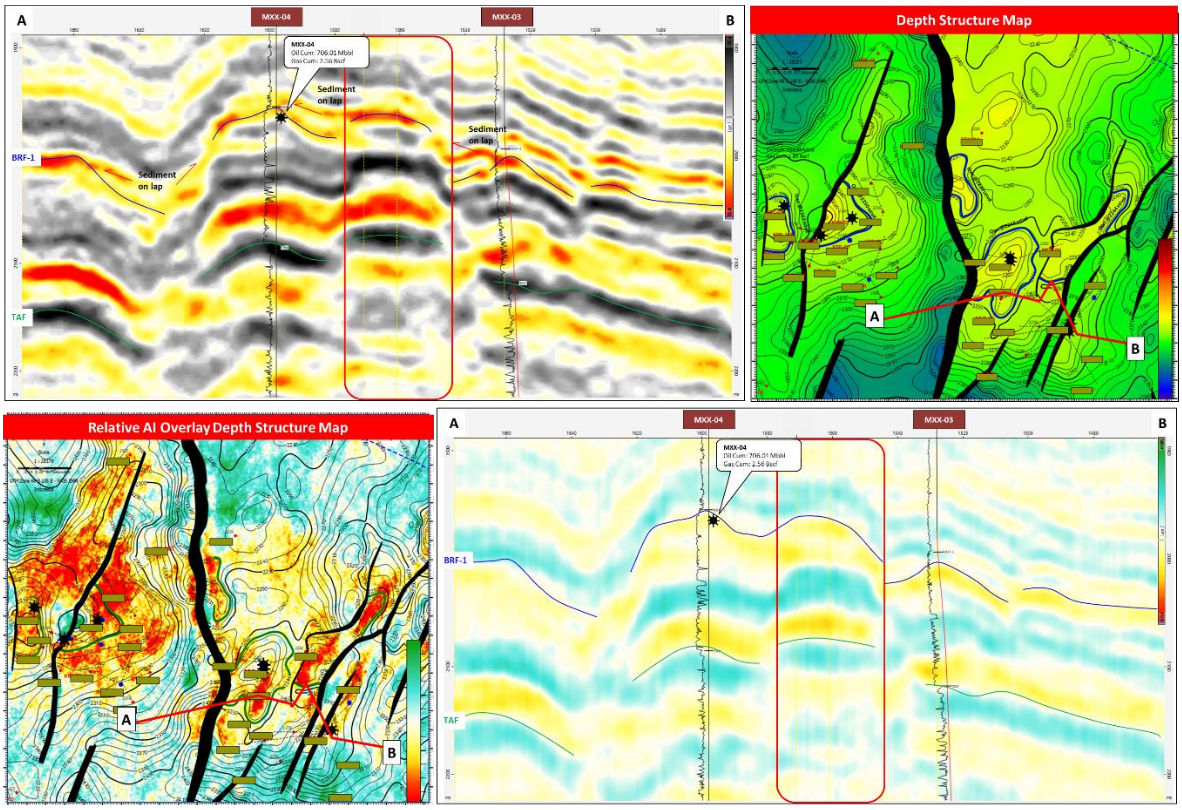


Figure 3. The PSTM seismic section combined Relative AI passes through MXX-04 towards STO-1. Several carbonates build up can be clearly recognize.

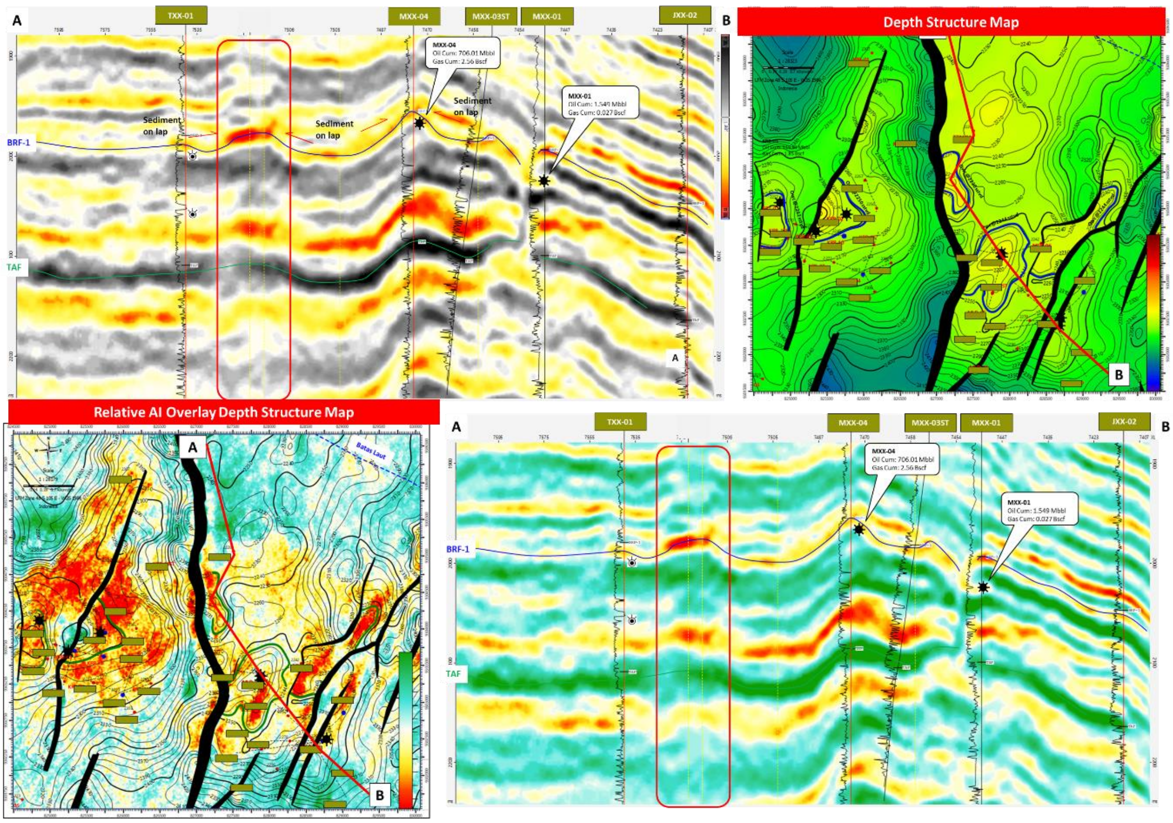


Figure 4. The PSTM seismic section combined Relative AI passes through STO-2 towards MXX-04 and MXX-01. Several carbonates build up can be clearly recognize.

The map and cross section of the AI distribution show that the STO-1 and STO-2 areas have the same response as the MXX-04 & MXX-10 proven areas which are indicated by the distribution of low AI values on the carbonate reef body. Between the carbonate reefs with the step out area there is a set of high AI values interpreted as a property barrier which indicates that each carbonate reef is not connected to each other (**Figure 6** & **Figure 7).**

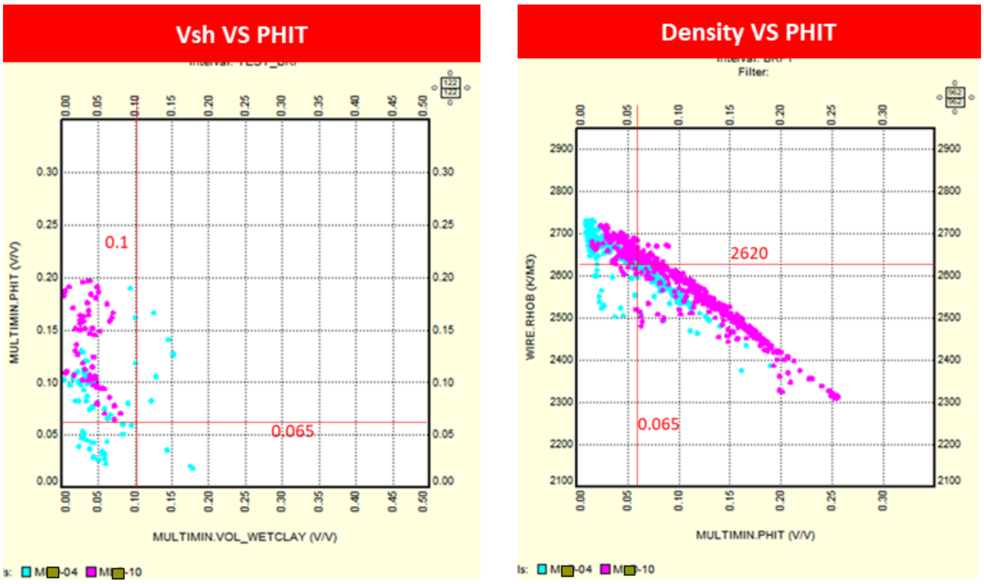
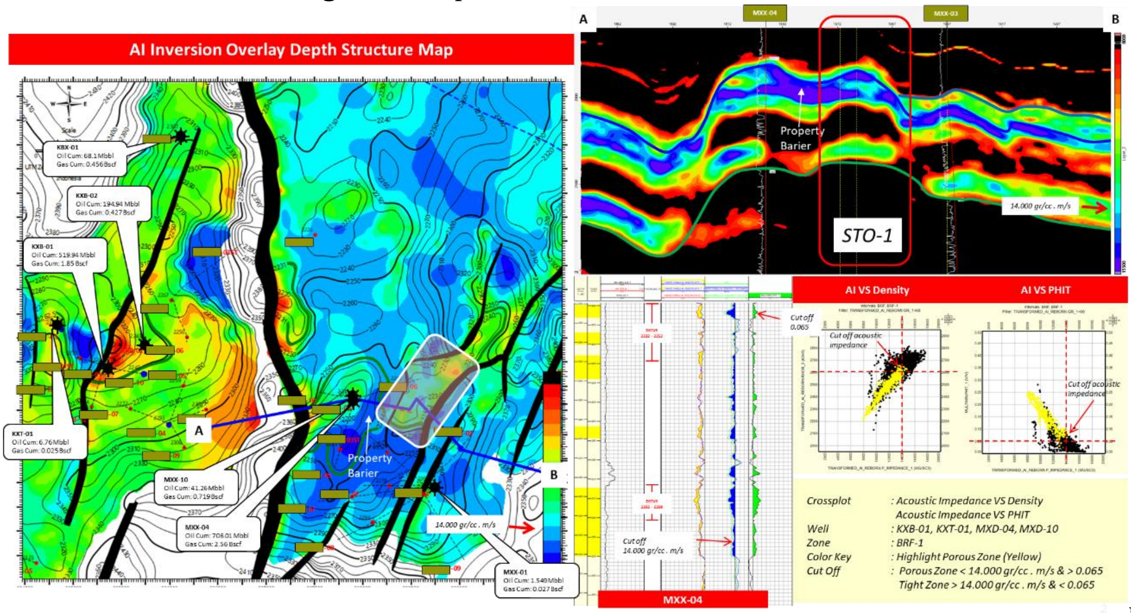


Figure 5. Petrophysical analysis to get cut off rock properties. a) Crossplot Vshale vs PHIT; b) Crossplot Density vs PHIT

Fluid Index was applied to analyse the presence of Hydrocarbon. The fluid index uses pre stack/gather data with AVO analysis first to get the same response for the existing area with outstep. Reservoir BRF MXX-04 is classified as AVO class 1 for high impedance gas sand (relative to the shale that covers it). This AVO class I top gas has positive peak amplitude for near offset, then dimming at mid angle and even polarity reversal at far angle as through amplitude (**Figure 8**).

Figure 6. Map and cross-section of the distributio



n of acoustic impedance inversion through the STO-1 area. Porous carbonate is indicated by the value <14.000 gr/cc m/s and tight carbonate is indicated >14.000 gr/cc m/s according to the crossplots of AI vs Density and AI vs PHIT

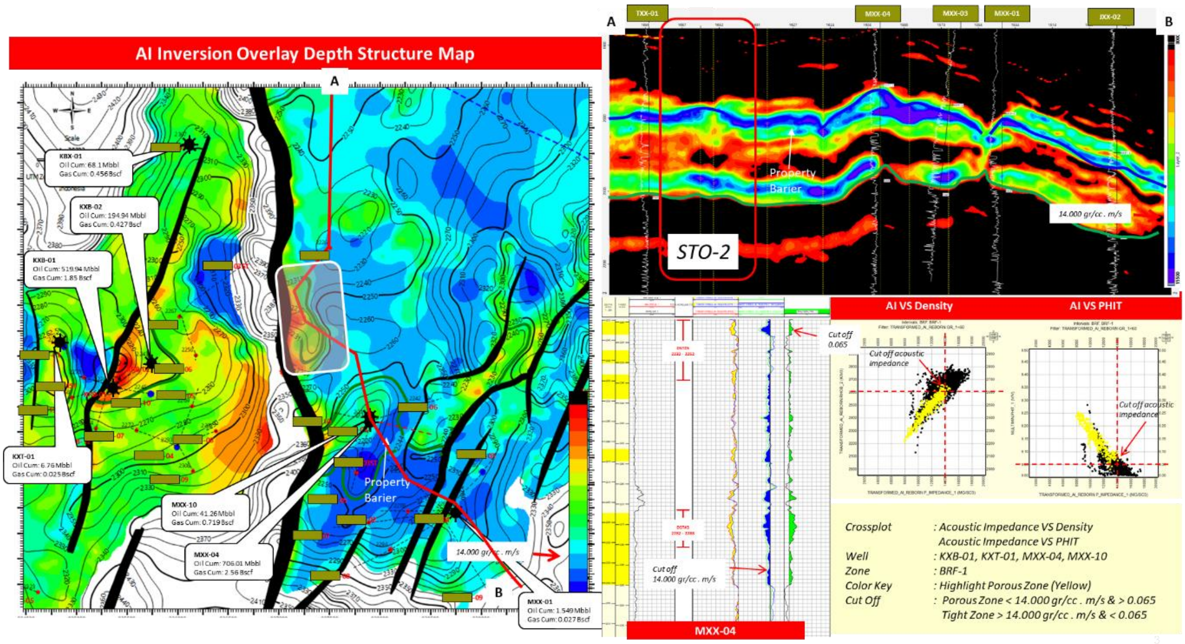


Figure 7. Map and cross-section of the distribution of acoustic impedance inversion through the STO-2 area. Porous carbonate is indicated by the value <14.000 gr/cc m/s and tight carbonate is indicated >14.000 gr/cc m/s according to the crossplots of AI vs Density and AI vs PHIT

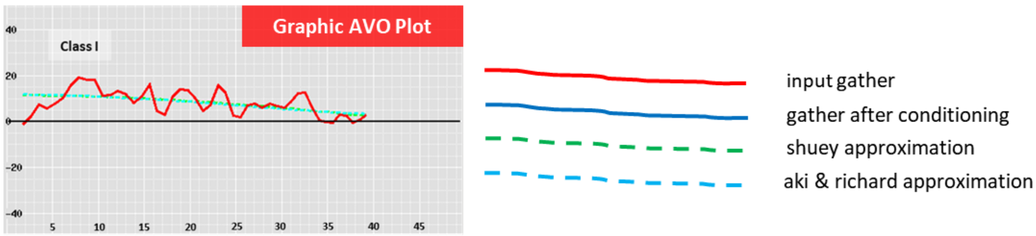


Figure 8. Graphic AVO analysis using gather data that passes through MXX-04

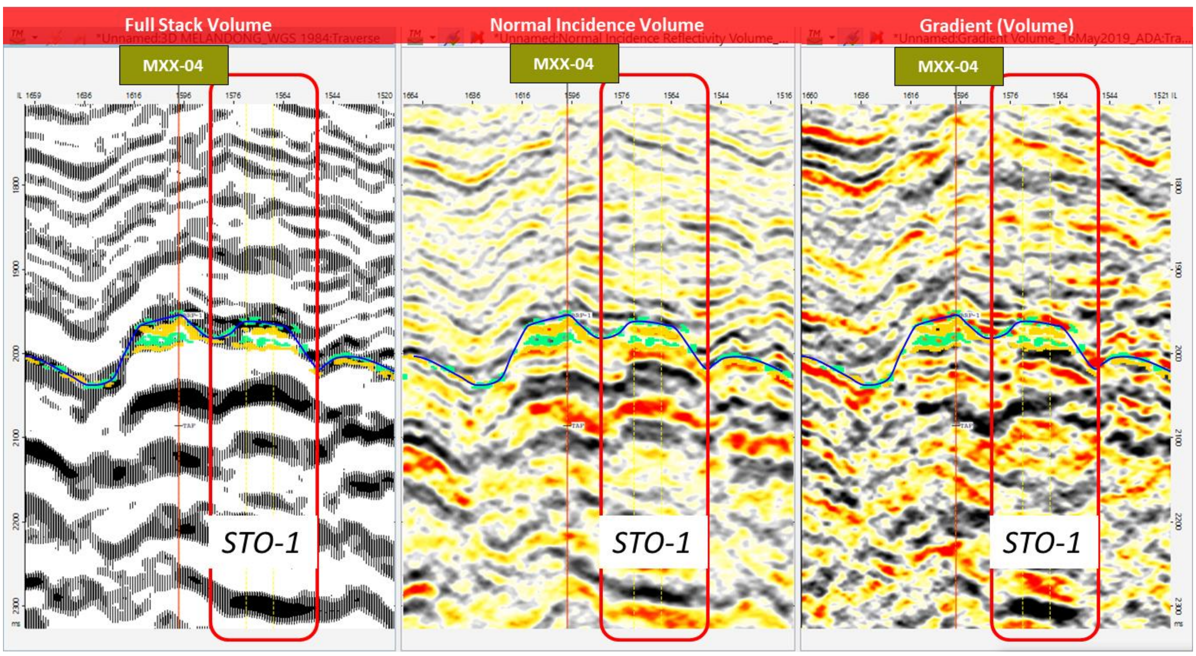


Figure 9. Cross-section of full stack, normal incidence and gradient volume through MXX-04 and STO-1 overlay fluid index value from crossplot gradient vs normal incidence. Yellow color as top class I and green color as base class I

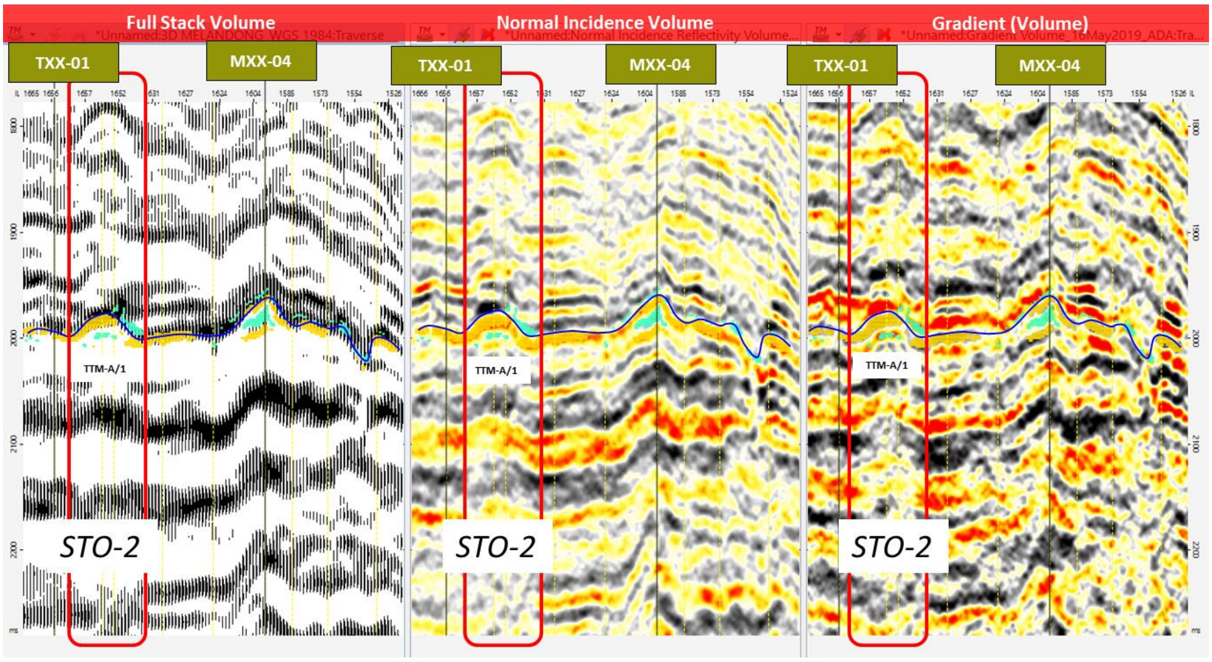


Figure 10. Cross-section of full stack, normal incidence and gradient volume through MXX-04 and STO-2 overlay fluid index value from crossplot gradient vs normal incidence. Yellow color as top class I and green color as base class I

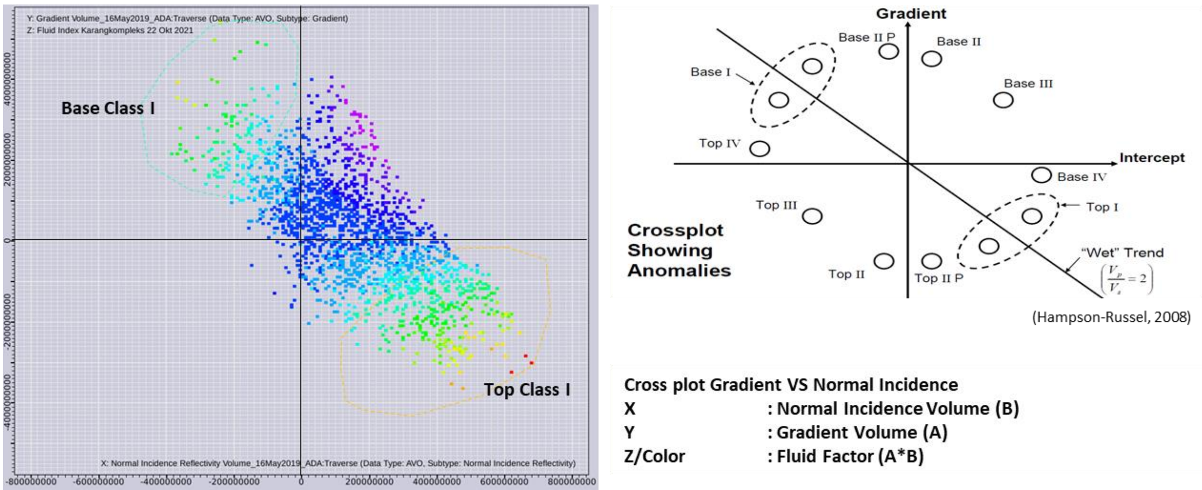


Figure 11. The DHI analysis uses a crossplot gradient vs normal incidence volume with fluid index color value. It can be seen that top class I is in quadrant II and base class I is in quadrant IV

The results of the AVO analysis were then performed inversion to obtain the gradient and normal incidence volume. From the both, the fluid index volume is made. To analyse the presence of hydrocarbons, a crossplot between the both was carried out with the color value of the fluid index. The crossplot represent that the top gas class I is in quadrant II and the base gas class I is in quadrant IV. Finally the results of the zooning top and base gas class I are then overlaid onto the full stack cross section, gradient stack and normal incidence stack (**Figure 9 – Figure 11**).

CONCLUSION

DHI distribution map has been validate for existing area and the result can be reference for determine the new prospect in Karang Kompleks Structure (**Figure 12**). This study might not be applied in other structure.

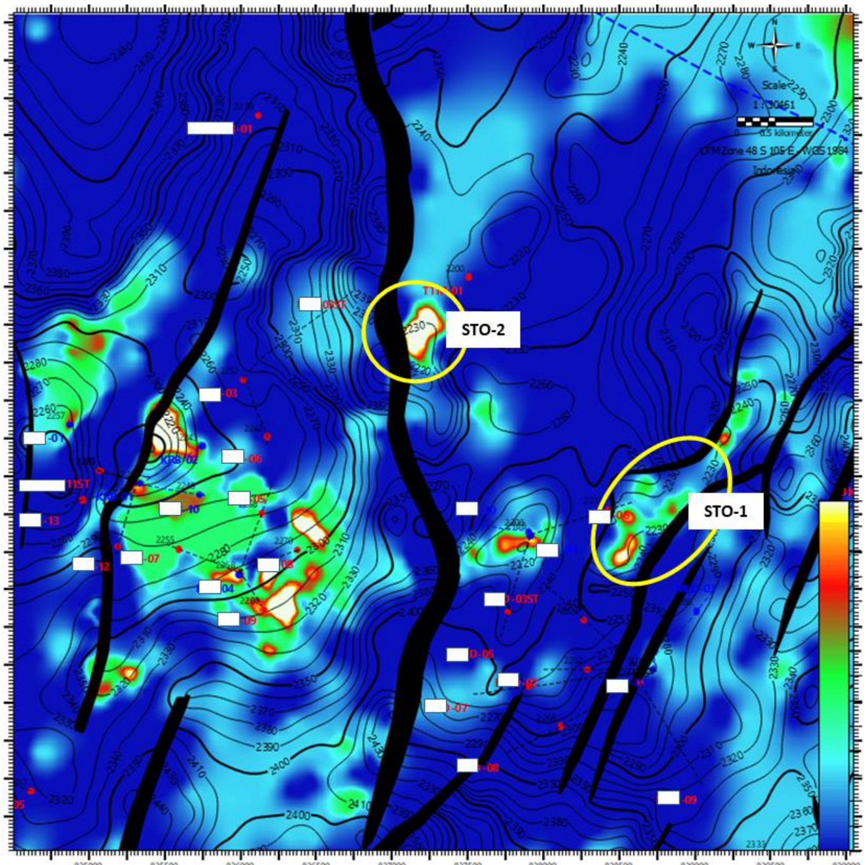


Figure 12. Fluid Index Map in area existing and new prospect area for layer BRF

ACKNOWLEDGMENTS
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REFERENCE

[1] Noble, R. A, Pramono Hehu., and Charlie Wu, C. H 1997 Oil Kitchen and Petroleum Bearing Sub-Basin in Northwest Java Area *IPA Proceedings, Annual Convention, Jakarta, 26 : pp 123-151*

[2] Reminton, C.H., and Pranyoto 1985 a Hydrocarbon Generation Analysis in Northwest Java Basin using Lopatin's Method *Proceedings of the 14th Annual Convention Indonesian Petroleum Association, Jakarta, Indonesia*