ABSTRACT

IDENTIFICATION OF LITHOLOGY AND GAS DISTRIBUTION ON PAY ZONE USING AVO ANALYSIS AND SIMULTANEOUS INVERSION IN "VR" FIELD, GULF OF MEXICO

By

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Lithology and gas identification in zone of Pay sand are part of reservoir characterization to determine zone of interest in “VR” field, Gulf of Mexico. Target zone is a layer of Pay sand with stratigraphic pinch-out trap, 26.95 meters thickness and located in ultra deep off-shore exploration 2970 meters. The methods applied include AVO analysis to provide boundary properties of rock layers and reflectivity’s change of the lithology in analyzing the presence of gas using AVO attribute. Furthermore, performing Simultaneous Inversion and *Lambda-Mu-Rho* (LMR) transformation for more detailed and representative analysis of rock’s physical properties. In this research also calculate effective porosity logs, prediction of Vshale and Vs log using Fluid Replacement Model (FRM) with AVO Zoeppritz syntetic modeling for validation at Sw = 29%. The results showed that Pay zone is a type of sand reservoir class III AVO at TWT 2550 ms, which has a lower impedance value than the cover layer. Simultaneous Inversion method are good enough to determine distribution of reservoir properties, with a correlation value of inversion results 0.98 in the target zone. Based on the results of log crossplot sensitivity analysis, results of Simultaneous Inversion and LMR analysis showed interest zone of Pay sand in "VR" field, consisting of gas sand reservoir, and cemented tight sand lithology, which has a lower Zp value [6000-7800 (m/s)*(g/cc)], relatively high Zs [3000-4500 (m/s)*(g/cc)], low density (2.2 to 2.38 g/cc), low Vp/Vs ratio (1.8 to 1.9 unitless), low *Lambda-Rho* (incompressibility) (20-21 GPa*g/cc), relatively high *Mu-Rho* (rigidity) (10-18 GPa*g/cc) and low *Lambda over Mu* (1.2 to 1.7 unitless). Zone of interest scattered around the VR-1 well, and the south of "VR" field with a depth from 3150 to 3250 meters.

Keywords: Reservoir characterization, Simultaneous Inversion, *Pay* sand, Amplitude Variation with Offset (AVO), Fluid Replacement Model (FRM), and *Lambda-Mu-Rho* (LMR).

ABSTRAK

IDENTIFIKASI SEBARAN LITOLOGI DAN GAS PADA ZONA *PAY SAND* MENGGUNAKAN ANALISIS AVO DAN INVERSI SIMULTAN DI LAPANGAN "VR", TELUK MEKSIKO

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Identifikasi litologi dan gas di zona *Pay sand* merupakan bagian dari karakterisasi reservoar yang bertujuan untuk memetakkan *interest zone* dari lapangan "VR", Teluk Meksiko. Zona target merupakan lapisan *Pay sand* dengan perangkap stratigrafi *pinch out*, yang memiliki ketebalan 26,95 meter dan kedalaman eksplorasi *ultra deep* 2970 meter. Metode yang diterapkan, yakni analisis AVO untuk memberikan sifat batas lapisan batuan serta perubahan reflektivitas litologi dalam menganalisis keberadaan gas menggunakan AVO *attribute*. Selanjutnya, dilakukan Inversi Simultan dan transformasi *Lambda-Mu-Rho* (LMR) untuk analisis sifat fisika batuan yang lebih detail dan representatif. Dalam penelitian ini juga dilakukan prediksi log porositas efektif, *Vshale* dan log Vs dengan metode *Fluid Replacement Model* (FRM) dengan validasi AVO Zoeppritz *syntetic model* menggunakan Sw = 29%. Dari hasil penelitian menunjukkan bahwa *zona Pay sand* merupakan jenis reservoar *gas sand* kelas III pada TWT 2550 ms, yang memiliki nilai Impedansi lebih rendah dibandingkan dengan lapisan penutupnya. Metode Inversi Simultan cukup baik dalam mendeterminasi persebaran properti reservoar, dengan korelasi hasil inversi sebesar 0.98 pada zona target. Berdasarkan hasil analisis sensitivitas data log, hasil Inversi Simultan dan analisis LMR menunjukkan zona *interest Pay sand* pada lapangan "VR", terdiri dari reservoar *gas sand* dan litologi *cemented tight sand*, yang memiliki nilai Zp rendah [6000-7800 (m/s)*(g/cc)], Zs relatif tinggi [3000-4500 (m/s)*(g/cc)], densitas rendah (2,2-2,38 g/cc), Vp/Vs *ratio* rendah (1,8-1,9 *unitless*), *Lambda-Rho* (Inkompressibilitas) rendah (20-21 GPa*g/cc), *Mu-Rho* (Rigiditas) relatif tinggi (10-18 GPa*g/cc) serta *Lambda over Mu* rendah (1,2-1,7 *unitless*). Zona *interest* tersebar di sekitar sumur VR-1, dan sebelah Selatan lapangan "VR" dengan kedalaman 3150 hingga 3250 meter.

Kata kunci: Karakterisasi reservoar, Inversi Simultan, *Pay sand*, *Amplitude Variation with Offset* (AVO), *Fluid Replacement Model* (FRM), dan *Lambda-Mu-Rho* (LMR).