

ABSTRAK

ANALISIS RESERVOIR BATU GAMPING UNTUK PENENTUAN SUMUR EKSPLORASI BERDASARKAN PENERAPAN INVERSI AKUSTIK IMPEDANSI 2D DAN 3D PADA LAPANGAN X FORMASI MUNDU CEKUNGAN JAWA TIMUR UTARA

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Minyak dan gas bumi merupakan salah satu sumber energi yang paling dibutuhkan, terbentuk dan terakumulasi melalui suatu proses yang disebut sebagai *petroleum system*. Reservoir karbonat secara spesifik terbentuk dari deposisi material kalsium karbonat (CaCO_3) hasil aktivitas organisme laut seperti koral dan foraminifera pada setting batimetri laut dangkal hingga dalam. Cekungan Selat Madura secara geologis diakui sebagai salah satu cekungan paling ekstensif di Indonesia bagian tengah dengan potensi akumulasi hidrokarbon yang signifikan. Studi ini menerapkan metode inversi seismik untuk memetakan karakterisasi reservoir bawah permukaan melalui analisis penampang vertikal maupun horizontal. Penelitian difokuskan pada analisis korelasi persebaran nilai Impedansi Akustik (AI) dan densitas terhadap potensi reservoir di Lapangan “X”, Cekungan Selat Madura. Basis data yang diintegrasikan mencakup satu sumur referensi serta data seismik 2D dan 3D *Post Stack Time Migration* (PSTM). Hasil inversi seismik mengidentifikasi zona target dengan karakteristik *low impedance* pada rentang 2600–3200 (g/cc m/s), porositas efektif 0,3(v/v) serta nilai densitas berkisar 1,7–1,85 g/cc. Berdasarkan analisis integratif antara anomali AI, densitas, dan *time structure map* yang saling memvalidasi, direkomendasikan penempatan sumur eksplorasi pada zona anomali tersebut yang secara struktural menempati posisi puncak antiklin guna mengoptimalkan target reservoir.

Kata kunci: Akustik Impedansi, Cekungan Selat Madura, Densitas, Globigerina Limestone, dan Inversi Seismik.

ABSTRACT

LIMESTONE RESERVOIR ANALYSIS FOR EXPLORATION WELL DETERMINATION BASED ON THE APPLICATION OF 2D AND 3D ACOUSTIC IMPEDANCE INVERSION IN THE FIELD X MUNDU FORMATION, NORTH EAST JAVA BASIN

By

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Oil and natural gas are among the most essential energy resources, formed and accumulated through geological processes known as the petroleum system. Carbonate reservoirs are commonly developed from the deposition of calcium carbonate (CaCO₃) materials produced by marine organisms such as corals and foraminifera, deposited in shallow to deep marine bathymetric environments. Geologically, the Madura Strait Basin is recognized as one of the most extensive basins in central Indonesia, with significant potential for hydrocarbon accumulation. This study applies seismic inversion methods to characterize subsurface reservoirs through the analysis of vertical and horizontal seismic sections. The research focuses on evaluating the correlation between the spatial distribution of acoustic impedance (AI) and density values and reservoir potential in Field "X", Madura Strait Basin. The integrated dataset consists of one reference well and 2D and 3D post stack time migration (PSTM) seismic data. The seismic inversion results identify target zones characterized by low acoustic impedance values ranging from 2600 to 3200 g/cc·m/s, porosity efektif 0,3 (v/v) and density values of approximately 1,7–1,85 g/cc. An integrated interpretation of AI anomalies, density distribution, and time structure maps shows consistent spatial relationships, indicating that these zones are structurally located at the crest of an anticline. Therefore, these areas are interpreted as prospective targets and are recommended for exploration well placement to optimize reservoir development.

Keywords: Acoustic Impedance, Density, Globigerina Limestone, Madura Strait Basin, and Seismic Inversion.