

Intisari

Cekungan Manui yang terletak di Lengan Tenggara Sulawesi merupakan cekungan frontier yang masih memiliki ketidakpastian tinggi terhadap potensi hidrokarbon akibat keterbatasan data dan kompleksitas evolusi tektonik. Cekungan Manui sebagai bagian utama dari Mintakat Matarombeo menunjukkan indikasi perkembangan ruang akomodasi yang signifikan serta keberadaan sistem struktur yang berperan dalam pengendalian pengisian sedimen dan pembentukan perangkap hidrokarbon. Penelitian ini bertujuan untuk mengkarakterisasi reservoir dan mengevaluasi potensi hidrokarbon di Cekungan Manui melalui integrasi analisis fasies seismik, atribut seismik, dan kerangka geologi regional.

Data yang digunakan meliputi 30 lintasan seismik dua dimensi *post-stack time migration* (PSTM), satu data sumur, serta data gravitasi satelit yang diolah menjadi anomali residual dan dimodelkan secara dua dimensi. Analisis fasies seismik dilakukan untuk mengidentifikasi sekuen stratigrafi, geometri reflektor, dan lingkungan pengendapan. Analisis atribut seismik meliputi RMS amplitudo, *envelope*, frekuensi sesaat, dan *sweetness* untuk menilai variasi litologi, ketebalan lapisan, dan indikasi porositas relatif. Pemodelan gravitasi digunakan untuk memahami konfigurasi kerak dan kondisi bawah permukaan yang mengontrol evolusi cekungan.

Hasil penelitian menunjukkan bahwa Cekungan Manui berkembang di atas kerak benua yang mengalami penipisan dan berada dekat batas benua-samudra, membentuk cekungan asimetris dengan depocenter terlokalisasi. Evolusi cekungan berlangsung dari fase pra-rift dan syn-rift hingga post-rift dan pasca-orogenik, menghasilkan pengisian sedimen klastik awal (Formasi Meluhu-Tokala), perkembangan karbonat bertipe *build-up* (Formasi Tampakura-Eemoiko), serta endapan molasa pasca-orogenik. Fasies dan atribut seismik mengindikasikan keberadaan reservoir potensial pada sekuen klastik, karbonat, serta basement terrekahkan.

Atribut RMS amplitudo dan *sweetness* terbukti paling sensitif dalam mengidentifikasi interval reservoir potensial, sementara frekuensi sesaat membantu membedakan ketebalan dan heterogenitas lapisan. Keberadaan gas *chimney* dan *pockmark* menunjukkan sistem hidrokarbon yang aktif, namun sekaligus mengindikasikan risiko kebocoran akibat sesar-sesar turun yang tidak mampat. Penelitian ini menyimpulkan bahwa Sub Cekungan Manui memiliki potensi hidrokarbon yang prospektif namun berisiko sedang hingga tinggi. Kontribusi utama penelitian ini adalah pengembangan model karakterisasi reservoir berbasis integrasi fasies dan atribut seismik pada cekungan *frontier*, yang meningkatkan pemahaman terhadap sistem petroleum Cekungan Manui dan dapat menjadi acuan eksplorasi hidrokarbon di Indonesia Timur.

Kata kunci : Cekungan Manui, Fasies Seismik, Atribut Seismik, Karakterisasi Reservoir.

ABSTRACT

The Manui Basin in the Southeastern Arm of Sulawesi is a frontier basin that still exhibits a high degree of uncertainty regarding its hydrocarbon potential due to limited subsurface data and the complexity of its tectonic evolution. The Manui Sub-Basin, as a major segment of this basin, shows indications of significant accommodation space development and the presence of structural systems that play an important role in controlling sedimentary infill and the formation of hydrocarbon traps. This study aims to characterize reservoirs and evaluate hydrocarbon potential in the Manui Sub-Basin through an integrated analysis of seismic facies, seismic attributes, and the regional geological framework.

The data used in this study consist of 30 two-dimensional post-stack time-migration (PSTM) seismic lines, one well dataset, and satellite gravity data processed into residual anomalies and modeled in two dimensions. Seismic facies analysis was conducted to identify stratigraphic sequences, reflector geometries, and depositional environments. Seismic attribute analysis includes RMS amplitude, envelope, instantaneous frequency, and sweetness to assess lithological variations, layer thickness, and indications of relative porosity. Gravity modeling was applied to understand crustal configuration and subsurface conditions controlling basin evolution.

The results indicate that the Manui Basin developed on thinned continental crust near the continent–ocean boundary, forming an asymmetric basin with localized depocenters. Basin evolution progressed from pre-rift and syn-rift phases to post-rift and post-orogenic stages, resulting in early clastic infill (Meluhu–Tokala Formation), the development of carbonate build-ups (Tampakura–Eemoiko Formation), and post-orogenic molasse deposits. Seismic facies and attribute responses indicate the presence of potential reservoirs within clastic sequences, carbonate units, and fractured basement intervals.

RMS amplitude and sweetness attributes are shown to be the most sensitive indicators for identifying potential reservoir intervals, while instantaneous frequency assists in distinguishing layer thickness and lithological heterogeneity. The occurrence of gas chimneys and pockmarks indicates an active hydrocarbon system, but simultaneously reflects leakage risk associated with non-sealing normal faults. This study concludes that the Manui Sub-Basin has prospective hydrocarbon potential with moderate to high exploration risk. The main contribution of this research is the development of an integrated seismic facies–attribute-based reservoir characterization model for a frontier basin, which enhances the understanding of the petroleum system of the Manui Basin and provides a reference for hydrocarbon exploration in Eastern Indonesia.

Keywords : Manui Basin, Seismic Fasies, Seismic Attribute, Reservoir Characterisation.