ABSTRAK

EVALUASI POTENSI SUMBER DAYA MINYAK DAN GAS, CEKUNGAN LAUT MERAH SUDAN

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Cekungan Laut Merah Sudan merupakan salah satu cekungan rift yang terbentuk akibat proses pemekaran Laut Merah dan memiliki potensi hidrokarbon yang cukup besar. Penelitian ini dilakukan pada Formasi Wardan, Formasi Zeit, dan Formasi Dungunab menggunakan data sumur AFAR-1 dan AFAR-2, data seismik 2D, data biostratigrafi, data *sidewall core*, dan data geokimia. Penelitian ini bertujuan untuk mengidentifikasi karakter litologi, elektrofasies, fasies dan lingkungan pengendapan, menentukan parameter petrofisika reservoir, mengestimasi potensi sumber daya minyak dan gas bumi, serta mengevaluasi risiko geologi pada daerah penelitian. Metode untuk melakukan estimasi sumber daya menggunakan metode volumetrik melalui simulasi Monte Carlo, serta evaluasi risiko geologi menggunakan metode Otis dan Schneidermann (1997). Hasil penelitian menunjukkan bahwa Formasi Wardan didominasi oleh batupasir dengan sisipan serpih, Formasi Zeit berupa perselingan batupasir dan serpih, sedangkan Formasi Dungunab didominasi oleh halit, anhidrit, dan serpih. Formasi Wardan memiliki nilai NTG sebesar 0,054, porositas 27,1%, dan Sw 90,1%; Formasi Zeit memiliki kualitas reservoir terbaik dengan NTG 0,172–0,432, porositas 18,3–24,7%, dan Sw 19,7–87,4%; sedangkan Formasi Dungunab memiliki NTG 0,350, porositas 30,9%, dan Sw 2,4%. Interpretasi DSM mengidentifikasi empat potensi lead, yaitu Lead PY-1, PY-2, PY-3, dan PY-4. Estimasi sumber daya menunjukkan bahwa Formasi Wardan memiliki *Oil In Place* sebesar 6,04–18,45 MMBO dan *Gas In Place* sebesar 7,34–22,31 BCF; Formasi Zeit sebesar 2.210,70–4.350,71 MMBO dan 1.859,09–3.641,08 BCF; sedangkan Formasi Dungunab sebesar 5.914,60–11.030,56 MMBO dan 4.926,93–10.021,60 BCF. Evaluasi risiko geologi menghasilkan nilai *Probability of Geological Success* (Pg) sebesar 0,0577–0,0977, dengan Formasi Wardan dan Formasi Zeit termasuk kategori *High Risk*, sedangkan Formasi Dungunab termasuk kategori *Very High Risk*.

Kata kunci: Cekungan Laut Merah Sudan, Lead, Monte Carlo, Resiko Geologi, Sumber Daya Migas

ABSTRACT

EVALUATION OF OIL AND GAS RESOURCE POTENTIAL IN THE SUDANESE RED SEA BASIN

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The Sudanese Red Sea Basin is one of the rift basins formed as a result of the Red Sea opening and possesses significant hydrocarbon potential. This study was conducted on the Wardan, Zeit, and Dungunab Formations using data from the AFAR-1 and AFAR-2 wells, 2D seismic data, biostratigraphic data, sidewall core data, and geochemical data. The objectives of this study were to identify lithological characteristics, electrofacies, depositional facies and environments, determine reservoir petrophysical properties, estimate oil and gas resource potential, and evaluate the geological risk of the study area. Resource estimation was carried out using the volumetric method integrated with Monte Carlo simulation, while geological risk assessment was performed using the Otis and Schneidermann (1997) method. The results indicate that the Wardan Formation is dominated by sandstone interbedded with shale, the Zeit Formation consists of interbedded sandstone and shale, whereas the Dungunab Formation is dominated by halite, anhydrite, and shale. The Wardan Formation has a Net-to-Gross (NTG) value of 0.054, an effective porosity of 27.1%, and a water saturation (Sw) of 90.1%. The Zeit Formation exhibits the best reservoir quality, with NTG values ranging from 0.172 to 0.432, effective porosity of 18.3–24.7%, and Sw of 19.7–87.4%. Meanwhile, the Dungunab Formation has an NTG of 0.350, effective porosity of 30.9%, and Sw of 2.4%. Interpretation of the Depth Structure Map (DSM) identified four potential leads, namely PY-1, PY-2, PY-3, and PY-4. Resource estimation indicates that the Wardan Formation contains 6.04–18.45 MMBO of Oil in Place and 7.34–22.31 BCF of Gas in Place; the Zeit Formation contains 2,210.70–4,350.71 MMBO of Oil in Place and 1,859.09–3,641.08 BCF of Gas in Place; while the Dungunab Formation contains 5,914.60–11,030.56 MMBO of Oil in Place and 4,926.93–10,021.60 BCF of Gas in Place. Geological risk evaluation yielded Probability of Geological Success (Pg) values ranging from 0.0577 to 0.0977, with the Wardan and Zeit Formations classified as High Risk, whereas the Dungunab Formation is classified as Very High Risk.

***Keywords**: Sudanese Red Sea Basin, Lead, Monte Carlo Simulation, Geological Risk, Oil and Gas Resources.*