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Petroleum Geology and Exploration Potential of Block 5, Offshore Angola, West Africa

Block 5 is an approximately 5000 sqkm exploration block, situated northwest from Luanda in the northern part of the Kwanza Basin. Eleven wells, drilled from 1973 to 1991 by Conoco resulted in three marginal discoveries and several good oil shows, mainly in the Albian Mucanzo and Catumbella Formations. Recently, the Block 5 exploration potential has been re-evaluated using a petroleum systems approach and interpretation of a new nonexclusive 3D seismic dataset by a multidisciplinary team.

Two oil-prone source rocks were documented in the pre-salt section, deposited in syn-rift grabens (Lower Bucumazi) and in the early post-rift drape (Cuvo) Formations, respectively. Oils from both sources have been detected in Block 5, using biomarkers and carbon isotope analyses. The Cuvo Source Rock has been modelled to be presently early to mid mature for oil generation in the south-western part of the block.

More than 500m thick good reservoir quality sands have been documented and interpreted in the western half of the block in the Albian, shallow water, fluvio-deltaic Mucanzo Formation. A second possible reservoir segment has been interpreted in the Upper Albian Quissonde Formation, which probably was deposited in an outer shelf to upper slope setting. These sands were incorporated into north-trending elongated salt-cored raft blocks, which formed mainly during the Cretaceous. Traps are three way closures, with the forth-way being the main raft-bounding fault.

The charge model for the Albian reservoirs calls for a tortuous migration path from the pre-salt Cuvo source through salt windows, formed within the raft blocks. Source rock richness, along with the migration efficiency are considered to be the highest risk for exploration in the western half of the block. Seals for the Mucanzo and Quissonde reservoirs are the tight Catumbella limestones and the labe mudstones and marls, respectively.