Three dimensional reservoir geological model and multiple scenario volumetrics of the F23 Miocene carbonate build-up, Luconia Province, offshore Sarawak

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Typically, the geology and production behaviour of gas reservoirs in the atoll shaped Miocene carbonate structures of the Central Luconia province, offshore Sarawak, are best constrained in the center of the field due to a biased distribution of wells. Control over the reservoir architecture, pore volume and fluid flow behaviour decrease significantly towards the reservoir flanks introducing uncertainties for an optimized reservoir management. An integrated reservoir geological study was initiated with the objective to decrease uncertainties and increase the understanding of their impact on static and dynamic reservoir models. Data from an integrated core, seismic and petrophysical evaluation, including lateral seismic porosity prediction and the application of geostatistics, were combined to a 3-D fully computerized reservoir model. The core and seismic evaluation reveals a complex internal reservoir architecture strongly influenced by paleo-wind pattern and sea level fluctuations with backstepping, progradational and aggradational growth phases. Transgressive systems tracts are represented by dense argillaceous limestones which form more or less continuous blankets which may isolate gas volumes and influence vertical water movement. During repeated periods of flooding the platform back-stepped up-wind only to prograde down-wind again during sea-level high stands until re-reaching the previous platform margin.

An uncertainty tree was constructed for the F23 field in order to assess the impact of combined and individual uncertainties on static and dynamic reservoir models. Parameters considered in the uncertainty tree are the top carbonate structure, the porosity distribution, the hydrocarbon saturation and the gas expansion factor. Most likely, low and high cases were used in order to assess the parameters with the most impact on the uncertainty of hydrocarbon volume and fluid flow, in particular possible flank water encroachment.

Results from the volumetric calculations arrive at a most likely GIIP close to that derived from material balance analysis. However, low and high cases significantly exceed the uncertainty range of the material balance GIIP. While the geology of the reservoir flank is now better constrained using refined seismic interpretations, uncertainties in these areas remain high.

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