Reserve Evaluation of a Pre-Mature Carbonate Field Based on Integrated Reservoir Modeling

Jiajie Chen and Hung Lung Chen
Marathon Oil Company
JChen@MarathonOil.com

Carbonate fields may experience pre-mature water breakthrough due to local distribution of highpermeability zones or fractures. It is therefore important to conduct integrated reservoir modeling in order to define the stratigraphic and structural framework in detail, understand the fluid contact, and estimate remaining reserve.

Taking an integrated approach, we have carried out detail reservoir modeling for a carbonate field in Western Canada. The producing interval is the Late Triassic Baldonnel Formation, dominantly with porous dolostone and limestone. We started with seismic mapping on available 2-D lines. The structure grids were tied with picks from existing wells. We conducted detailed core and thin-section analysis, identified various petrophysical facies, and tied the variation of rock types to a sequence stratigraphic model. Further, we constructed a geocellular model to delineate variation of petrophysical properties in 3-D. We also collected and analyzed available pressure data to compile P/Z plots and inferred original gas in place from reservoir engineering prospect. The original gas in place revealed by the geological model concurs with that from the engineering model, suggesting that the original gas-water contact was at 775 m subsea, although it was impossible to distinguish gas-water contact in a traditional way due to the presence of bitumen in the reservoir zones. We modeled the variation of the gaswater contact and compared the step changes of remaining reserve to decline curve analysis. The results suggest that the current gas-water contact is between 758 and 762 m subsea, giving a remaining reserve of about 89 BCF (with 62 BCF recoverable). With the current contact inferred, it is possible to recommend several new locations in the northern part of the field to develop the remaining reserve. We conclude that an integrated engineering-geoscience approach can lead to a significant increase in resource capture.