

## **Integration of Facies Analysis and Geostatistics in the 3D Modeling of South Swan Hills Devonian Reef Reservoir**

Stephen Longfield, Mandy Dunlop, Hadi Slayman, Steve Charbonneau, Yuan Zee Ma, Suzy Chen  
Penn West Exploration, Schlumberger Data Consulting Services

The South Swan Hills reservoir is a Devonian carbonate reef complex that is located in west-central Alberta, Canada. A 3D geocellular model was successfully constructed to accurately ascertain the STOIP and to optimize future development through simulation studies, while incorporating multi-disciplinary data sets.

The first stage of the project was to complete a full field core study to determine facies types, depositional environment and the stratigraphic architecture of the reef. The core was logged over a year and a half and used to create 2D facies probability maps. These were used with a geostatistical algorithm to distribute each facies within the inter-well regions. This allowed the uncertainty inherent in facies mapping to be factored into the modeling, while at the same time honouring well data and facies relationships. A porosity model was generated using a geostatistical algorithm, which honored the porosity log data at the wells, the porosity distribution *within each facies* and, through the use of variograms, any geospatial trends. Uncertainty in the true facies, porosity and fluid saturation distribution, as well as in the oil/water contact, was then quantified in order to determine a range of possible STOIP.

The modeling effort resulted in a P50 STOIP of 140 MMbbl more oil (total 1.09 Bbbl), which is 14.7% larger than previous studies completed on the South Swan Hills unit. This more robust and realistic geological model was subsequently up-scaled to a reservoir simulation model, which is being used for history matching and forecasting production performance, aiming to identify infill drill locations and enhanced oil recovery opportunities to increase oil production rates and reserves.