## Reservoir Characterization of the Clive South A Nisku Field

David Garner*, TerraMod Consulting Inc., Tony Geier and Mark Balen, Ulster Petroleum Ltd., Jay Gunderson, Mincom Inc.

We present a case history of a geostatistical method of reservoir characterization followed by a successful reservoir simulation. The key objective of the study was to determine feasibility and plan an efficient water-flood scheme for the Nisku Formation of the Clive South A Field.

The main goals of the 3D stochastic modeling in the field study were as follows:

- Pilot the usefulness of a geostatistical methodology in characterizing a Nisku carbonate reservoir for the purpose of reservoir simulation.
- Provide an image of the reservoir that has the same variability as the natural phenomenon. The methodology was intended to measure the geological heterogeneity from the wells at the well log scale and to honour that variability in the inter-well space.
- Combine greater geological, petrophysical and/or geophysical detail and heterogeneity into the models than would normally be achieved by conventional mapping methods (Galli et al, 1994).
- Gain insight into the stratigraphic framework and architecture of the reservoir (Lemouzy et al., 1995)

Our database consisted of 73 wells, of which all 73 had porosity logs and 49 had routine core analysis information. Core-tied porosities were generated from log porosities. Continuous permeabilities were derived from porosity-permeability relationships and core. Using porosity histograms, petrophysical lithofacies were identified using 5 categories of porosity ranges. The categorization was suitable for the scale of our problem while recognizing alternative detailed carbonate texture and rock fabric classification schemes are attainable (Lucia, 1995). Two more lithofacies, anhydrite and shale, were determined from the geological interpretation. Structure tops were available in 77 wells. No seismic data was available.

Lithology, porosity and permeability volumes were built on high resolution grids. The goal was to have an image of the spatial distribution of the physical parameters for fluid flow modeling. A generally robust simulation technique called a truncated Gaussian simulation (Matheron et al., 1987, Galli et al., 1994) was applied for the lithofacies. Petrophysical distributions were assigned to each lithofacies category. A stochastic reservoir model was then built for the study area and three final models were delivered. A northeasterly trend of increasing porosity was measured and confirmed by the geological interpretation. A non-stationary geostatistical method designed to ensure an increase in porosity to the north was used (Johann et al., 1997). Non-stationarity refers to the presence of a geological trend within the study area.

The subsequent fluid flow or reservoir simulation required averaged values of the petrophysical data on a coarser scale than was used to model the reservoir geologically. Porous volumes were averaged. Since permeability is a non-additive parameter, the algebraic isotropic analytical method was applied to estimate the effective absolute permeabilities in the upscaled models.

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