# Sequence Stratigraphic and Depostional Controls on Reservoir Continuity within the Cretaceous Doe Creek Member of the Kaskapau Formation, Valhalla Field, Alberta, Canada

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## Abstract

The Doe Creek Member of the Late Cretaceous (Cenomanian) Kaskapau Formation is located in northwestern Alberta on the Peace River Arch of the Western Canadian Sedimentary Basin. Valhalla Field was discovered in 1979 and is the major producer of hydrocarbons from the Doe Creek interval. Estimates of original in-place oil and gas at Valhalla are 279 million barrels and 44.7 billion cubic feet, respectively. As of May 2008, 65 million barrels of oil (82% of recoverable reserves) and 13.5 billion cubic feet of gas (42% of recoverable reserves) have been recovered through primary and secondary depletion. As production from the Doe Creek "I" pool declines, increases in recoverable reserves will rely on the application of tertiary recovery methods. The effectiveness of both secondary and tertiary recovery is reliant upon a detailed understanding of the preferred pathways for fluid flow within the reservoir interval.

Reservoir Sandstone bodies of the Doe Creek Member trend NE to SW, range from <1 m to 8 m in thickness and are composed of very-fine to fine-grained marine shoreface deposits. These sandstones grade both laterally and vertically into marine shales, and in conjunction with a southwestward regional dip, provide the trapping mechanism that accounts for hydrocarbon accumulation at Valhalla.

Core-observed depositional facies and well log attributes are used to construct a well log transform to predict facies in wells lacking core control, and to group depositional facies into four distinct associations, i.e,, reservoir facies, based on reservoir quality. The spatial and temporal distribution of reservoir facies within the Doe Creek Member was assessed by evaluating the sequence stratigraphic controls on reservoir quality and continuity across Valhalla Field. A total of ten retrogradationally-stacked parasequences and/or associated bedsets occur within the Doe Creek interval of which four include reservoir quality sandstone (I-1, I Sand, I+1 and I+2). For these sandstones, maps were generated that depict the spatial distribution of reservoir facies, average effective porosity, gross pore volume thickness, hydrocarbon pore volume thickness and the average fraction of calcite cement. Comparison of these maps with fieldwide trends of total fluid and oil production suggest a strong correlation, and validate the utility of the sequence-keyed stratigraphic framework presented in this study as a guide for enhanced oil recovery.