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Sedimentology, Sequence Stratigraphy and Reservoir Characterization of the 'Wilrich', Spirit River Formation, west-central Alberta

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Summary

Progradational, wave dominated shoreline sandstones forming extensive, laterally continuous reservoirs often have sweet spots that are not revealed by net sandstone maps and cross sections. The study area (T46 to 57 and R14 to 22 W5) is located within the Alberta Deep Basin in west-central Alberta. The petroleum industry referred 'Wilrich', is a wave dominated, mainly progradational, slightly aggradational, shallow marine deltaic shoreline succession that prograded northward along the foreland basin axis following a maximum transgression of the Moosebar Sea. Lateral changes in composition, sedimentary processes and trace fossil assemblages are documented in cores within the study area, together with identification of key sequence stratigraphic surfaces. Based on cored wells, sedimentary facies and stratigraphic surfaces were picked and correlated between wells based on the geophysical well log response, showing subtle variations in facies thicknesses, which together with the identification of sequence stratigraphic surfaces allows for the subdivision of the 'Wilrich' sandstone sheet into several parasequence sets. The sandstone sheet formed as laterally northward accreting shorelines, with major marine flooding surfaces separating the sandstone sheet into several parasequence sets. The progradational 'Wilrich' is the older and geographically southern parasequence sets of the Spirit River Formation clastic wedge, with the overlying Falher Member characterized by a dominantly aggradational to slightly progradational stacking pattern.

The 'Wilrich' is an emerging highly economic liquids rich tight sandstone play hosting a continuous hydrocarbon accumulation. This study integrates along shore variation in shore normal facies architecture, sedimentary facies, and unconventional reservoir property measurements to identify potentially higher reservoir quality zones, sweet spots. This is accomplished through the identification of subtle lateral differences in facies thickness, sedimentary processes, mineral composition and grain texture leading to changes in porosity, pore types and thereby permeability of the laterally continuous tight sandstones.

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