GeoConvention
Calgary • Canada • March 7-11 2016
OPTIMIZING RESOURCES

Contrasting Reservoir Properties for Albian Wilirch and Falher Shoreface Sandstones, Spirit River Formation, West-Central Alberta

Dillon J Newitt and Dr. Per K Pedersen
Department of Geoscience, University of Calgary
djnewitt@ucalgary.ca and pkpeders@ucalgary.ca

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. Within the sandstone sheet, mineral composition and depositional processes likely varied both along the shoreline and through time as it was deposited, resulting in subtle lateral changes in porosity, pore types and thereby permeability of the sandstones. The study area (T46 to 57 and R14 to 22 W5) is located within the Alberta Deep Basin in west-central Alberta. The Wilrich Member is a wave dominated, mainly progradational, slightly aggradational, shallow marine shoreface 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 petrophysical 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 shoreface sandstone sheet into several parasequences. The sandstone sheet formed as laterally northward accreting shorefaces, with flooding surfaces separating the shoreface sandstone sheet into several parasequences. The progradational “Wilrich” shorefaces are the older and geographically southern shorefaces of the Spirit River Formation clastic wedge, with the overlying Falher Member characterized by an aggradational to slightly progradational stacking pattern. This likely leads to meteoric and then more brackish waters filling pores during early diagenesis, leading to differences in pore types and thereby permeability of the sandstones between the Wilrich and Falher Members.

This study highlights key sequence stratigraphic surfaces in order to unravel the internal architecture, as well as autocyclic variation, within laterally continuous sandstone sheets to characterize the different parasequences by their mineral composition and sedimentary processes and thereby identify sweet spots within a tight sandstone reservoir. It also highlights the regional stratigraphic depositional difference between Wilrich and Falher shoreface sandstones which leads to the potential control for the unconventional resource play of the Wilrich Member.

Acknowledgements

The author would like to thank the Tight Oil Consortium (TOC) for continuous funding and support of this project. Additionally, the supervision of Dr. Per Pedersen at the University of Calgary, geoLOGIC systems for providing software, the AER Core Research Centre for allowing core access, and feedback provided by other students in the Centre for Applied Basin Studies (CABS).