A High Resolution Sequence Stratigraphic Framework in the Cardium Formation, West Pembina Boundary, Alberta, Canada

Adam Fraser*, Department of Geoscience, University of Calgary, Calgary, Alberta

afraser@ucalgary.ca

and

Dr. Per Kent Pedersen, Department of Geoscience, University of Calgary, Calgary, Alberta

pkperders@ucalgary.ca

GeoConvention 2012:Vision

Introduction

The Cardium Formation is comprised of offshore to shoreface sandstones and conglomerates, and contains one of the largest oil accumulations in Canada; Pembina oil field in central Alberta. Since the 1950's, the primary target in the Cardium Formation has been the shoreface sandstones and conglomeratic reservoirs. Recently multi-stage fractured horizontal wells have been targeting the low porosity and permeability Cardium sandstones. In order to explore for additional oil reserves reservoir in this formation, an enhanced understanding of reservoir geometry and compartmentalization is necessary. High resolution sequence stratigraphy and studies on modern day dips of high and low energy shorefaces show that the parasequences behave in a shingled manner. A high resolution sequence stratigraphic framework has been established utilizing the vast well log database in Townships 47-49, Ranges 11-14 to better understand facies distributions in the Cardium Formation that will ultimately lead to enhanced reservoir characterization.

Theory

Previous stratigraphic studies of the Cardium Formation has mainly used allostratigraphy as a method to correlate surfaces and lithologic units (e.g. Plint et al.,1986). This method has produced a basin scale stratigraphic framework to understand basin development and depositional history; however additional stratigraphic surfaces and complexities may exist. Modern day shoreface studies show that shorefaces architecture is complex, with seaward inclined surfaces segmenting the shoreface sandstone bodies. High to low energy shorefaces such as Sapelo Island, Georgia, Galveston, Texas, and Port Hueneme, California show shoreface surfaces are inclined ranging from -0.5 - -5.0^{o} that gradually become almost horizontal basinward.

High resolution sequence stratigraphy using facies associations and sandstone/shale ratios in cores show there are imbricated parasequence stacking patterns in adjacent wells. This signifies that Cardium shoreface deposits are not genetically correlative in a basinward direction. This relationship is similar to the Viking Formation in the Joarcam field; Alberta, which also shows imbricated parasequence stacking patterns in adjacent wells (Posamentier et al, 1992). The main sequence stratigraphic control for this relationship is in forced regression. Observations suggest that using

relationships between parasequence stacking patterns is the most effective method to produce a high resolution sequence stratigraphic framework.

Conclusions

Generating a high resolution sequence stratigraphic framework is key to the exploration and development of this new Cardium tight oil play as it documents the lateral continuity, facies distribution and the variability of reservoir properties including porosity, permeability, flow characteristics, and hydraulic fracture characteristics.

Acknowledgements

I would like to thank Dr. Per Kent Pedersen for all of his help and support on this project. I would also like to thank the sponsors of the Tight Oil Consortium for their funding of this project.

References

Plint, A.G., Walker, R.G. and Bergman, K.M., 1986. Cardium Formation 6. Stratigraphic framework of the Cardium in subsurface. Bulletin of Canadian Petroleum Geology, Vol 34, No. 32, p 213-225.

Posamentier, H.W., Allen, G.P, James, D.P., and Tesson M. 1992. Forced regressions in a sequence stratigraphic framework: concepts, examples, and exploration significance. American Association of Petroleum Geologists Bulletin, v. 76, pp. 1687-1709.