Reservoir Characterization and Depositional Interpretation of the Middle Cretaceous Jumping Pound Sandstone in the Southern Alberta Foothills

Nick A. Zajac*, Department of Geoscience, University of Calgary
nazajac@ucalgary.ca
and
Dr. Per Kent Pedersen, Department of Geoscience, University of Calgary
pkpeders@ucalgary.ca

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The Upper Cretaceous Second White Specks formation, found within the Alberta and Colorado Group across southern Alberta is famously known as a world-class marine source rock, responsible for charging multiple Cretaceous hydrocarbon reservoirs. With unconventional hydrocarbon plays flourishing, source rock intervals are increasingly found to contain potential unconventional type reservoirs, leading to an examination of the reservoir potential of the Second White Specks Formation as presented in this study. The Middle Cretaceous, Early Turonian Jumping Pound Sandstone, found at the top of the Second White Specks Formation in the southern Alberta foothills and plains, represents an unexplored reservoir with large hydrocarbon potential. In order to better understand this resource play, distribution and depositional environment of the Jumping Pound Sandstone must be acquired so that further reservoir characterization can be evaluated.

This study aims to address the regional distribution and architecture of the Jumping Pound Sandstone occurring within the southern Alberta foothills and adjacent plains in a study area spanning T11-18, R2W5-25W4. The interpreted morphology of the sand body, along with lithological facies descriptions allows for depositional interpretation of the sandstone as well as a platform for further reservoir characterization.

Regional distribution, architecture and morphology of the Jumping Pound Sandstone were interpreted through the identification of four facies relationships gathered within both the sand body and underlying Second White Specks shales. Ten cores within the study area were used to characterize these facies relationships. In order to display facies orientation and distribution, shallowing upwards parasequences were mapped across the study area, illustrating regional reservoir trends. Net sandstone mapping of facies relationships also aided the understanding of regional sand distribution. Sixty meters of measured section at an outcrop exposure along Highwood River, as well as gamma ray and TOC data collected at the outcrop, helped correlate the facies relationships between well logs and core across the study area. Lastly, analysis of outcrop, core and petrographic data helped tie sand body architecture together with an interpreted depositional environment, aiding overall reservoir characterization.

Based on the evaluation of outcrop, core and well log data, four facies relationships established the foundation for architectural analysis of the reservoir. Mapping of the facies relationships displayed typical clinoform progradation, illustrating the overall regional trend of the sand body. Architectural variability of the sand body was revealed by clinoform mapping, also highlighting significant reservoir

complexity across the study area. Analysis of core, outcrop and petrographic data provided evidence for depositional environment interpretation of both the Jumping Pound Sandstone and the underlying shale lithologies.

In general, clinoform and net sandstone mapping helped reveal facies variability and sand body distribution across the study area. Reservoir complexity was further illustrated by clinoform deposits, identifying regional depositional characteristics that were previously unknown. Such facies distributions increased the understanding of relationships seen in outcrop, core and wireline logs correlated over the study area. Core, outcrop and petrographic analysis also combined to reveal depositional environment interpretations for the Jumping Pound Sandstone and underlying Second White Specks shale lithologies. In general, marine processes dominating both the Jumping Pound Sandstone and parts of the Second White Specks shales provided insight for further reservoir characterization of this unconventional resource play.

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References

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