

Understanding Carbonates Karsting and Dolomitization through Multi-attribute Seismic Reservoir Characterization

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Abstract

During the Devonian period, Alberta being at the equator was home to massive reefs and carbonate platforms. The Devonian petroleum system of Western Canada is one of the most prolific hydrocarbon system.

The study is focused on detecting karst features and associated dolomitization through the use of seismic attributes, rock physics and inversion. Dolomitized rims of the karst features contain high porosity dolomites filled with oil and gas depending on the present depth. Wabamun formation constitutes of thick carbonate bank that blankets older reef complexes. As the reefs got buried under the later sedimentation, the diagenetic processes of compaction caused the porosity to collapse, especially in the middle of the large barrier reef complexes. This porosity collapse triggered karsting within the later deposited Wabamun carbonates.

Using advanced attribute analysis, we carried out volume curvature, spectral decomposition, waveform facies, fault likelihood and similarity analysis. The above processes allowed us to distinguish morphology of the karsting structures, facies differences in the vicinity of the structures and their proximity to the underlying fault systems. Fault and Fracture analysis revealed small scale fabric of possible conduits of hydrothermal fluids. Seismic inversion is also applied to detect the interlayers of shales below the Wabamun carbonates that could hinder the movement Magnesium rich fluids responsible for hydrothermal dolomitization.