

Characterizing Influences on Diagenesis in Colorado Group Mudstone by Integrating Multiple Datasets

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ABSTRACT

The Cretaceous Colorado Group contains several prolific source rock intervals and host large volumes of oil in west-central Alberta. Several vertical wells have each produced over 1 million barrels of oil from the main source rock of the Second White Specks Formation; however, there has not been repeatable success when targeting this interval. The unpredictable nature of the productivity demonstrates the importance for understanding the 3D heterogeneity of this organic rich mudstone from deposition to diagenesis in order to successfully identify, and exploit hydrocarbons from reservoir "sweet spots". This study focuses on the Second White Specks petroleum system that consists of organic rich, siliceous mudstones of the Fish Scales and Belle Fourche formations and the organic rich, calcareous mudstones of the Second White Specks Formation. Microfacies descriptions from core and thin sections were integrated with petrophysical, RockEval, XRF and CT scan data in order to determine how diagenesis affected the interval of interest. Described microfacies reveal that although there is a lithology change between the formations of interest, similar depositional processes acted upon the sediments of the entire study interval. Thin beds of the same microfacies can have significantly different porosities and permeabilities while having the same grain composition and sedimentary structures present. The variation in reservoir properties suggests that these beds had different diagenetic histories, which appear to be related to the lithology of the under- and overlying beds. This would suggest that diagenetic fluids were primarily locally sourced rather than externally sourced. Understanding controls on the diagenetic history is essential for predicting reservoir "sweet spots" within organic rich mudstones that have undergone significant inorganic and organic diagenesis.