

Unconventional Shale Play Stand-Off in Alberta: Duvernay Formation versus Nordegg Member: Stratigraphy, Rock Properties, Depositional Settings

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Summary

The Devonian Duvernay Formation has experienced significant exploration activity over the last 5 years with over 200 horizontal wells drilled, over half of which have production data available. This activity illustrates the “hot” nature of this play and highlights its richness in both liquid and gas HC resources. The activity has also resulted in an early foundation in understanding the geological properties of the Duvernay, including organic matter maturity, liquid/gas in place reserves, as well as the fracability of the rocks. In general, the Duvernay’s organic-rich shale units were deposited within a relatively protected shallow shelf area surrounded by active carbonate reefs and platforms, with normal bioproductivity but anoxic bottom waters. The shale sequence ranges in thickness from 5- 60 m and during burial and diagenesis, oil and gas generation and migration has led to oil/gas-charged adjacent porous reef complexes. The diagenetic progression and deep burial reduced total organic contents to ~2-7 wt-% with Tmax maturity values ranging between 420->470°C (immature to dry gas).

In comparison, the Lower Jurassic Nordegg Member has seen relatively little activity and testing in the quest to understand the potential hydrocarbon system. The black shales of the Nordegg Member are ~20-40 m thick and have high organic contents commonly in excess of 10 wt-%. The Nordegg sequence was deposited on a shelf slope to shallow carbonate platform where chert and limestone units are present. The maturity of the organic matter in the Nordegg Member ranges from ~400->470°C and hence presents ideal source rock potential for both liquids and gas reservoirs. However, the few completion attempts have delivered poor results and extensive horizontal drilling and completions have never taken off.

Here we present comprehensive datasets for both the Duvernay Formation and the Nordegg Member regarding regional distribution, structural settings, organic matter contents, organic matter maturity as well as mineral compositions and reservoir pressure information in order to highlight the “theoretical” hydrocarbon resource potential of both plays. Favorable and unfavorable factors are presented and drilling and completion issues discussed.