

Lithofacies Characterization and Sequence Stratigraphic Framework of Some Gas-bearing Shales within the Horn River Basin, Northeastern British Columbia

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The mid-Late Devonian Evie, Otter Park, and Muskwa Shales within the Horn River Basin and Cordova Embayment of northeastern British Columbia are currently being targeted for exploration and recovery of shale gas. The reservoir properties and estimated reserves of these organic rich, basinal shales are being reported as comparable to the Barnett shale in Texas.

Detailed core and well log characterization of lithofacies within the Horn River shales has revealed the following. The Evie Shale is a medium grey, organic rich, calcareous, siliceous shale; the Otter Park Shale is a dark grey, calcareous to non-calcareous, siliceous shale; and the Muskwa Shale is a dark grey to black, organic rich, siliceous shale. The Evie and Muskwa Shales are relatively more siliceous and high in organic content.

A high frequency sequence stratigraphic framework has been developed based upon interpretation of depositional environments for each lithofacies and their stacking patterns. The Evie Shale gamma-ray log consists primarily of upward increasing API, coupled with upward dirtying of lithofacies (calcareous lithofacies overlain by argillaceous, calcareous dominated lithofacies). The Otter Park and Muskwa Shales gamma-ray log consists primarily of upward decreasing API, coupled with upward cleaning of lithofacies (argillaceous lithofacies overlain by siliceous dominated lithofacies).

A high frequency sequence stratigraphic framework has been developed based upon interpretation of depositional environments for each lithofacies and their stacking patterns. The framework is at three time scales. A probable 2nd order scale is identified over the late Elfian through early Frasnian age (6.5 ma). At this scale, there is a basal transgressive - highstand Evie sequence and an overlying Otter Park through Muskwa lowstand - transgressive sequence. A probable 3rd order scale is identified over an approximate 1-2 ma age. At this scale, four transgressive - highstand sequences are interpreted through the Evie to Muskwa Shales. At a higher frequency, up to 15 progradational and retrogradational parasequences, averaging <10 m thick, are identified and correlated from the Horn River Basin to the Cordova Embayment.

This characterization aids in the identification of superior source, reservoir, and seal intervals/lithofacies for potential enhanced recovery of natural gas. Lithofacies stacking patterns within the sequence stratigraphic framework may be correlative throughout the basin, further improving exploration and development opportunities in the Horn River Basin.