

A sequence stratigraphic framework for the Horn River Shale, Horn River Basin, British Columbia

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Introduction

The Horn River Shale is an emerging shale gas play in northeastern British Columbia, Canada that contains gas reserves estimated at 448 tcf of ultimate gas in place or greater. The objective of this study is to establish a sequence stratigraphic framework for the Horn River Shale, and to associate rock properties such as lithology, mineralogy and organic content with 2nd and 3rd order sequences and systems tracts. To achieve this, we will examine at least 10+ long cores from the Horn River Basin and integrate sedimentological observations with geochemistry and petrophysics. This presentation describes results from an initial set of two long cores.

Sedimentology and Geochemistry

The Horn River Shale consists of the Evie, Otter Park and Muskwa members. Cores preserve at least ten high-resolution mudstone lithofacies that are sedimentologically and geochemically distinct. The lithofacies range from carbonate-rich to silica-rich mudstones, and preserve varying degrees of lamination, bioturbation, and cementation. Broadly, carbonate-rich mudstones are found in the lower Horn River Shale (Evie) and silica-rich mudstones are found in the upper Horn River Shale (Otter Park and Muskwa). Geochemically, TOC content is highest in the Evie and Muskwa, averaging 3.5 to 4.0%, and 2.5% in the Otter Park.

Sequence Stratigraphy

To the southeast, the platform equivalents of the Horn River Shale are various carbonate deposits of the Elk Point and Beaverhill Lake Groups. These units have been explored traditionally for oil and gas, and their 2nd order sequence stratigraphy is well constrained. Certain 2nd order sequence boundaries present on the platform can be traced into the basin. For example, the sub-Watt Mountain unconformity is a subaerial exposure surface that is expressed in the basin as a thick prograding limestone package capping Evie shale deposition. The limestone package represents the base of a 2nd order T-R sequence in the shale and can be used to constrain the sequence stratigraphic model. Picking out 3rd order sequences within the 2nd order framework is more challenging. For this we advocate tracking the distribution of lithofacies, geochemical signatures, and wireline log patterns vertically and spatially throughout the basin. We would expect to find cyclical stacking patterns within the shale representing three to six 3rd order sequences.