

Correlation and Chronostratigraphy of the Duvernay Formation: Elemental and Stable Carbon Isotope Stratigraphy

Sarah J. Porter¹, Gabriel Rotberg¹, Gemma Hildred¹, Barry Lees¹, Tim Pearce¹, and James Griffiths¹

¹Chemostrat Ltd. and Chemostrat Inc., Welshpool, United Kingdom (sarahporter@chemostrat.com)

Abstract

The Upper Devonian (Frasnian) Duvernay Formation of Alberta is a proven, areally extensive source rock and has become a major and active shale resource play. The Duvernay is conformably overlain by the Ireton Formation and conformably overlies platform carbonates of the Cooking Lake Formation in the East Shale Basin and the Majeau Lake Formation in the West Shale Basin, where the Cooking Lake Formation is absent (e.g. Stoakes and Creaney, 1984). Although productive, the Duvernay consists of a carbonate shale sequence characterised by significant lateral facies variations that produces exploration and development challenges when targeting sweet spots and modelling changes in mineralogy for fracture optimisation. However, the lack of reliable biostratigraphy and variable log response, and lateral facies variation ensures that chronostratigraphic correlation is poor, which in turn hampers regional play fairway mapping. For example, the Duvernay is believed to be age equivalent to the Muskwa Formation, although these plays have different organic and mineralogical characteristics, which implies that more detailed time resolved palaeoenvironmental reconstructions of the Upper Devonian are required. This study demonstrates a proof of concept study of the application of C-isotope chronostratigraphy in combination with elemental chemostratigraphy to constrain the correlation of Duvernay both on a field to sub regional scale.

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