

The Lodgepole Formation Souris Valley Beds: Key Sedimentological Features Used to Characterize Source Rocks and Self-Sourced Unconventional Reservoirs

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Abstract

The informally named “Marker Bed” unit within the Souris Valley Beds is organic rich and heterogeneous regionally and temporally at a macroscopic-, microscopic-, and geochemical-scale. This heterogeneity causes basin-wide correlation of this horizon to be problematic. This study suggests the term “Marker Beds” be replaced by the name Viceroy Unit to better describe where the unit occurs geographically in the subsurface.

Recognizable Sub-facies ‘A’, ‘B’, and ‘C’ within the Viceroy Unit consist of a hierarchy of beds and laminaesets, each of which have sedimentological characteristics similar to the “triple motif” of Macquaker et al. (2010). Each bed is separated by an erosional (scoured) surface and contain laminaesets whose internal structure is indicative of bedload sediment deposition under storm driven ‘event sedimentation’. We propose that the storm driven ‘event sedimentation’ associated with tropical storms off the coast of Louisiana provide a useful sedimentological analog for the Viceroy Unit.

The Viceroy Unit has been identified as possessing a number of characteristics that typify a ‘self-sourcing reservoir’ (i.e., an unconventional reservoir) such as a very high natural micro- to macro-fracture network (Bend and Johnson, 2015), a dominant brittle characteristic, thermally mature organic matter, a high bitumen content (3 to 47 mg bitumen gram rock) and hydrocarbon yield from 2 to 35 mg per gram of rock.

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