

Stratigraphic Architecture and Facies Distribution of the, Montney Formation: Fundamental Control on Horizontal Well Productivity, Dawson Creek Region, NE. BC

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Abstract

The Lower Triassic Montney Formation in northeast B.C. comprises a 300m thick, siliciclastic, shelf margin complex that accumulated adjacent to the western margin of Pangaea during an overall rise in relative sea-level. This overall sea level rise was punctuated by at least three significant episodes of falling relative sea level, which were responsible for the development of laterally extensive and regionally continuous stratigraphic surfaces. These surfaces subdivide the Montney Formation in the Dawson Creek region of NE. BC., into at least three depositional sequences, informally named Sequence 1, Sequence 2, and Sequence 3, in ascending order.

Ephemeral rivers draining an arid coastal plain are inferred to have supplied vast quantities of previously deposited silt to the prograding and aggrading shelf. An integrated sedimentological and ichnological analysis of Montney Formation cores in the Dawson Creek region, suggests that storm and wave influenced deltas were responsible for construction of the shelf and associated clinofolds. In response to falling relative sea level or, conversely, to an abrupt increase in sediment supply, shallow water, shelf-perched deltas are inferred to have migrated across the shelf, towards the shelf margin. Lateral accretion of the margin occurred mainly during the stillstand that followed relative sea-level fall, while aggradation occurred mainly during the periods of stable relative sea level that followed the rising stage of the cycle.

Unconventional tight gas reservoirs in the Montney Formation are associated with successions that comprise the Lowstand Systems Tract, which occur at the base of both Sequence 2 and Sequence 3. Conversely, the Highstand Systems Tracts develops significant reservoir quality in only the uppermost of the three sequences (Sequence 3). This distribution likely reflects increased wave agitation and reworking as a consequence of progradation into shallower water than that which existed during the Highstand Systems Tracts of the older sequences (Sequence 1 and Sequence 2).

Advanced petrographic and petrologic analysis has aided in characterizing the reservoirs associated with the various depositional elements of the respective sequences, and provides additional insights into the nature and controls of reservoir quality. In addition to factors such as reservoir pressure, hydrocarbon saturation, and reservoir geomechanics, primary deposition has exerted an important control on horizontal well productivity, as well as influencing the applicability and effectiveness of the various completion techniques that are being employed. Production and completion data from the Montney Regional Heritage Field demonstrate these inter-relationships and may serve to provide an analogue for unconventional Montney developments elsewhere in the Western Canada Sedimentary Basin.