Sedimentology, Stratigraphy and Reservoir Characteristics of the Montney D1 and D2 Horizons in the Pouce-Coupe Area

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The Montney D1 and D2 horizons in the greater Pouce Coupe Area are characterized by liquids rich natural gas. Situated along the Alberta-British Columbia Border, 150 km north west of Grand Prairie this area has been an important area of Montney exploration for ~ 25 years. Technological innovations over the last 15 years, including horizontal drilling and advances in frac technology, have rendered the moderate porosity and low permeability Montney D1 and D2 horizons economic. To date 490 wells have produced from the D1 horizon and 4 wells have produced from the less understood and more lithologically complex D2 horizon.

31 wells have been cored in the D1 and D2 horizons. Eight Lithofacies were identified based on detailed sedimentological and ichnological descriptions of these core. The study area is interpreted to have been situated in the distal offshore- offshore transition area with turbidity currents being the most important depositional process. The Montney coastline was characterized by rare perennial rivers with common ephemeral / seasonal river systems that only delivered sand and silt to the coast during major storms (Zonneveld and Moslow, 2014). These sudden, often catastrophic, ephemeral fluvial depositional episodes resulted in rapid, albeit short-lived sediment input and, concomitantly, produced oversteepened shoreface profiles. This, coupled with syn-sedimentary tectonics, created an unstable ramp setting prone to mass wasting events, these gravity flows did not have a single point source. Instead they were linearly sourced creating sheet flows.

The D1-D2 transition is characterized by the appearance of silty shale beds. The occurrence of clay in the Montney Formation is rare because significant clay formation by feldspar hydrolysis was inhibited by the lack of time sediments spent in subaqueous feeder channels. Other areas of the Montney that have significant amounts of clay have been interpreted to have accumulated under the influence of rare perennial deltas. The occurrence of sharp-based, silty shale beds within the D1-D2 transition may be relict of hyperpycnal flows from such deltas.

Sedimentary facies deposited in the proximal offshore by linear sourced turbidity currents have been found to have the best reservoir quality. Restricted grain size along with rapid deposition resulted in poorly defined laminae that made post depositional fluid movement through this unit inefficient. As a result this facies is characterized by limited calcite cement and much of the original porosity is retained. Sedimentary

facies deposited by linear sourced turbidity currents in the offshore transition have a higher coarse silt fraction. Higher paleo-porosity/ permeability encouraged diagenetic fluid flow through this unit causing this facies to be highly cemented and of poor reservoir quality.

The D1 horizon comprises thick occurrences of proximal offshore units, resulting in thick uninterrupted pay zones. The D2 horizon comprises multiple shallowing upwards sequences with a predictable succession of proximal offshore deposits overlain by the offshore transition deposits. This results in stacked, thinner (approx. 3-5 m thick) pay zones. Multiple stacked pay zones make the D2 horizon a viable prospect as exploration continues.

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