

Petroleum hydrogeology of the Triassic in the Alberta Basin

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The Triassic and adjacent strata are complex in both their stratigraphy and their associated contained fluids. Facies and structural variations in the strata translate into variations in the permeability and transmissivity of the rocks. Pressure and flow systems reflect the rock property variations. The characterization of these interconnected properties and processes can lead to exploration opportunities. Fundamental to this understanding is a characterization of the formation water flow system which is described in this seminar.

Based on a comparison of hydraulic head distribution for the formation water flow systems, the vertical hydraulic communication between individual aquifer systems is remarkably low given the structural/stratigraphic complexity of the rocks. Vertical communication mainly occurs at spotty locations along the various subcrop edges of individual units. What is common to many aquifers in the succession, are large horizontal variations in hydraulic head suggesting that there is a high lateral variability in the permeability and transmissivity of the aquifers.

The Belloy and Montney aquifer systems both show flow to the northeast in a regional sense from high values adjacent to the thrust-fold belt to low values along the subcrop edges. Both aquifers are characterized by extremely tortuous flow paths when examined on a local scale. These typically consist of interconnected ridges and troughs of high and low hydraulic head where flow is concentrated in the troughs and dispersed at the ridges. The Doig and Halfway aquifers show a departure from the overall northeasterly directed flow. In this case, formation water enters the aquifer systems from along the thrust-fold belt and along the northeastern subcrop edge, and exits either along the northern subcrop edge or in the extreme southeast. The Lower and Upper Charlie Lake aquifers both show a return to generally northeasterly directed flow systems. These also are overprinted by prominent and interconnected ridges and troughs of high and low hydraulic head. The Baldonnel and Nordegg aquifers, while maintaining a northeasterly directed flow system, show much flatter hydraulic gradients in the hydraulic head distributions (widely spaced contours). This suggests that the aquifer transmissivity is relatively high. While tortuous flow paths still exist on a detailed scale, the prominence of these features is greatly diminished. The Baldonnel aquifer has much fresher formation water than in underlying aquifers or the Nordegg aquifer above. It is concluded that the Baldonnel is well connected to recharge from the thrust-fold belt to the west.