

Lower Colorado and Upper Mannville Flow Systems in Underpressured Aquifers Up-Dip of the Gas Charged Deep Basin and their Relationship to the Gas Trapping Mechanism

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The Cretaceous Upper Mannville and Colorado aquifers in T 39 to T 76; R 26 W4M to R 13 W6M are divided into underpressured and normally pressured hydrostratigraphic units (HSUs) that are distinct from the gas charged Deep Basin equivalents. The Viking and Falher reservoirs form underpressured, interconnected HSUs with flow from the Falher to the Viking in areas where the Joli Fou shale becomes more sandy, as clearly established by salinity and head values. Due to the competency of the Colorado Shale above, the pressures in the regional Viking aquifer (and to a lesser extent the Falher aquifer) are primarily influenced by the elevation of the Viking outcrop to the north, as opposed to local topographic drive. P/D ratios are low for both the Viking and Falher HSUs, varying from 4 kPa/m to 9 kPa/m, as a result of the isolation from the surface by the Colorado shales and the lower pressures in the Deep Basin. The large scatter in the data is likely a result of the variation in the surface elevations of tested wells.

The gas-charged underpressured Deep Basin Viking is isolated from the regional outcrop pressured Viking aquifer by a major change in stratigraphy. This results in an effective up-dip seal to the "Deep Basin" reservoirs along a well defined band of low permeability siltstones and shales. This up-dip seal isolates the Deep Basin reservoirs to the extent that they are out of equilibrium with the underpressured Viking and Falher HSUs. The low pressures in the Deep Basin are related to an expansion of pore space due to erosional and glacial rebound and tectonic relaxation.