TOP AND LATERAL SEAL INTEGRITY IN THE THRUSTED TERRAIN OF NORTHEAST BRITISH COLUMBIA, CANADA.

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Successful exploration for natural gas in Cretaceous, Triassic and Carboniferous reservoirs has been ongoing in the foothills belt of northeast British Columbia since the 1970's. Sufficient seismic and hydrodynamic data exists to indicate these gas pools have been filled to the structural spill point with column heights reaching up to 600 metres attesting to the integrity of the seals. These reservoirs require and often exhibit abundant natural fractures created by compression during the Laramide orogeny. The top seals such as the Jurassic Fernie and Triassic Montney shales also have undergone brittle deformation and fracturing but unlike the reservoir units, the fractures within the caprocks tend to be healed with cements. The effectiveness of these relatively brittle top seals to hold large hydrocarbon columns is related to the overall thickness of these shales, their rheology, chemistry and diagenetic history. The results of triaxial stress tests, XRD mineralogy and petrographic studies have been incorporated with well bore data such as FMI™ image logs, dipole sonic logs and drill cuttings to document the changes in top seal integrity with depth. Shallow structures (less than 1500m from surface) have small or no hydrocarbon column, which is likely caused by catastrophic top seal failure. Structural closure may also be compromised by leakage of hydrocarbon along and across the leading edge of the thrust faults. There are relatively few pressure systems present in the Mississippian to Cretaceous interval when compared to the abundance of thrust faults. This is explained by the observation that most thrust faults here die out laterally and only a rare few link up and are regional enough to effectively form a regional hydrodynamic barrier. Of greater concern is the fault juxtaposition risk for reservoirs that are above and stratigraphically close to the basal detachment. In this instance, the proximity to the decollement surface provides for a small to non-existent forelimb and closure on the structure is totally dependant on the leading edge fault acting as a seal. In structures with a fault-bend fold geometry, this risk is particularly high. Exploration success in thrusted terrains analogous to northeast British Columbia should include quantification of risk on both top and lateral seal for each individual prospect. Subtle differences in dip-slip along the fault may dramatically affect juxtaposition risk, as will changes in structural style along strike or depth of seal from surface.