



Manifestations of Migration in Rocky Mountain Unconventional Systems: Charge Gain and Loss

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Summary

It is well known that migration across many distance scales typifies Rocky Mountain petroleum systems. From ultra-long distance migration in the Pennsylvanian-Permian system to more localized migration of incised valley fill systems of the Lower Cretaceous, evaluating migration has been key to delineating economic accumulations. With recent focus on unconventional petroleum systems in Rockies Basins, migration is again coming to the forefront.

Conventional accumulations in Cretaceous sands can be thought of as “charge loss” from a respective source rock and, thus, the unconventional system. Regional pressure data from DSTs, mudweight and sonic logs show localized corridors of altered pressure due to migration. In these corridors, unconventional wells underperform and have a subtle decrease in gas and light ends due to preferential migration.

In addition to charge loss, many reservoirs (both conventional and unconventional) show evidence of additional charge. The reservoirs contain mixtures of various maturity fluids as well as fluids from multiple source rocks. These areas are subject to “charge gain” and thus have productivity that exceeds preliminary estimates of their potential. The regions of charge gain are strongly associated with NE-SW trending lineament zones. The lineaments have been identified by various workers using seismic, grav-mag, satellite and subsurface mapping. This work shows a strong relationship between increased vertical migration and the map of the derivative of the structure map on various bentonite horizons. The derivative value is akin to curvature analysis in seismic data and reflects a higher frequency of faulting and fracturing.

To properly evaluate “tight” petroleum systems in the Rocky Mountain region, the effects of charge gain and loss must be included. When fully integrated with evolving production data, it is clear that these effects are critical in economic evaluations of acreage at hand. Failure to account for these factors significantly increases exploration risk.