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George W. Shurr, GeoShurr Resources, LLC, Ellsworth, MN

Natural Gas Systems in Cretaceous and Tertiary Reservoirs in the Rocky Mountain Region

Natural gas systems in Cretaceous and Tertiary rocks in Rocky Mountain basins fall into two distinct categories: thermogenic and biogenic. There are obvious differences between the two types of systems including geologic setting, depth, gas composition, well performance, and production costs. However, there are also important similarities related to generation, migration, and accumulation in unconventional and conventional reservoirs. Representative fields are used to characterize each type of system.

Both thermogenic and biogenic systems have relatively continuous accumulations of in-situ gas that cover large areas and smaller sweetspots with migrated gas. Unconventional, low porosity and permeability rocks host the in-situ gas and reservoirs with higher porosity and permeability contain migrated gas. Nitrogen content may reflect the degree of migration because high porosity reservoirs have gas with more nitrogen.

Thermogenic systems are basin-specific. Each of the structural basins in the Rocky Mountain foreland has a deep, basin center accumulation of in-situ gas. Shallow, basin margin fields in foreland structures contain migrated thermogenic and/or biogenic gas.

Biogenic gas systems are generally located on shallow basin margins. The Alberta, Powder River, and Denver basins all have thermogenic basin center accumulations, but also have major biogenic gas production on their gently-sloping eastern margins. Early generation biogenic gas is generated shortly after deposition of water sensitive host rocks. Late generation biogenic gas formed long after host rock deposition and is associated with aquifers. The margins of the Williston basin have in-situ early and late generation biogenic gas, as well as migrated thermogenic and early biogenic gas.