

The Type II Source Rock Fallacy: Niobrara and Mowry Case Studies from the Mid-Cretaceous Seaway

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When a major organization like the USGS labels an unconventional play as containing an oil-prone Type II source rock, the paradigm shifts to define a thermal maturity sweet spot. Asset trend analysis in the Powder River Basin Niobrara and Mowry petroleum systems support this to be around 1% vitrinite reflectance equivalence (VReq), which is frequently associated with a heat flow anomaly. The laterals in this zone, however, still exhibit a fair degree of variation in production rates which is partially attributed to source rock heterogeneity. Instead of solely being a Type II source rock, there are also benches dominated by Type mixed oil/gas (II/III), gas (III), and inert (IV) source rock organic facies. The primary variables in organic matter preservation potential include paleogeography and sea level, which influence the oxidation state of the water column and rate of sediment influx. Documentation of the actual kerogen types present in the unconventional benches is performed with organic petrographic methods, augmented by Rock Eval screening, log analysis (density and sonic), and application of fundamental methods in the geochemical toolbox. The results provide an understanding of the indigenous distribution of source rock type (i.e., application of kerogen porosity and generation kinetics) in each of the unconventional benches. It is then possible to apply correction methods for thermal maturity to reveal the optimal landing targets in 3D visualizations. Within the Powder and Wind River Basins, the approach is demonstrated in 1000's of feet of stacked pay opportunities with regional trends identified.