Mudrock Reservoir Deposition & Stratigraphy: Not Homogeneous, Not Boring

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Mudrocks comprise any deposit with >50% of grains <62 microns in size. Lithology consists of variable proportions of biogenic quartz, biogenic carbonate, detrital quartz (and feldspar), detrital carbonate, clays, volcanic ash, organic matter, pyrite, dolomite, and/or phosphate. Major influences on composition and deposition include tectonic setting, source terrane, basin physiography, water depth, circulation and upwelling, oxygenation, climate, eustasy, and detrital influx. With such a wide range of parameters, mudrocks are anything BUT homogeneous and definitely are not boring.

Mudrocks do not simply fill basins passively. Competition between extrabasinal input and intrabasinal biogenic productivity creates conditions for lithologic cycles, clinoform geometries, and water-column stratification. Benthic fauna colonize the seafloor during dysaerobic to aerobic periods, then experience complete "terror" during periods of mass transport. An understanding of these stratigraphic relationships requires regional correlations that commonly cover thousands of square miles.

Macroscopic core description, tied to the stratigraphic framework and integrated with laboratory analyses and petrophysical interpretation, is critical in understanding variations in composition and texture. A rich diversity of facies is discernable in core. Sedimentary structures such as ripple cross laminae, graded bedding, scour surfaces, rhythmic couplets, and minute burrows to "cryptobioturbation" are common. Such features relate directly to depositional processes and sequence stratigraphy. The resulting rock fabric ultimately controls the distribution and production of hydrocarbons in mudrock reservoirs.

Depositional patterns from basins of the Rocky Mountains, Gulf of Mexico, and Canada suggest that mudrock reservoirs are associated with distinct sequence stratigraphic hierarchies. Most prospective mudrock intervals develop during 2nd -order transgressions. In basins with strong extrabasinal sediment influx, the better reservoirs require load-bearing grains and typically form during either 3rd -order highstands or lowstands. By contrast, in basins dominated by intrabasinal biogenic material the best reservoirs often occur in 3rd-order condensed sections. Such units are frequently brittle, with low clay content, high TOC, and abundant microfossils. Thus, the integration of rock description and sequence framework provides better insight into lateral and vertical changes in mudrock character and reservoir targeting.