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Mudrock Reservoirs – Why Depositional Fabric & Sequence Stratigraphic Framework Matter

Jeffrey A. May & Donna S. Anderson

EOG Resources, Inc., Denver, CO

Mudrocks comprise any deposit with >50% of grains <62 microns in size. Composition, fabric, and texture often are extremely variable. Major influences on these parameters include tectonic setting, source terrane, basin physiography, water depth, circulation and upwelling, oxygenation, climate, eustasy, and detrital influx. Thus, mudrock character – which ultimately controls the distribution and deliverability of hydrocarbons – is anything BUT homogeneous.

Macroscopic core description, tied to stratigraphic framework and integrated with lab analyses and petrophysical interpretation, is critical in understanding variability and deciphering patterns in composition, fabric, and texture. A rich diversity of facies can be discerned. Sedimentary structures such as ripple cross laminae, graded bedding, scour surfaces, rhythmic couplets, and minute burrows to “cryptobioturbation” are common. Stratigraphic variations in these features relate directly to changing depositional conditions and sequence position.

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.

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.

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