

Stratigraphy and Petrophysical Characteristics of the Niobrara Formation in the Denver Basin, Colorado and Wyoming

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The ten major stratigraphic units of the Upper Cretaceous Niobrara Formation provide a framework for predicting both hydrocarbon source and reservoir potential of the formation throughout the Rocky Mountain region of the western United States. Water depth, climate, proximity to the thrust belt bordering the seaway on the west, paleobathymetry, current circulation patterns and sea level fluctuations each played a role in shaping the nature and distribution Niobrara lithologies within these units.

The Niobrara Formation contains a mix of chalk and marl lithologies. Coccolith-rich fecal pellets provide a distinctive feature of the formation. Black shaly marls, which are rich in coccoliths and chalk fecal pellets, are the major hydrocarbon source rocks. Similar shaly beds also provide sealing facies overlying more chalk-rich reservoirs intervals. Organic richness in the source interval is typically 2 to 4% but ranges up to more than 7% in less mature rocks. Thermal maturity of these source beds varies regionally on the basis of burial depth and local heat flow. The presence of multiple source beds of varying quality and maturity impact hydrocarbon fluid quality across the play.

Recent developments in wire line logging technologies are allowing operators to better address some of the key criteria for exploiting heterogeneity in this play: pay recognition, lateral placement, and stress profile and orientation variation. The result is a more robust understanding of the complex mix of lithologic components and their effect on petro- physical models, drilling practices and completion optimization.