# Unconventional Potential of the Mowry Shale in Southwest Wyoming

**Samuel M. Hudson[1], Brent Greenhalgh[2], Brad Taylor[1], Austin Toner[1], and Mikayla Kartchner[1]**

[1]Brigham Young University
[2]Dominion Energy Wexpro Company

## Abstract

The Cretaceous Mowry Shale is one of the premiere hydrocarbon producing formations across Wyoming, and has been an active exploration target for recent unconventional oil and gas exploration in basins such as the Powder River and Bighorn basins. The organic rich, siliceous strata acts as a source for conventional hydrocarbon systems in southwest Wyoming as well, where the overlying Frontier Formation and underlying Dakota Formation are among the many proven hydrocarbon reservoirs. As these established conventional fields mature, there is increasing interest in prolonging field life through unconventional development of the Mowry Shale. At the time of Mowry deposition, southwest Wyoming was near the margin of the Mowry Sea, and was also proximal to the major sediment source of the Sevier orogenic uplift. These differences in depositional environment have important implications for source rock richness and preserved organic matter (OM) type. Understanding the geochemical character of these strata is necessary to determine feasibility of unconventional development in the area. Over 150 samples from outcrop, core, and cuttings were characterized using Rock-Eval pyrolysis and X-ray fluorescence (major and trace elements), and a representative subset of samples was examined in thin section. Through integration of organic and inorganic geochemical analysis, important geochemical trends in the Mowry Shale near the western margin of the Mowry Sea can be seen. Rock-Eval pyrolysis shows good to excellent organic richness, with TOC values from ~0.5 to 4% across all samples. Additionally, varying but consistent amounts of terrestrial, detrital OM input can be seen across the study area (Type II/III to Type III kerogen), suggesting a mixed oil/gas hydrocarbon yield. Elemental composition derived from XRF analysis shows that deposition of the preserved organic matter did not occur in an anoxic bottom-water environment, as is often assumed for black shales, but in oxic-suboxic waters. Large amounts of excess silica are seen across all samples, and is shown to be largely biogenic through elemental analysis and thin section examination. This, along with enrichment of nutrient-proxy elements suggest high primary productivity as the mechanism for organic matter preservation. Spatial trends can also clearly be seen in the dataset, with detrital organic matter decreasing to the east (basinward), organic richness increasing in the same direction, and a visual shift from more detrital silica to biogenic silica as seen in thin section. These trends suggest more favorable conditions exist in the eastern portion of the study area. Detailed geochemical characterization of the Mowry Shale through outcrop and subsurface samples leads to a much more complete understanding of the conditions present at the time of deposition, and will lead to more informed exploration and development decisions in southwest Wyoming.