

The Marcellus Shale: Geologic Controls on Reservoir Quality and Geochemical Aspects of Future Potential Resources

Ashley S.B. Douds, Core2Core Geologic
Randy Blood, DRB Geologic Consulting

The Middle Devonian Marcellus Shale is present in vast portions of the geographically extensive Appalachian Basin. Indeed, the Marcellus is found in the subsurface and/or outcrop of New York, Pennsylvania, West Virginia, and Ohio. Mineralogic, depositional, sequence stratigraphic, reservoir pressure, and thermal maturity models explain the variability in lithostratigraphic expression and reservoir development in the Marcellus Shale. Clay-poor, overpressured condensed sections rich in organic-matter describe reservoir facies in existing core development areas in the condensate and dry gas windows. Moreover, such facies are present in large portions of the Marcellus basin that are not currently economic but could be exploited under certain economic conditions. In 2019, the Potential Gas Committee (PGC) estimated that the technically recoverable resource in the Atlantic Region, which is largely driven by the Marcellus, is 1,311 TCF of gas which encompasses large areas that have not been developed indicating a vast remaining resource.

In addition to abundant hydrocarbons, the Marcellus shale hosts as yet unknown quantities of critical minerals that may be extracted from drilling waste streams. Current government sponsored critical mineral research is focused on coal and coal mining by-products; yet the geologic parameters conducive to critical mineral deposition and enrichment in certain coals are also present in shales: clays, organic matter, phosphate grains/beds, and exposure to hydrothermal fluids. Understanding the distribution of these critical minerals, including rare earth elements, and how they align with sequence stratigraphic and thermal maturity trends in the basin, could be an important tool for developing a domestic source of critical minerals for future supply in the United States.