

Lithostratigraphy and Petrophysics of the Devonian Marcellus Interval in West Virginia and Southwestern Pennsylvania

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In the Appalachian basin, Middle Devonian organic-rich shale interval, including the Marcellus Shale, is an important target for exploration. This unconventional gas reservoir is widespread across the basin and has the potential to produce large volumes of gas (estimated to have 1,307 trillion cubic feet of recoverable gas). Although the Middle Devonian organic-rich shale interval has significant economic potential, stratigraphic distribution, depositional patterns and petrophysical characteristics have not been adequately characterized in the subsurface. Based on log characteristics, tied to core information, the lithostratigraphic boundaries of the Marcellus and associated units were established and correlated throughout West Virginia and southwestern Pennsylvania. Digital (LAS files) well logs were used to generate estimates of lithology and fluid content and then compared across the study area. In addition, the lithologic solution was calibrated to X-ray Diffraction (XRD) data. Using previous studies on organic shale, relationships between the natural radioactivity (as measured by the gamma-ray log) were incorporated with new techniques to identify potential pay intervals. The comparison between the Uranium content and the measured bulk density identified intervals in the Marcellus with high gas saturations and compared to corrected water saturations. These techniques of identifying lithology and potential free gas in the Marcellus interval can be extremely useful in identifying exploration targets and when deciding where to fracture stimulate a wellbore.