Petrophysical Analysis of the Utica Shale Play across Eastern Ohio using Core and Well Log Analysis

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Abstract

The extensive Ordovician Utica Shale play in the Appalachian Basin is a mixed carbonate-siliciclastic system that grades from primarily carbonates at its base in the Lexington/Trenton limestones into primarily shale for the Utica. It is the third highest producing dry shale gas play in the contiguous U.S., although is known to produce wet gas and oil in various parts of the basin. Although some data are available on this play, models that scale from well site through basin are not publicly available.

The objective of this research is to create a model capable of reflecting the mineralogy across eastern Ohio as a part of a larger effort to create a scalable model that will encompass the entire Utica Shale Play. This model aims to determine the relationship between far-field tectonics and eustatic changes that allowed for organic material preservation and deposition of this mixed carbonate-siliciclastic system. The Tracker well in Portage County was used to develop a series of petrophysical equations by performing regressions between the well logs, rock pyrolysis data, and XRD derived clay content within Interactive Petrophysics 2021 software. From this, a mineral model was developed, with core data providing initial calibration of the mineralogy and porosity. The resulting model is capable of scaling the entire play, with core data and rock pyrolysis being utilized in the calibration of the model on a well-by-well basis. The results indicate that structural highs appear to correlate with carbonate rich siliciclastics or thickened carbonated platform, and siliclastic poor or thin shale intervals. Clay content increases adjacent to structural highs and appear to correlate with areas of increased TOC, or “sweet spots”. These findings are localized, with mineralogy and organic content being observed as heterogeneous throughout the area, and influenced by far-field tectonics (spatial) and eustatic changes (temporal) throughout the region.