

Sequence Stratigraphy, Reservoir Properties and Preservation of Organic Carbon in the Middle Devonian Marcellus Shale

Roy L. Sexton and Timothy R. Carr, Department of Geology and Geography, West Virginia University, Morgantown, WV, 26506, rsexton2@mix.wvu.edu and tim.carr@mail.wvu.edu

The Marcellus Shale of the central Appalachian basin is emerging as an important unconventional resource play with approximate aerial extents of 34,000,000 acres and gas in place estimates as high as 500 trillion cubic feet. The Marcellus has long been considered a probable petroleum source rock for Upper Devonian reservoirs. However, advances in drilling and completion technology including horizontal drilling and hydraulic fracturing have made economic production of gas from the Marcellus possible.

Despite increased exploration and production of the Marcellus there is still much that is not understood about the depositional environment and the distribution and preservation methods of organic material within the formation. New interpretations are beginning to challenge traditional views on organic-rich shale deposition such as water depth, water column stratification, importance of organic production vs. preservation, presence of anoxic and euxinic conditions, and permanent pycnocline vs. seasonal mixing. Additionally, there is a lack of understanding of the relationship between these factors and the sequence stratigraphic framework of individual units.

This study is intended to investigate the influencing geologic parameters under which the Marcellus Shale accumulated over a portion of the Appalachian basin, specifically, northern West Virginia and southwestern Pennsylvania. The study incorporates characterization of the sedimentology of the cored Hamilton Group sections including pyrite framboid size and distribution, sedimentary structures, and microfossil assemblages. This is accompanied by geochemical analysis including identification of trace elements, programmed pyrolysis, x-ray diffraction, degree of pyritization, total organic carbon, carbon and sulfur isotope concentrations, and redox indicators such as manganese, vanadium, chromium, and molybdenum. This data has been placed into a sequence stratigraphic framework of the Marcellus Shale in order to determine relationships between individual sequences and bottom water chemistry, the distribution and preservation methods of organic material during sediment deposition, depositional environments, and relationships between core and well logs.