

Tectonic and Depositional Setting of Ordovician Utica and Devonian Marcellus Black Shales, New York State

Smith, Langhorne B.¹ (1) New York State Museum, Albany, NY.

The Ordovician Utica and Devonian Marcellus black shales both have potential to produce gas in New York State and share some common attributes in their distribution and interpreted depositional setting. Both were deposited during the early stages of mountain building events, overlie and/or have internal unconformities and deposited in relatively shallow water on the craton-ward side of foreland basin axes.

The Marcellus Shale disconformably overlies the Onondaga Limestone and is composed of a basal black shale, a widespread limestone unit and an upper black shale. The lower black shale and the limestone onlap and pinch out on a tectonic high to the west that was likely exposed during their deposition. This onlapping relationship suggests that water depths cannot have been more than a few tens of meters. It is interpreted that more siliciclastic-rich and organic-poor facies were deposited to the east. Other organic-rich Devonian black shales also overlie unconformities and occur only on tectonic highs.

The Ordovician Utica Shale was deposited in an area of extensive active normal faulting and the most of the organic-rich units are preserved in tectonic lows. The Flat Creek Member of the Utica is an organic-rich calcareous shale that immediately overlies a subaerial unconformity and is time-equivalent to the Trenton Limestone. The lower part of the Flat Creek is the most organic-rich and this interval and its Trenton equivalents thin and pinch out over tectonic highs suggesting relatively shallow water conditions. The upper Flat Creek grades laterally into an interbedded limestone and organic-rich black shale called the Dolgeville Formation that then grades laterally into an organic-rich member of the shallow marine Trenton Limestone. The Trenton and Dolgeville are eroded and capped by an angular unconformity that is overlain by the organic-rich Lower Indian Castle Member of the Utica which thickens and is best developed in fault-bounded lows. During deposition of the Lower Indian Castle, most of western New York was probably subaerially exposed suggesting relatively shallow water depths for shale deposition. The Utica Shale can be correlated eastward into a succession of siliciclastic-rich, organic-poor turbidite facies that is up to eight times thicker than the organic-rich shale succession suggesting that the Utica was deposited on the cratonward margin of the basin in relatively shallow water conditions.