Petrographic Pore Characterization in the Upper Devonian Geneseo Shale of New York in the Context of Depositional Setting - SEM Observations from Ion-Milled Samples

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Fabrics and textural features of shales from the the Upper Devonian Geneseo Shale of New York were examined in order to determine the dominant sedimentary processes at the time of deposition. The Geneseo shale represents the third major tectophase and clastic cycle of the Catskill Clastic wedge which prograded westward across Central New York State. Depositional setting was interpreted by utilizing information gleaned from core description, hand specimen and thin section examination, and scanning electron microscopy. In addition, total organic carbon (TOC), and evaluation of gamma ray logs indicate that TOC content of the Geneseo Shale varies in accordance with periods of aerobic vs. dysaerobic depositional conditions. The Lower Geneseo Shale is a monotonous, organic-rich shale with little or absent visible bioturbation and a low diversity of benthic assemblages. It represents a maximum flooding surface (MFS) deposit, is diachronous with the underlying Tully Limestone, and its fauna suggests dysaerobic basinal conditions. Upsection the dark shales of the Lower Geneseo grade into shallower water clastics and limestones. Shallower water clastics include silt dominated dark gray shales with sedimentary features such as ripples, bioturbation, and erosion surfaces. They are interpreted as highstand system tract (HST) deposits. The succession consists of multiple black shale to gray shale cycles that range in thickness from a few decimeters to several meters, and reflects eustatic sea level change overprinted on the general westward progradation of the Catskill Delta during the initial stages of the Acadian Orogeny.

Scanning electron microscopy of ion-milled samples allows definition of three principal pore types in the Geneseo. Type 1 pores are triangular openings, 50 to 1000 nanometers wide, which are delineated by phyllosilicate frameworks. They are the dominant pore type in HST gray shales. Type 2 pores occur within kerogen blebs and organo-clay aggregates, and most likely are related to hydrocarbon generation (10 to 500 nanometers wide). They are the dominant pore type in MFS black shales. Type 3 pores originated due to partial dissolution of carbonate minerals (dolomite or calcite, 50 to 500 nanometers wide). The requisite acidity probably was generated by late diagenetic formation of carboxylic acids. They are most common in MFS black shales.