Clastic Depositional Environments and Sequence Stratigraphy in the Acadian Foreland Basin in Western New York State.

SMITH, GERALD J., Department of Geology, University at Buffalo, Buffalo, NY; JACOBI, ROBERT D., Department of Geology, University at Buffalo, Buffalo, NY

The foundations of the present oil-industry were laid in the Upper Devonian sediments of the Acadian Foreland basin. The Famennian-aged reservoirs of the Bradford sandstones and similar clastic deposits were major plays in western Pennsylvania and western New York State.

The Devonian sedimentary section in the Acadian foreland basin has been the subject of study for over 160 years. In New York State, the lithostratigraphy is well documented, and is considered one of the better exposed sections in the entire basin. However, lenticular deposits and ubiquitous structural offsets throughout the western part of the New York State section has led to an over-simplified stratigraphic section. Based on detailed examination of over 1500 outcrops (measured centimeter scale) in a 480,000 km² area, we assembled a Famennian stratigraphic cross-section (Figure 1) that traces the changes in depositional environments across western New York State. By constructing detailed cross-sections and focusing on the changes in the depositional environments during Late Devonian, we feel it is possible to integrate the various lenticular deposits into a plausible sequence stratigraphic model.

The oldest stratigraphic group of the Famennian stage is the Canadaway Group, which consists of depositional environments ranging from anoxic deep-water black shales and turbidite complexes to wave-dominated foreshore. The overlying Conneaut Group is characterized by intensely storm-dominated shoreface and nearshore deposits. The major sandstone beds of both the upper Canadaway and Conneaut groups form lenticular sandstones that have proven difficult to correlate, but by interpreting the sandstones as storm or tidal ridge bars, many of the correlating difficulties can be resolved. It is these sandstones that were the major oil plays of the late 1800’s, containing an estimated 250 million barrels of oil in New York State. The base of the Conewango Group is an erosive unconformity with overlying thick conglomerate lenses that we interpret to be incised valley deposits. The remainder of the Conewango Group is comprised of clastic deposits that range from offshore to prograding alluvial plain (Figure 2).

Using sedimentary data collected from fieldwork in 2001, combined with data collected from 1991-2000, the changes in paleoenvironment were examined to form a coherent sequence stratigraphic model for western New York State (Figure 3). Within the stratigraphic section of the study area, four major erosional surfaces can be recognized within the Upper Devonian, the lowest at the Famennian-Frasnian boundary, the next within the Rushford Formation, the next below the Salamanca-Wolf Creek Conglomerates, and the uppermost at the base of the Oswayo Formation. Three of these erosional surfaces correspond to sequence boundaries in our sequence stratigraphic model. From our collected stratigraphic data and observations regarding changes in depositional environment, we have identified five major sequences during the Famennian. Four of the sequences are comprised of transgressive systems tract and highstand systems tracts; one sequence contains a preserved lowstand systems tract in addition to the transgressive and highstand tracts. The sequence stratigraphy within the field area has been strongly influenced, locally, by reactivation of basement faults.

Applying our findings to the rest of the historic oil play may allow better insight into the production potential of lenticular and other isolated reservoirs.
Figure 1
Depositional Facies of the Upper Devonian Acadian Foreland Basin

Figure 2
Abbreviations:
- EHS = Early Highstand Stage
- HST = Highstand Systems Tract
- IVF = Incised Valley Fill
- LHS = Late Highstand Stage
- LST = Lowstand Systems Tract
- TSE = Transgressive Surface of Erosion
- TST = Transgressive Surface Tract

Figure 3