Anatomy of the Marcellus Shale in the Appalachian Basin

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Historic DOE Eastern Gas Shale Project data were compiled to develop a database of geochemical analyses, well logs, lithological and natural fracture descriptions from oriented core, and reservoir parameters. Nine wells intercepting the Marcellus Shale from depths of 750 M (2500 ft) to 2500 M (8200 ft) were used to build a detailed geologic framework of the Marcellus Shale across the basin.

In addition to the historic data, new analytical tools were employed to determine kerogen distribution, natural and induced fracture morphology, porosity and permeability of the formation. The tools include several CT scanners, optical and confocal microscopy to quantify mineral and organic volume, acoustic microscopy to determine 3D spatial distribution of fractures and heavy minerals, and SEM to evaluate migration pathways for the fluids. Other analytical methods included fluid inclusion analysis, source rock analysis, and chemistry of gas and water that complete a set of parameters for input to burial history and reservoir modeling tasks.

Earthvision was utilized to display and perform volumetric calculations on individual wells, horizontal well pads, and on a regional basis. The results indicate that the shale lithology changes across the basin. The characteristics of the organic material and structural features influence reservoir gas potential. The success of drilling, completion, and stimulation methods are affected by the current state of in-situ stress and changes in lithology control the geometry of induced fractures during stimulations. The gas potential from the Marcellus Shale is variable over the vertical stratigraphic section. The results from this study may help industry optimize the recovery of gas from this resource.