

**AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003**

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Identification of Vuggy Gas Zones in the Ordovician Beekmantown Dolomite

A petrophysical analysis was made of selected Ohio wells from the Ordovician Beekmantown "dolomite". "Facies" (=flow units?) were identified by multi-well clustering analyses using the software application GAMLs. GAMLs permits multi-dimensional, probabilistic clustering of digitized data. Any missing (null) data (NPHI, PEF.....) is estimated during the clustering process.

Core data was sparse to absent. Porosity, permeability, and water saturation were determined using a forward-modeling procedure that relies on: 1- the probability assignments from a clustering analysis; 2- the assignment of a specific mineralogy to each cluster; 3- a database that gives well log responses for minerals and fluids; 4- modification and utilization of a published (by others) method that uses porosity, grain density, and mineralogy-based surface area to estimate permeability.

An FMI log from one well showed vugs that range in size from pinpoint to more than one foot in diameter. Our petrophysical analyses indicate that the gas-containing (low S_w) horizons are associated with the larger vugs. The clustering analyses indicate that the large-vug horizons are delineated as identifiable, distinct clusters. That is, the well logs "see" these vuggy horizons when analyzed in multi-dimensional space. A "rock type description" made using the FMI log was used to initialize clustering run(s) that include wells with no FMI log. These runs can be used to determine whether or not other wells contain large gas-containing vuggy zones, and so can be used to help determine perforation intervals in recently drilled wells (or, in older wells).