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PS The Gothic Shale at Greater Aneth Oil Field, Paradox Basin, Southeastern Utah: Seal for Hydrocarbons and Carbon Dioxide Geologic Sequestration*

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Search and Discovery Article #80068 (2009)

Posted November 13, 2009

*Adapted from poster presentation at AAPG Convention, Denver, Colorado, June 7-10, 2009. See related articles: Gas Shale Reservoir Characteristics from the Pennsylvanian of Southeastern Utah, USA, Search and Discovery article #10216 and A Tale of Two Breccia Types in the Mississippian Leadville Limestone, Lisbon Field, Paradox Basin, Southeastern Utah, Search and Discovery article #30107.

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Abstract

Greater Aneth oil field, Utah's largest oil producer, was discovered in 1956 and has produced over 451 million barrels (bbls) of oil. Located in the Paradox Basin of southeastern Utah, Greater Aneth is a stratigraphic trap producing from the Pennsylvanian Paradox Formation. Because it represents an archetype oil field of the western U.S., Greater Aneth was selected to demonstrate combined enhanced oil recovery (EOR) and carbon dioxide (CO₂) sequestration. The Aneth Unit in the northwestern part of the field has produced 149 million bbls of the estimated 450 million bbls of OOIP—a 33% recovery rate. The large amount of remaining oil made the Aneth Unit ideal to demonstrate both CO₂ storage capacity and EOR by CO₂ flooding.

Within the Paradox Formation, the Gothic Shale seals the underlying Desert Creek reservoir zone. The Gothic Shale ranges in thickness from 5 to 27 ft, averaging 15 ft. Within the Aneth Unit, it is remarkably uniform consisting of black to gray, laminated to thin-bedded, dolomitic marine shale. The Gothic contains total organic carbon as high as 15% with type III and mixed type II-III

kerogen. Natural fractures include horizontal and inclined (30 to 44°) with evidence of shear in the form of slickensides; some mineralization is present. Geomechanical, petrophysical, petrological, and geochemical analyses were conducted to determine (1) the geologic controls on sealing efficiency (using x-ray diffraction [XRD], scanning electron microscopy [SEM], and thin sections to interpret mercury injection capillary pressure data), (2) effects of pressure changes on seal efficiency due to CO₂ injection and storage, and (3) chemical interaction between CO₂ and the seal at its contact with the reservoir through time.

Acknowledgements

This ongoing research is performed under the direction of the New Mexico Institute of Mining and Technology, Brian McPherson, Project Manager and Principal Investigator, as part of the Southwest Regional Partnership on Carbon Sequestration-Phase II: Field Demonstrations Project. This project is funded by the U.S. Department of Energy through the National Energy Technology Laboratory, Contract No. DE-FC26-05NT42591. Support is also being provided by the Utah Geological Survey (UGS), New Mexico Institute of Mining and Technology, and Sandia National Laboratories. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the U.S. Department of Energy under contract DE-ACOC4-94AL85000.

Geochemical, petrophysical, petrographic, and geomechanical analyses were conducted by TerraTek, Salt Lake City, Utah; Sandia National Laboratories, Albuquerque, New Mexico; and Poro-Technology, Houston, Texas. We thank Wagner Petrographic in Lindon, Utah, for preparing fluorescent red-dye epoxied thin sections and billets for examination of natural fractures and organics by the laser scanning confocal microscope. The poster design was by Stevie Emerson of the UGS. Figures were prepared by James Parker and Cheryl Gustin of the UGS, TerraTek, and Sandia National Laboratories; core description was provided by S. Robert Bereskin, Bereskin & Associates, Inc., Michael Laine, Ammon McDonald, Thomas Dempster, and Brad Wolverton of the UGS assisted with sample preparation and core photography.

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