



2008-09 AAPG Distinguished Lecture

Abstract

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A Geologist's Introduction to Permeability Averaging and the Effects of Scale on the Permeability of Heterogeneous Rocks

Most naturally occurring porous media exhibit some degree of spatial permeability variation, usually referred to as heterogeneity. Few rocks are homogeneous, although some are more variable than others. One of the consequences of heterogeneity is scale dependence. That is, the permeability of a large volume of rock, often called the "effective permeability," will in general be different than the permeabilities of smaller volumes within it.

In this presentation I will use published measurements to illustrate the effects of scale on permeability.

Then I will outline some important theoretical predictions concerning effective permeability and show how these theories offer a powerful framework for understanding the behavior of heterogeneous rocks. Finally I will suggest a permeability averaging method that can be used to reconcile observations at different scales and to predict effective permeability for reservoir modeling purposes.



Jim Jennings

Education

1983 Ph.D., Petroleum Engineering,
Texas A&M University
1981 M.S., Petroleum Engineering,
Texas A&M University
1978 B.S., Petroleum Engineering,
University of Wyoming

Experience

2007–present Principal Reservoir Engineer, Shell International Exploration and Production, Houston, Texas
2000–07 Research Scientist, Bureau of Economic Geology, The University of Texas at Austin, Texas
1995–2000 Research Associate, Bureau of Economic Geology, The University of Texas at Austin, Texas
1998–95 Senior Research Engineer, ARCO Exploration & Production Technology, Plano, Texas
1986–88 Reservoir Engineer, Standard Alaska Production Company, Anchorage, Alaska
1983–86 Project Engineer, Standard Oil Production Company, Warrensville, Ohio

Publications and Awards

2006 Editor, Advances in reservoir characterization reprint volume, Society of Petroleum Engineers
2003 Visiting Professor, Shell International Exploration and Production, Rijswijk, The Netherlands
2002 Outstanding Technical Editor, Society of Petroleum Engineers
Authored or co-authored over 40 journal and conference proceeding papers.
Five publications relevant to the lectures
Zhang, Liying, Nair, Narayan, Jennings, J. W., Jr., and Bryant, S. L., 2005, Models and methods for determining transport properties of touching-vug carbonates: Society of Petroleum Engineers, Paper No. SPE 96027.
Lucia, F. J., Kerans, Charles, and Jennings, J. W., Jr., 2003, Carbonate reservoir characterization: Journal of Petroleum Technology, v. 55, no. 6, p. 70–72.
Jennings, J. W., Jr., and Lucia, F. J., 2003, Predicting permeability from well logs in carbonates with a link to geology for interwell permeability mapping: Society of Petroleum Engineers Reservoir Evaluation & Engineering, v. 6, no. 4, p. 215–225.
Jennings, J. W., Jr., Lucia, F. J., and Ruppel, S. C., 2002, 3D modeling of stratigraphically controlled petrophysical variability in the South Wasson Clear

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Fork reservoir: Society of Petroleum Engineers, SPE Paper No. 77592.

Jennings, J. W., Jr., Ruppel, S. C., and Ward, W. B., 2000, Geostatistical analysis of permeability data and modeling of fluid-flow effects in carbonate outcrops: Society of Petroleum Engineers Reservoir Evaluation and Engineering, v. 3, no. 4, p. 292–303.

Professional Memberships

American Association of Petroleum Geologists
International Association for Mathematical Geology

Society of Petroleum Engineers

Professional Interests

Carbonate reservoir characterization
Applications of statistics and geostatistics in reservoir analysis and modeling
Modeling flow in porous media and scaleup of fluid flow properties
Applications of Fourier transform methods in analysis and modeling of spatial statistics