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## Abstract

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## **Reservoir Quality Assessment: Petrography as a Tool for Deciphering Kinetically-dominated Systems and the Need for Petrographic Education**

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As exploration efforts turn increasingly to unconventional reservoirs and, especially, to deep, hot targets, accurate prediction of reservoir quality becomes a great challenge. In rocks that have experienced a protracted history of post-depositional chemical and mechanical alteration, rock properties cannot be readily predicted from primary sediment characteristics. A dominant reason for this difficulty is that, despite temperatures that are somewhat elevated compared to the surface, reactions in sedimentary basin are relatively sluggish and driven largely by kinetics (rate-controls) rather than by thermodynamics. In such systems, prediction of reaction paths and mechanical behavior cannot be obtained from an understanding of bulk composition and thermal conditions alone. In sedimentary basins, rocks inevitably preserve a complex history of their modifications. Efforts to predict the progress of an individual, pore-modifying reaction (e.g., quartz cementation) must take the proper historical context of the reaction (i.e., its individual rate-control) into account. Predictive approaches that do utilize such a conceptual framework can meet with great success.

The broad field of sedimentary petrography involves the tools and skills required to assess kinetically-dominated

processes and the complex historical records they leave behind. Although polarized light microscopy remains fundamental, the tool-kit of the modern petrographer encompasses a broad range of supporting methods. Cathodoluminescence, both SEM- and light microscope-based, fluorescence microscopy, and back-scattered electron imaging are examples of techniques that are yielding vital new insights into the post-depositional processes operative in reservoir rocks. Despite the advent of such technologies, and the great (and growing) practical utility of petrography, opportunities for university students to learn petrography have been diminished as a consequence of several intersecting historical factors that have displaced petrography courses from the curriculum. A multi-media digital resource, *Sandstone Petrology: A Petrographic Image Atlas*, is the result of an NSF-funded project to create and assess materials that lend efficiency to the study of highly visual subject matter. It is the hope that projects such as this will serve to support the growing industry demand for expertise in the area of rock characterization and rock property prediction.

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## Kitty L. Milliken

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**Education:**

- 1975 Vanderbilt University, B.A.,  
geology  
1977 University of Texas at Austin,  
M.A., geology  
1985 University of Texas at Austin,  
Ph.D. geology

**Experience:**

- 2004-present University of Texas at  
Austin, Senior Research Scientist  
1999-2004 University of Texas at Austin, Research -  
Scientist  
1997-99 University of Texas at Austin, Research  
Associate  
1996-97 Institut Français du Pétrole, Visiting  
Researcher  
1987-97 University of Texas at Austin, Research  
Scientist Associate  
1998-present University of Texas at Austin, Lecturer  
1986-present Short-courses for industry on diagenesis  
and electron microbeam imaging  
techniques and consulting on reservoir  
quality assessment

- 1985-86 Exxon Production Research Company,  
Research Geologist  
1979-80 Texas Bureau of Economic Geology,  
Research Associate

**Professional Interests:**

Integration of petrographic and geochemical methods to decipher histories of chemical and mechanical modification in sedimentary rocks; application of this approach to sandstones, shales, carbonate rocks, and cherts in an effort directed at understanding the fundamental chemical processes of the upper crust; reservoir quality assessment

**Publications and Professional Activities:**

Authored and co-authored over 70 scientific papers.  
Co-Editor, Journal of Sedimentary Research, 2004-2008

**Memberships:**

American Association of Petroleum Geologists  
Geological Society of America  
Society for Sedimentary Geology

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