Evaluating Siliciclastic Reservoir Quality in a Changing World*

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Predicting reservoir quality prior to drilling is a major goal in both exploration and for optimized field development. However, today many of the prime opportunities only exist in deeper, hotter basins, where seismic imaging is challenged. To meet that challenge, detailed reservoir characterization integrated with basin modeling has been successfully used to predict reservoir quality in deep "conventional" reservoirs (typically quartz-rich) which are dominated by a preserved, primary intergranular porosity network. The accuracy of our predictions is based on a fundamental understanding of the primary controls on porosity evolution (for given depositional settings), and our ability to forward model compaction and high temperature (>70-80oC) quartz cement growth.

However, in the last decade, we have also seen an explosion of activity in fine-grained, microporous, clay/organic-rich reservoirs (with nano-sized pores). These "unconventional" reservoirs (e.g. tight gas/shale gas) which were previously considered to be uneconomic, are extremely heterogeneous and often contain unstable, ductile mineral phases that react differently (from conventional reservoirs) during burial diagenesis. To meet the "nano" challenge, new tools and methods in reservoir characterization are being developed to maximize recovery.

In this talk, we will review some of the key characterization tools currently being used for "sweet spot" identification in both "conventional" and "unconventional" reservoirs. We will also examine how modern grain coat studies and laboratory experiments are providing new insights into the impact of early diagenesis on reservoir quality. Lastly, we will examine the question of where is the porosity in tight gas/shale gas reservoirs, which takes us into the new world of nanoscale pore imaging.