S. Robert Bereskin[1] and John A. Kieschnick[2]: (1) Bereskin and Associates, Inc.; (2) TerraTek, Inc.

Depositional, Diagenetic, and Original (Inorganic) Compositional Influences on Thermogenic Shale Gas Production, Western North America

Categories of characteristic lithofacies associated with thermogenic gas shale production greatly impact available pore space and other important rock properties. These lithofacies associations can also directly affect several related parameters, including log interpretation, stimulation protocol, and production recoveries. The more important, and generally common, categories include the assemblages of: (1) carbonates, (2) clastic influxes, (3) dominantly argillaceous assemblages, (4) phosphatic influences, (5) authigenic silica-rich assemblages, and (6) the mixtures of any or all of the above. Although much intergradation occurs among shale facies, the following empirical observations have been made from numerous recent studies conducted by the authors. Shales rich in diagenetic calcite, dolomite, and ankerite usually possess poorer reservoir quality because of their inherent effect as void-filling cements that now occupy pore throats and /or pore space. The same result of reduced reservoir quality can occur with highly compacted and/or foliated argillaceous mudstones of certain clay morphologies. On the other hand, clastic and authigenic silica-rich categories commonly result in the development of producible porosity/permeability relationships depending on both depositional and subsequent diagenetic processes. Finally, the effects of phosphatic and mixed lithofacies can have a highly variable effect, depending on the depositional and diagenetic processes involved.

It is also important to consider the influence of depositional and/or environmental parameters upon thermogenic gas shales production and field development. Broad example categories include the lateral proximity to nearby depositional systems (clastic and carbonate), variable sedimentation styles and rates, complex bioturbation patterns, obvious variations in all aspects of chemical oceanography, and planktonic blooms in terms of influencing the eventual composition of benthonic accumulations. In many cases, so-called statistical shale plays within a producing basin will eventually vary in an exploratory sense, largely because of the stratigraphic and/or lithologic variation related to both environmental and resulting mineralogical changes. Operators need to be acutely aware of this potential for both facies and strategic changes especially if a large, corporate acreage position is involved.