Shale Gas Play Evaluation Using Basin Modeling

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Evaluating shale gas plays requires determination of original gas in-place (OGIP) and free versus sorbed gas. Initial screening for thermogenic shale gas plays often utilizes variables of thermal maturity, shale organic carbon content, shale thickness or mineralogy, but time dependent variables derived from basin modeling can aid in the screening. This paper demonstrates how basin modeling can be used to regionally address OGIP for a shale gas play and provide insight to production sweet spots.

The first area of application is controls and prediction of paleo-adsorption capacity versus present-day adsorption capacity at reservoir pressure and temperature conditions. Sorbed gas on organic matter is a function of pressure and temperature and organic matter maturity. Most shale gas plays to date are uplifted; hence, these shales have been buried deeper and hotter in the past under conditions where the sorbed gas capacity is significantly reduced compared to their present-day capacity. Model application will be shown on how to estimate potential under-saturation with respect to sorbed gas capacity and forward model the expected range of sorbed versus compression gas in the pore space.

A second application in basin modeling combines use of kerogen kinetics and source rock geochemistry to better understand the influence of solution gas on shale gas plays. Higher productivity areas of shale gas plays to date are often in high maturity (>1.4 %Ro) areas where solution gas contribution to OGIP is minor. Original gas-in-place is a function of free gas (related to porosity), solution (aqueous and oil) gas and sorbed gas. At lower thermal maturity levels (< 1.4 %Ro), depending on source rock organic facies, solution gas can become a significant component of total gas content. At lower thermal maturity levels, the ability to form a free gas phase is increasing sensitive to the source rock organic facies and kinetics.