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Unconventional Reservoirs: Basic Petrophysical Approach for Shale Gas

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Shale gas is as an unconventional natural gas resource that is the current focus of the oil and gas exploration and development industries worldwide. However, as the gas content of shale reservoirs is one of key factors justifying the economic development of these reservoirs, and an accurate estimation of the gas content is required in the assessment of shale gas resources. Shale Gas has intense activity taking place in regions like North America.

Organic matter deposited with shales containing kerogen that matured as a result of overburden pressure and temperature, giving rise to source rocks yielded and expulsed hydrocarbons. Produced gas comes from both adsorbed gas in the organic matter and free gas trapped in the pores of the organic matter and the inorganic portions of the matrix. i.e. quartz, calcite, and dolomite.

Gas volumes are estimated through a combination of geochemical analysis and log interpretation techniques. TOC, desorbed total gas content, adsorption isotherms, and kerogen maturity amongst other parameters can be measured in cores, and cutting in the laboratory. These data are used to estimate total desorbed gas content and adsorbed gas content which is a part of total gas. The ΔlogR Passey log method is used to detect potentially productive areas. Permeability is one of the most important parameters, but at the same time, one of the difficult to measure in a shale gas. core calibrated porosity, mineral composition, water saturation , and elastic modules can be obtained through electric and radioactive logs. It is possible to estimate different gas in-situ volumes using porosity-resistivity based total gas in-situ, and geochemical based adsorbed gas in-situ. The difference should be the free gas in-situ.

The study successfully identified the state of the art in petrophysical evaluation through logs and core, log response in presence of kerogen, log interpretation techniques, and petrophyical workflow is an index for volumetric estimation of gas in-situ in shale gas reservoirs. Horizontal drilling and Hydraulic frac are the most of the technologies that should use as lessons learned.