A Conventional Look at an Unconventional Reservoir: Coalbed Methane Production Potential in Deep Environments

Tonnsen, Robert R.[1]; Miskimins, Jennifer [2] (1) Tonnsen Consulting, Golden, CO. (2) Petroleum Engineering, Colorado School of Mines, Golden, CO.

As technology evolves and the exploitation of unconventional resources becomes conventional practice, new applications and knowledge will lead engineers and geologists to explore marginal hydrocarbon saturations in unique geologic horizons. One of these horizons of interest is deep (greater than ~5000 ft.) coalbed methane (CBM). It has been shown in numerous studies that coalbed permeability is highly sensitive to in-situ stress conditions and subsequent changes in stress that accompany both water and gas production. However, most studies have focused on shallow CBM and there has been little research into coals at depth. This paper shows how simulation of CBM production is highly dependent on the assumption that pore volume compressibility remains constant as the coal experiences changes in effective stress. While this assumption may be acceptable for modeling shallow CBM production where stress changes are relatively small, the assumption likely does not hold true for deeper environments where necessary changes in stress would be more significant. When this assumption is relaxed and adjusted so that pore volume compressibility is allowed to vary with changing stress conditions, a new vision of CMB emerges where permeability may be present and maintained during production from deeply buried coals. This conjecture comes with a caveat: deep coals that contain water as the dominant phase in the cleat system will likely never produce commercial rates of natural gas. Nevertheless, the potential exists that CBM could produce at economic rates if the coal is present within a conventional trap with structural or stratigraphic closure and a seal that has lead to the development of a gas saturated cleat system. If a coal is considered a “conventional” reservoir where gas generation, timing, migration, and storage are optimal for creating an accumulation, economic gas production rates could be possible.