Re-evaluation of Gas Shale Reservoir Characterization: Applicability of CBM Analogues

Daniel Ross*
University of British Columbia, Vancouver, British Columbia, Canada
dross@eos.ubc.ca

and

Marc Bustin
University of British Columbia, Vancouver, British Columbia, Canada

Abstract
To date, a large proportion of gas shale reservoir evaluation and exploration is based on coalbed methane experience. However there are distinct variabilities of adsorption characteristics and gas capacities between coals and shales suggesting further modification of existing CBM wisdom is required for gas shale research.

In all unconventional reservoirs reported (shale and coal – types), the high internal surface area of organic matter, the micro and mesoporosity, provide an important gas storage mechanism through physical adsorption. However the porosity characteristics of marine macerals which leads to gas adsorption are not well understood. Devonian gas shale reservoirs show a good correlation between TOC and gas adsorption - a reflection of the larger micropore volume associated with the organic content. However it is apparent from Jurassic reservoir systems, more gas is stored as a solute gas (within bitumen/bituminite) as oppose to adsorbed gas as micropore volumes are consistently low with varied sorbed gas capacities. Furthermore, shales have a larger inorganic component than many coals hence stating best gas shale reservoirs are organic-rich may be an over-simplification.

There are distinct differences in the isotherm profiles between coals and shales. For example, many shale isotherms do not conform to the Type I Langmuir isotherm. Gas saturation does not occur within the experimental pressure which implies gas is still diffusing and adsorbing at higher pressures. Also, many TOC-lean shales produce isotherms with negative methane adsorption profiles – a result never seen with CBM isotherms due to the large sorbed gas capacities masking any subtle complications in the analysis set-up.

Unlike coalbed methane reservoirs, the free-gas component (non-sorbed gas) in gas shales comprises a large amount of the total gas capacity especially at high temperatures and pressures. Because of the low slope of the adsorption isotherm at high pressures and temperatures, little sorbed gas will be produced until reservoir pressure is markedly depleted.