

## Correlation Between Coalbed Methane Production and LogFAC<sup>1</sup> Permeability Factors in the San Juan Basin: Implications on Coalbed Methane Exploration in Western Canada

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### ABSTRACT

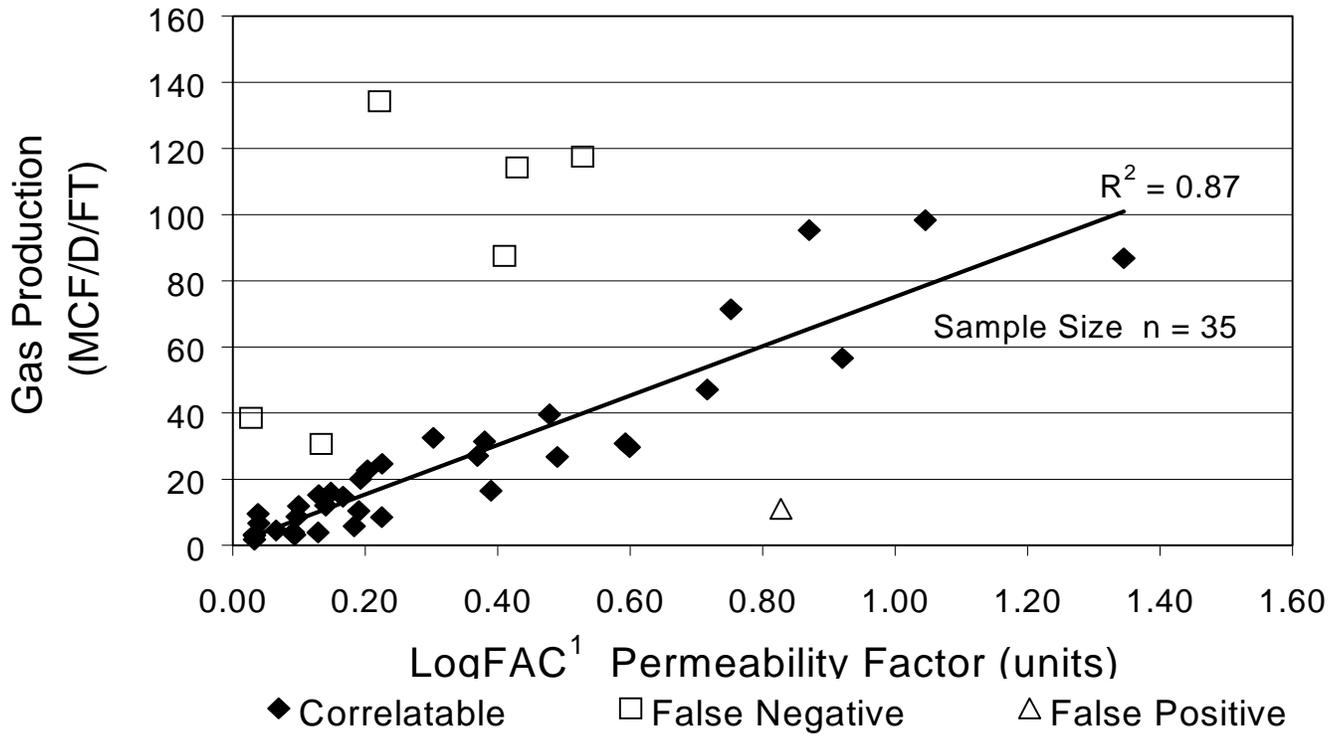
The abundance and openness of fractures (cleat) in coal is widely regarded as the primary control on permeability and hence coalbed methane producibility. Measuring and predicting the *in-situ* permeability of coal however remains the most difficult aspect of evaluating coalbed methane plays even in areas where substantial well log data exist. Utilizing, LogFAC<sup>1</sup>, a volume based method for detecting and measuring permeability in subsurface coal deposits, conventional historical geophysical well log data can be utilized to measure the ability of the coal to accept fluids. Permeability can be characterized by the volume of mud filtrate accepted by the formation. Calculation of LogFAC permeability factors enables evaluation of the comparative permeability of coal seams. Permeability factors are not convertible to millidarcy values at this stage of research.

Methane production was compared with LogFAC permeability factors using production records and well data from Fairway and non-Fairway zones in the Fruitland Coals in the San Juan Basin. The LogFAC response is correlatable with methane production in 35 of 42 examined wells. In these 35 wells, the linear correlation is  $r^2 = + 0.87$ . The linear relationship between LogFAC response and methane producibility is consistent with Darcy's Law. Statistical analysis indicates a significant relationship between the magnitude of the LogFAC permeability factor and coalbed methane production.

Six of the remaining seven San Juan Basin wells show false negative responses whereby the LogFAC permeability factors indicate non-productive zones while production data records prolific production. This can be explained by the mechanism that gives rise to the LogFAC response. The remaining well exhibits a false positive LogFAC response, with permeability factors indicating high potential production, but records show modest production. The cause of this false positive response is undetermined.

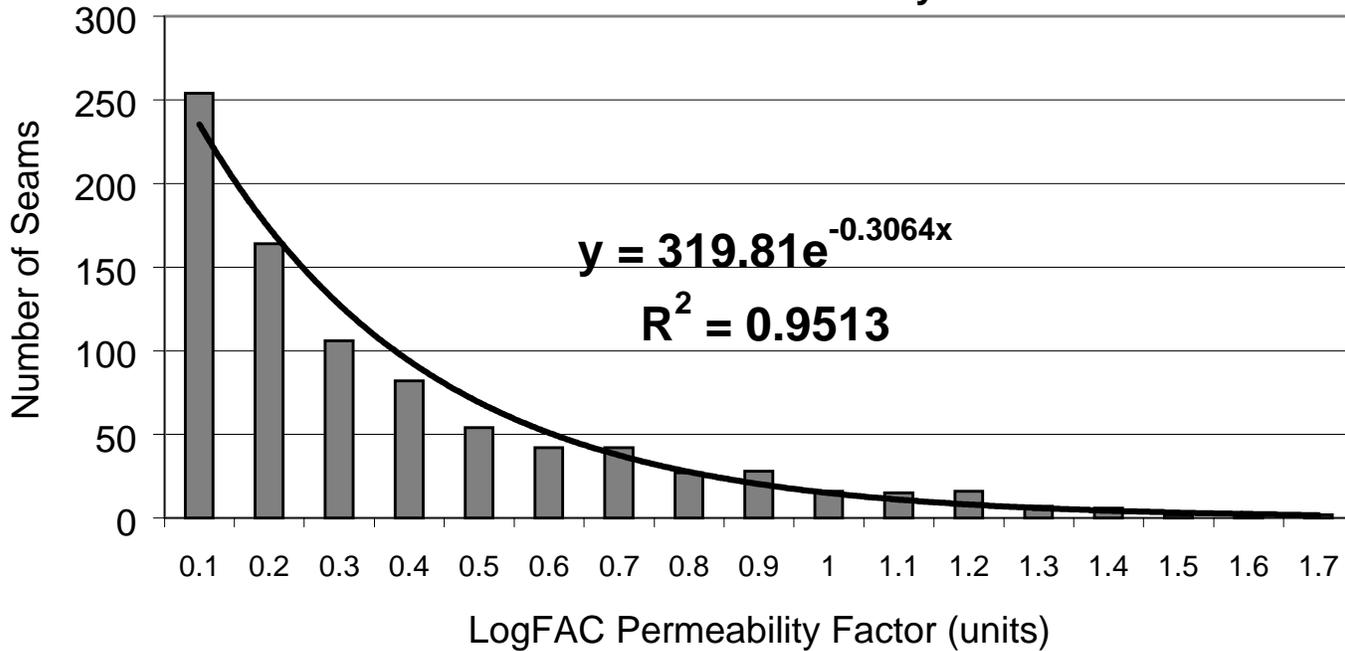
Extension of the LogFAC technique to other basins shows that San Juan Basin type responses also exist in the Western Canada Sedimentary Basin. Research conducted on 854 coal seams in a 125 well study area in Western Canada shows an inverse exponential relationship between LogFAC<sup>1</sup> permeability coefficients and frequency. This frequency distribution is consistent with fracturing as predicted by fracture theory. In a second Western Canada study area, mapping of LogFAC permeability responses shows zones of increased LogFAC permeability factors that indicate potential coalbed methane reservoirs.

## Gas Production vs. LogFAC<sup>1</sup> Permeability Factor San Juan Basin, Colorado and New Mexico



Graph of San Juan Basin coalbed methane production in mcf/d per foot of coal seam thickness vs. LogFAC Permeability Factor. A statistically significant relationship is present in 35 of the 42 wells examined.

## Frequency vs. LogFAC<sup>1</sup> Permeability Factor Western Canada Study Area



Frequency histogram showing number of coal seams in each LogFAC Permeability Factor category. Data are from 854 coal seams located in 125 wells in Western Canada. Frequency distribution pattern is consistent with fracturing as predicted by fracture theory