Stress Regime in the Cretaceous Succession of the Alberta Basin: A Predictor for Coal Bed Methane Producibility

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ABSTRACT
Coal permeability is a critical factor in coalbed methane (CBM) producibility. In the absence of direct data, the stress regime is a good regional-scale indicator of areas with enhanced permeability, hence better CBM producibility potential, provided all other factors are equal. Estimates of vertical and minimum horizontal stress magnitudes and their directions in numerous wells in the southern and central parts of the Alberta basin where Cretaceous coal-bearing strata are found show that $S_v > S_{H\text{min}}$ and that $S_{H\text{min}}$ orientations generally parallel the deformation front, indicating that coal face-cleat fractures will likely be vertical and aligned in a SW-NE direction. Consequently, the axis of maximum coal permeability is likely to be in this direction. This has significant implications for the local-scale design and siting of CBM production wells, and of CO$_2$ injection wells in case CO$_2$ is used for enhanced CBM recovery. Vertical stress magnitude gradients increase slightly with depth, but decrease significantly in a SW-NE direction. Gradients of $S_{H\text{min}}$ magnitudes show a more complex pattern, with a few elongated lows parallel to the deformation front, varying in width between ~40 km and ~100 km, and in length from ~100 km to ~450 km. Stress gradients in southern Alberta, both vertical and horizontal, are generally high. The distribution of stress magnitude and gradients suggests that, on a regional scale, the most prospective areas for CBM production in Alberta would be in central-eastern Alberta, if all other factors, such as coal characteristics and gas content, are equal.

INTRODUCTION
Worldwide resources of methane trapped within the coal porous system are greater than the collective reserves of all known conventional gas fields. However, only in very few places, primarily in the United States, has this energy source been commercially tapped. Except for the Black Warrior basin, all major basins in the United States where coalbed methane (CBM) is produced or have producibility potential, such as the San Juan and Powder River basins, are foreland basins of the...