Stress Strain Relationship and Fracture Dilation in Triangle Zones and Basin Centered Gas Plays

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In the past ten years numerous gas wells have been drilled to test the productivity of the Jura-Cretaceous fractured sands in the Triangle Zone and Basin Centered Gas plays in the Western Canadian Sedimentary Basin. (Mackay et al 1996 and Newson 2001). These clastic plays have produced gas at widely varying rates from sands that have similar petrophysical signatures.

In the conventional analysis of this data it has been difficult to establish a solid link between the productivity of the wells and the reservoir properties. However, a detailed structural study tied to the stratigraphic model for the area has shown that it is possible to calculate the requisite strain (Epard et al 1993) and use it as a proxy for fracture dilation for the specific reservoir unit with the structure. This may be done on a predrill scenerio based on the deformation style and kinematic history for the area.

In this study, a series of sections were drawn over potential drilling targets and existing production. These sections used depth migrated 3D seismic, petrophysical logs, imaging logs and cutting descriptions. This provided the basic input into conventional reserve calculations and a tool for predicting gas flow rates.

Using these detailed cross sections, the excess area method to determine depth to detachment surfaces was applied. (Groshong et al 1994) A relationship was then built between the detachement surfaces and the intervening litho mechanical units. The strain was then calculated for each of the stratigraphic intervals within the litho mechanical units. This calculation used the difference between the line length and area balance of each unit to calulate the requisite strain, shortening and depth to detachment surfaces.

By using the fundamental principles of rock mechanics it has been possible to generate a relation ship that links the stress strain relationships of the reservoir to the tecto stratigraphic units within the structure. A by product of this calculation is the requisite strain which may be used as a proxy for fracture dilation and hence predict gas flow rates from the reservoirs.

The results of this study has given exploration and development companies the tools to predict the reserves of natural gas and initial flow rates on a prospect by prospect basis within a defined structural domain. This will positively affect the discovery costs for natural gas in Triangle Zone and Basin Centered Gas Plays as we enter a period of stable gas prices and increasing costs.

References

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