Internal Relationships of Fractures Within the Cardium Formation of the Lovett River Thrusted Triangle Zone, Alberta

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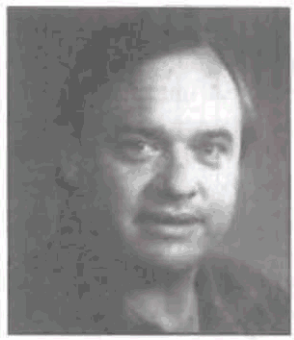
Conventional techniques that assess fractured systems, especially when focused on a reservoir's permeability, are constrained to using whole core samples (or small core plugs), reservoir testing, and petrophysical indicators. Exploration and subsequent development drilling in the Cretaceous Cardium Formation triangle zone in N.W. Alberta provided an opportunity to step beyond traditional analytical methods of evaluation and begin to focus on critical issues related directly to understanding the internal relationships of a fractured, low-permeability siliclastic rock.

Cores recovered from structurally complex terrains, as in the Lovett River/Robb area, often contain numerous vertical to subhorizontal fractures throughout the recovered interval. Application of conventional laboratory tests commonly lead to permeability values that are invalid due to the presence of the fractures. Where samples are of suitable quality for conventional tests, the resultant K_{max} values are typically skewed to reflect zones of unfractured rock, thus excluding intervals of significant fracture development.

New techniques using both a profile micropermeameter and image-based analytical system (IBAS) have been developed to allow the understanding of relationships between permeability and porosity of low-permeability, fractured reservoir rocks. Core samples are slabbed to produce a flat surface upon which the micropermeameter tests are conducted. Values for the rock matrix as well as the fractures and nearby boundary regions (dilatant gouge zones) are measured. The IBAS system allows detailed mosaic images using reflected and UV light to be produced for the same core surface. Variations in fluorescence across the core surface can be used to map differences in permeability and porosity.

Once the quantification of fractures and related cataclastic phenomena (dilatant gouge) have been defined, the data are compared to outcrop fracture studies and petrophysical logs such as borehole images. By utilizing the sample intervals as an analogy, conclusions can be drawn as to the type of fracturing present and also the potential for hydrocarbon storage and producibility in both the cored and non-cored intervals. This information compared to detailed outcrop work allows the understanding of fold "maturity", position of the sample on the fold, fracture characteristics, fracture density, relationships of fracture porosity to matrix porosity, and fracture conductivity. This approach has proven successful in better quantifying the prolific, fractured Cardium Sandstone reservoir within the Foothills' triangle zone of northwestern Alberta.

Biographical Sketch



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