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Richard Y. Shang and Malcolm Lamb, Schlumberger, Calgary, AB

Fracture Pattern Identifications Based on Borehole Images: Example from the Foothills, Western Canada

Evaluation and characterization of fractured reservoirs have been important topics in petroleum geology over past decades. However, conventional wireline logs often fail to produce results consistent with production data because of limited vertical resolution and the complicated nature of fractured reservoirs. Recent development of advanced borehole image logging tools has yielded a new opportunity to adequately characterize fractured reservoirs. This paper will demonstrate the use of these advanced logging tools to quantitatively assess fractured reservoirs. In the Foothills, Western Canada, natural fracture systems are important contributors to reservoir producibility and sometimes porosity in many fractured reservoirs. In general, natural fracture systems in that area can be classified into three groups: regional fractures, fold-related fractures, and fault-related fractures.

Regional fractures form as a result of far-field tectonic compression in combination with high pore pressure and propagate in the plane of maximum and intermediate compressive stresses. The unidirectional regional fractures can create highly anisotropic horizontal permeability in a reservoir. Knowledge of the presence and character of such fractures can be invaluable in optimizing a deviated wellbore path.

Four basic orientation patterns of fractures are common in contractional fold settings: transverse, longitudinal, shear and bedding-parallel fractures. Using borehole images, these fractures can be easily identified and structural position can be conveniently reconstructed based on fracture sets and orientation patterns.

In the Foothills, the thrust fault is a dominant fault type. Fracture characteristics and orientation data identified from borehole images can be used to determine the location and orientation of the thrust fault plane.