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## ***Prediction of Fractured Reservoir Properties and Performance in Folded Carbonates of the Canadian Foothills, Alberta and British Columbia***

by J.M. Degraff, Exxon Production Research, Houston, Texas  
D.V. Allan\*, Imperial Oil Limited, Calgary, Alberta, and  
D.F. Goff, Exxon Production Research, Houston, Texas

Fractured reservoirs are common exploration targets in fold and thrust belts because of the relatively high levels of structural deformation. A recently completed effort to predict fracturing and its effect on reservoir quality in the Canadian Rocky mountain foothills has shown that: 1) lithology and structure are the primary controls on fracture intensity and orientation, 2) intensity of effective fractures is correlated to gas productivity, and 3) map curvature is a useful tool for predrill estimates of fracture intensity and expected flow rates. Methods used in the study included core and outcrop fracture description, petrophysical analyses, and productiv-

ity analysis.

Geologic factors having the greatest control on fracturing were quantified with respect to fracture characteristics. Fracture intensity was compared with whole core permeability and flow rates from wells with sustained production. Lithologic factors that enhance fracturing in these carbonate reservoirs are increased dolomite and silica content, low porosity, fine grain size, and lack of silt and clay. Structural factors that enhance fracturing are the amount of stratal bending, which is quantified by map curvature, and the presence of faults, especially in stacked duplexes of sliced forelimbs of fault propagation folds.

Higher flow rates generally correlate well to higher fracture intensities and greater map curvature. Although curvature is highest along fold hinges, it varies significantly with changes in tightness along a single fold and between different folds. These results enable us to integrate lithologic and structural data from these complex settings for improved fracture prediction, which is important for prospect evaluation, target selection, and drilling and completion strategies.

\*now at Husky Oil Operations Limited, Calgary, Albata

### **Biographical Sketch**



James M. Degraff

EPR, James was a Research Associate at Purdue University for one year, and a contract Professor of Geophysics with the U.S. Peace Corps in Paraguay for three years. He received his B.S. in Geology from Michigan Technological University in 1975, his M.S. in Geophysics from M.T.U. in 1976, and his Ph.D. in Structural Geology from Purdue University in 1987.

James M. Degraff is a Research Specialist with Exxon Production Research Company, where he has worked since 1988. He specializes in structural geology, fractured reservoirs, geomechanical modeling, tectonics, and fracture mechanics of rocks. Prior to working for