

Risking Fault Seals in the Gulf of Mexico: A Joint Industry Study

by Grant Skerlec, SEALS International

An analysis of more than 200 faults in a joint-industry study of the Gulf Coast provides a database of actual fault seal behavior in producing fields. This empirical database demonstrates that fault seal behavior is predictable rather than random and that faults are more important than is commonly thought in controlling hydrocarbon accumulations. Quantitative fault seal analysis has demonstrated that the behavior of seals is empirically related to the amount of sand and shale incorporated in the fault zone. Faults with sand-rich gouge leak, and faults with shale-rich gouge seal.

An empirically defined threshold allows prediction of fault seal behavior with a high degree of confidence. Fewer than 10% of the faults in the Gulf Coast are exceptions to the rule. Exceptions are a result of other factors, including low permeability and high displacement pressure sands and thin-bedded sand/shale sequences.

Examples from these Gulf Coast fields demonstrate the fundamental importance of faults in controlling hydrocarbon accumulations. Faults and fault seal behavior control the presence or absence of hydrocarbons, percent fill, hydrocarbon column heights, entrapment of oil versus gas, and high-side and low-side trap risk. Faults control the lateral distribution of hydrocarbons within fault compartments, as well as the vertical distribution of hydrocarbons among stacked sands. Faults control fluid flow during both field development and hydrocarbon migration. Bypassed residual accumulations and unnecessary production wells result from neglecting routine fault seal analysis during field development. Dry holes and mistaken assessments of reserves result from neglecting routine fault seal analysis during exploration.

Biographical Sketch

Dr. Grant M. Skerlec received a B.A. from Franklin & Marshall College and a Ph.D. from Princeton University. He spent 10 years as an explorationist with Exxon and

has been an independent consultant specializing in the analysis of fault seals and top seals since 1987.

Dr. Skerlec joined Exxon Production Research Company in 1978 and began working on fault seal analysis. He joined Esso Norway in 1982 and later Esso Exploration and Production U.K., applying quantitative seal analysis to prospect and play assessments in the North Sea, Norwegian Sea, and Barents Sea. Since 1987, Dr. Skerlec has been an independent consultant and head of SEALS International,

which specializes in the application of fault seal analysis to prospect assessments and field development. SEALS International has developed an extensive global database from regional fault seal studies in numerous hydrocarbon producing basins. This database allows calibration of seal/leak thresholds and provides analogs of fault-dependent traps for quantitative risk assessment. SEALS International has also developed software for routine, quantitative seal assessment. Dr. Skerlec also teaches a series of courses and workshops on fault seal and top seal analysis. ■