WILLIAM T. SHEA, JR. - Biographical Sketch

Bill Shea received a B.A. in geology and economics from Rice University in 1983. He attended Imperial College, London, on a Marshall scholarship (M.Phil., 1986), and earned his Ph.D. in geology from Texas A&M in 1991. Bill joined Exxon Production Research in 1991, where he has worked on a variety of seal-related problems. He is currently part of a research team that is studying fault-related reservoir compartmentalization.

SUSAN HAGGERTY - Biographical Sketch

Susan Haggerty is a research specialist in the Secondary Migration Section at Exxon Production Research Company, where her current research assignment involves the study of fluid flow and sealing processes associated with faults. Susan earned a B.A. degree in geology from Augustana College, Rock Island, Illinois, in 1986, and a Ph.D. in geology from the University of Leeds, England, in 1989.

HGS GENERAL MEETING HORS D'OEUVRES NIGHT

Seal Controls on Trap Capacity and Migration

by William T. Shea, Jr. and Susan Haggerty

HGS General Meeting - December 13, 1993
Hors d'Oeuvres and Poster Session, 5:15 P.M., Speaker Presentation, 6:30 P.M.
Post Oak Doubletree Inn

The capillary properties of sealing rocks can control hydrocarbon column heights and influence the geometry and position of migration pathways. We have used mercury-injection capillary pressure (MICP) data to investigate the sealing properties of both cap rock and fault seals, and apply the results to predict trap seal capacities and model migration processes.

Most mudrock seals, irrespective of depositional environment, have extremely fine pore-throat systems that are capable of trapping large (>1000 ft.) hydrocarbon columns. These seal capacities are typically greater than trap closure heights, and only limited vertical leakage is expected through matrix pores. Results to date suggest that seal quality does not degrade significantly until total clay contents fall to <30 wt.%. Flow simulations show that in these silty "waste" zones, long-distance lateral migration can occur at geologically-rapid rates.

The capillary-pressure response of several North Seal fault seals is highly variable, due to differences in lithology and deformation conditions. Grain-scale deformation and cementation dramatically increase capillary entry pressures relative to the undeformed reservoir. However, entry pressures are not generally as high as those measured on common top seals. These results show that fault zone material can provide an effective hydrocarbon seal, but may trap only limited fault-dependent column heights.

The rock property data can be integrated into a "fill-and-spill" type migration model that assumes: (1) impermeable top seals, (2)rapid migration rates, and (3) bottlenecking at faults. In places where vertical migration is critical (e.g., Gulf of Mexico), we propose that the same fault can seal an accumulation and provide an effective migration pathway.