Go to Second Poster

Seal Character and Variability Within Deep-Marine Depositional Systems: Seal Quantification and Prediction

William R. Almon and William C. Dawson
ChevronTexaco, Bellaire, TX

Abstract

Seals are a key element of petroleum systems, yet they have received limited systematic study. Textural and compositional variations permit the recognition of six shale lithofacies in Tertiary, deep-marine, depositional settings. Each shale type end-member has distinctive textures and fabrics, which record variations in depositional conditions. Textural and compositional variations of shales, considered within the context of sequence stratigraphy, provide a basis for seal risk assessment.

As determined from mercury injection capillary pressure (MICP) analysis, the pressure required to attain critical seal pressure (10% non-wetting saturation) varies over a considerable range (15 to 20,000 psia). Tertiary shales from offshore Brazil have consistently low critical seal pressures relative to age-equivalent shales from offshore West Africa. Tertiary shales from wells in the Gulf of Mexico have intermediate MICP values (mean: 4,700 psia). The organization of shale facies within a sequence stratigraphic framework reveals systematic variations in seal character. Silt-poor shales from uppermost transgressive systems tracts, and some condensed shales, have good to excellent seal potential. In contrast, silt-rich shales from highstand and lowstand systems tracts have moderate to low sealing capacities. Seal quality generally increases as total clay and carbonate content increase; other compositional variables have limited predictive relationship with seal character. Likewise, log-derived parameters lack significant potential to accurately predict critical non-wetting saturation values. Additional seal variability factors include changes in the rate of deposition, early marine cementation, and depositional fabric. Available data provide a compelling argument for textural control of seal character induced by high-frequency stratigraphic cycles.

ChevronTexaco