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

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Summary & Conclusions

Six shale types are recognizable within deepwater marine depositional settings (based on differences in shale fabric & MICP analyses). These shale types appear to correspond with high-frequency (wire-line log scale) stratigraphic fluctuations.

Clay-rich shale types 1 and 2 consistently have excellent seal potential. Silt-rich mudstones (shale types 3, 4 and 5) have relatively low seal capacities. There is a strong positive correlation between total clay content and critical seal pressure (10% non-wetting phase saturation). Carbonate-cemented mudstones (shale type 6) can have excellent to exceptional membrane seal capacity, but are brittle and tend to fracture.

Variations in depositional fabric strongly influence seal character. In particular, the presence of laminar fabric, low (<10%) content of detrital silt (siliciclastic and/or bioclastic), and elevated content (> 70%) of detrital clay matrix appear to enhance seal potential of marine shales.

Excellent to very good seal capacity is found in shales from uppermost 3rd- and 4th-order transgressive units and some condensed intervals. Shales from silt-rich parts of highstand and lowstand stratal packages have markedly reduced seal capacities. Both silt content and the organization of silt (laminae and mottles) influence seal character.

Wire-line log derived parameters appear to have reasonable ability to estimate critical seal pressure in these samples. The entire set of critical injection pressures can be predicted from log-derived bulk density values. Seal capacity for shale type 6 can be predicted from GR-log data.

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Acknowledgements

We thank ChevronTexaco for granting permission to present these data and interpretations. W. T. Lawrence prepared thin sections and assisted with photography. E. Donovan and J. L. Jones provided SEM images, and D. K. McCarty completed XRD analyses. R. Lytton offered paleontological data and biostratigraphic interpretations. Poro-Technology, Houston, TX conducted MICP analyses. Graphic design by L. K. Lovell.