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Improved Characterization of the Compartmentalized and Overpressured Vicksburg Sandstone Reservoirs Using Integrated Sequence Stratigraphy, Diagenesis, and Petrophysics

The natural gas-bearing transgressive systems tract (TST) Vicksburg interval in TCB Field, South Texas, was the focus of a comprehensive petrophysical evaluation. This interval was deposited in a transgressive shallow marine setting and is composed of thinly bedded and laminated silty, very fine-grained sandstones, siltstones, and shales. The TST interval was selected for its specific sedimentary features and compositional complexity that are typical of low-resistivity/low-contrast shaly sandstone reservoirs.

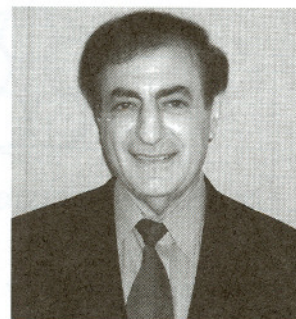
The goal was to develop improved formation evaluation techniques for this type of reservoir. Cores were sampled for thin-section, X-ray, SEM, ϕ - k , capillary pressure, and cation exchange capacity (CEC) analyses. Array induction, gamma ray, neutron-density, micro-imaging, and nuclear magnetic logs were calibrated to cores. High-resolution logs allowed the recognition of reservoir and non-reservoir facies thicker than 1 ft, while micro-imaging resolved beds down to the one-half inch scale. High-resolution density porosity measurements were very close to measured core porosity values and used to estimate total porosity. The low-resistivity signatures of sandstones are mainly generated by the abundance of clays, especially illite/smectite mixed-layer clays. The Pickett crossplot technique was used to derive m , n and R_w values for water saturation (S_w) calculation. Resistivity modeling using Waxman-Smits and Modified Dual-Water methods also yielded m and n values that agreed with those from the Pickett technique. Reliable results

were achieved using the simple Archie equation modified using the newly estimated m , n and R_w values. Modified Archie, Waxman-Smits and Modified Dual-Water methods yielded S_w values that correlated best to those from core analyses. ■

The goal was to develop improved formation evaluation techniques for low-resistivity shaly-sandstone reservoirs in the Vicksburg interval of the TCB Field, Jim Wells County, South Texas.

Biographic Sketch

ZUHAIR AL-SHAIEB has been a faculty member of the Oklahoma State University School of Geology since 1972, and currently has the title of Professor of Geology. He received BS degrees in Geology and



Chemistry from Damascus University, and MS and PhD degrees in Geology from University of Missouri at Rolla. His major research experiences are focused in the "Reservoir Characterization" discipline, and compartmentalization of deep and overpressured reservoirs. He has published 70 articles, 85 abstracts, 40 reports and monographs, and presented more than 100 invited presentations. He has conducted research projects in the Anadarko, Arkoma, and Powder River Basins, the Gulf Coast Area, and more recently Souedieh Oil Field in Syria. He was awarded the "Distinguish Educators Award" by the AAPG in March 2002, and is currently an Associate Editor for the AAPG Bulletin.