Thursday, February 21, 2008

Petroleum Club • 800 Bell (downtown)
Social 11:15 a.m., Lunch 11:45 a.m.

To attend this meeting you can register online at www.sipes-houston.org, call (713 651-1639), fax (713 951-9659), e-mail (bkspee@aol.com), or mail your reservation to Mrs. B.K. Buongiorno (1001 McKinney, Suite 801, Houston, TX 77002) by Tuesday February 19, 2008. Payment is required by regular mail or pay at the door with check or cash. Members and Affiliates who register by that date pay $30. The cost is $35 for guests and new registrations at the door. No-shows will be billed.

SIPES Luncheon Meeting

by ***Fred Hilterman and Zhengyun (Jenny) Zhou***
Geokinetics

New Interpretation Techniques for Predicting Pore Fluid, Lithology and S_w from Seismic AVO

The prediction of lithology and pore-fluid properties using only seismic amplitudes across a prospect is highly questionable, even if the seismic amplitudes are calibrated at an available well location. In addition, if an amplitude-versus-offset (AVO) interpretation across the prospect is conducted, the same uncertainly remains. Many interpreters will offer various explanations for the failures… the ones drilled in the past. The prospect may have a different porosity or shale content than at the calibration well, or the encasing shale properties may have changed. However, by comparing certain amplitude properties on the prospect to the same amplitude properties at the reservoir's down-dip brine-saturated location, predictions of lithology and pore content are highly enhanced.

To reduce interpretation ambiguity, two reflection-coefficient transforms (lithology and pore fluid) are derived from well-log curves

To reduce interpretation ambiguity, two reflection-coefficient transforms (lithology and pore fluid) are derived from well-log curves in the prospect area. We show that the AVO response (comparing the near-angle amplitude to the far-angle amplitude) is dominated by lithologic properties, thus the name, Lithology Transform. Basically, the far-angle amplitude is linearly related to the near-angle normal-incident response (NI). This linear relationship holds for high- to low-porosity sands. Meanwhile, the pore-fluid interpretation is contained in a linear relationship of the NI for a hydrocarbon-charged sand to the NI for its equivalent brine-saturated state. This linear relationship is called the Pore-Fluid Transform. As an example, gas sands with $S_w = 0.3$ have a linear NI relationship to their brine-saturated NI regardless of the sand porosity.

Both the lithology and pore-fluid interpretations depend on NI values. What was lacking for many years was a method to determine the NI values from the seismic amplitudes observed on the workstation. To solve for the NI values, we introduce a seismic interpretation technique that combines near- and far-angle horizon maps to yield a map whose values are estimates of normal incidence. The NI difference between the prospect and its equivalent down-dip wet reservoir leads to the prediction of pore fluid and S_w. To accomplish this task, the Lithology and Pore-Fluid Transforms are combined with the AVO thin-bed response. The NI value of the upper interface of a thin-bed reservoir is predicted regardless of the thickness, porosity, cementation, encasing shale properties, etc. By comparing NI values at the prospect with NI values at down-dip brine-saturated locations, estimates of S_w are possible. As an added bonus, by comparing the far-angle amplitudes with the near-angle amplitudes, estimates of porosity are possible.

A field example across a Tertiary reservoir in the Gulf of Mexico illustrates the technique. ■

Biographical Sketch

Fred J. Hilterman received a geophysical engineering degree and PhD in geophysics from Colorado School of Mines. He worked with Mobil from 1963 to 1973, when he joined the University of Houston as a Professor of Geophysics. At UH, Dr. Hilterman co-founded the Seismic Acoustics Laboratory (SAL). In 1981, he co-founded GDC, now a subsidiary of Geokinetics, where he is Chief Scientist. He also lectures at the University of Houston, where he is a Distinguished Research Professor.

Dr. Hilterman is a longstanding member of GSH, SEG, EAGE and AAPG. His services to the societies include associate editor for *GEOPHYSICS*, SEG and AAPG Distinguished Lecturer, 2001 DISC Instructor, Chairman of *The Leading Edge* editorial board, SEG Vice-President and both Technical and General Chairman of SEG Annual Meetings. He was the 1996–97 SEG President.

He has received the SEG Best Paper Award and Best Presentation Award, CSM VanDiest Gold Medal and Distinguished Alumni Medal, SEG Virgil Kauffman Gold Medal, Cecil Green Enterprise Award, Maurice Ewing Award and Honorary Memberships in SEG and GSH.