Tuesday, September 21, 2004

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Social 5:30 p.m., Dinner 6:30 p.m.

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North American Explorationists Dinner Meeting

*by **L. Frank Brown Jr., Robert G. Loucks, Ramón H. Treviño,** and **Ursula Hammes,** Bureau of Economic Geology, John A and Katherine G. Jackson School of Geosciences, The University of Texas at Austin, Austin, Texas*

The North American Explorationists would like to welcome everyone to what we hope will be another season of exciting geology. We lead off with an update of the fine regional work being done by the Bureau of Economic Geology. For the last twenty years, the Bureau has published a wealth of information on the main trends in Texas, helping companies find and produce more reserves. Join us to see their latest thinking on the Frio and some of the controls that can help predict reservoirs.

Steve Earle, Chairman

Understanding Growth-Faulted, Intraslope Sub-basins and Associated Reservoir Targets by Applying Sequence Stratigraphic Principles: Examples from the South Texas Oligocene Frio Formation

Detailed analysis of Oligocene Frio Formation intraslope, growth-faulted sub-basins in the Corpus Christi, Texas area indicates that deposition during relative lowstands of sea-level was the main cause or "trigger" of growth faulting. Lowstand depocenters on the low-gradient, upper continental slope comprising basin-floor-fan facies, slope-fan systems and prograding, lowstand delta systems exerted sufficient gravity stress to trigger major sections of outer shelf and upper slope strata to fail and move basinward. The faults sole out deep in the basin and rotation of hanging-wall blocks mobilized deep-water muds and forced the mud basinward and upward to form mud (shale) ridges that constitute the basinward flank of intraslope sub-basins overlying footwall fault blocks.

Understanding the origin of the growth-faulted sub-basins and their chronostratigraphic relationships and depositional processes provides a perspective that can improve deep on-shelf exploration.

Lowstand sedimentation associated with third-order falls of relative sea-level produced load stress that triggered major regional syndepositional growth-fault systems. Sub-basins on the downthrown side of each arcuate fault segment composing a regional fault system were filled during a single lowstand of sea-level. Consequently genetically similar but diachronous lowstand depositional systems filled each successive growth-faulted sub-basin trend. Sub-basin development and fill extended the Frio shelf-edge stepwise into the Oligocene Gulf of Mexico Basin. Thus each successive, basinward sub-basin was younger than the previous landward sub-basin.

Lithostratigraphic Frio and Anahuac strata comprise six chronostratigraphic, third-order depositional sequences (~32.0–23.38 Ma) and myriad fourth- and fifth-order sequences or parasequence sets. Except for incised valley-fills, lowstand tracts comprise off-shelf systems deposited within active, growth-faulted, intraslope sub-basins. Off-shelf and on-shelf deposition are temporally unique. Maximum Anahuac flooding (~24.57 Ma) provided a regional, dated marker to which latest published ages of sequence surfaces were calibrated. Maximum flooding surfaces and type 1

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unconformities are essentially isochronous, but sand-rich lith ofacies are mostly diachronous.

Sequence-stratigraphic analyses of Oligocene (Frio Formation) growth-faulted sub-basins in Corpus Christi Bay and offshore Mustang Island demonstrate that current exploration targets consist of sand-rich, proximal, deltaic, prograding wedge and incised-valley-fill sandstones, respectively. Postdepositional crestal faults on rollover anticlines provide reservoir trapping mechanisms. Wireline-log facies of productive reservoirs in the sub-basins are genetically similar, but more than 10 mi (> 15 km) apart, and several major faults separate successive sub-basins. A methodology is presented that incorporates the sequence-stratigraphic interpretation of each sub-basin which improves correlations of systems tracts between the widely separated sub-basins. This methodology consists of composite wireline logs created by splicing unfaulted and relatively conformable log segments from the deepest wells in an area. The composite log provides a stratigraphic record that captures a complete succession of depositional and cyclic history. Site-specific sequence-stratigraphic-section (S5) benchmark charts contain composite logs and additional data that summarize available geologic information for a specific sub-basin.

Growth-faulted sub-basins all along the Texas coast have been prolific petroleum targets for decades and are now the focus of prospecting for deep, on-shelf gas. Lowstand basin-floor and slope-fan sandstones are the principal gas targets. Understanding the origin of the growth-faulted sub-basins and their chrono stratigraphic relationships and depositional processes provides a perspective that can improve deep on-shelf exploration. ■

Biographical Sketches

Robert Loucks (Speaker) is a Senior Research Scientist at the Bureau of Economic Geology, working on siliciclastic and carbonate reservoir characterization. He was the recipient of the 1999 AAPG Wallace E. Pratt Memorial Award for Best Paper, the 1982 SEPM Excellence of Presentation Award, and the 1991 SEPM Excellence of Poster Presentation Award. Bob served as the Mideast AAPG Dean A. McGee International Distinguished Lecturer in 1999.

Frank Brown received his BS degree in geology and chemistry from Baylor University in 1951 and his MS and PhD from the University of Wisconsin, Madison, in 1953 and 1955, respectively. Frank has worked for Standard Oil of Texas (Chevron), 1955–57, the Bureau of Economic Geology (BEG), 1957–60 and 1966–89, and as an International Consultant, 1989–1999. From 1960 through 1966 he was associate professor at Baylor University. He was Professor of Geological Sciences at The University of Texas at Austin, 1971–1989 and Emeritus Professor, 1989–1999. Since 1999 he has been a Research Professor at BEG, where he continues his studies of the sequence stratigraphy of the Gulf Coast of Texas and Mexico.

Ramon Trevino received his BS degree in geology (Texas A&I University, 1983) and his MS degree in geology (The University of Texas at Arlington, 1988). He worked for Mobil from 1988 through 1992 and received an MBA from the University of Oklahoma in 1994. Since 1995, he has worked on sequence stratigraphic reservoir characterization at the Bureau of Economic Geology.

Ursula Hammes obtained her Diploma in Geology from the University of Erlangen, Germany, in 1987, and her PhD from the University of Colorado at Boulder in 1992. She spent 10 years in industry and joined the Bureau of Economic Geology in 2002 as a Research Associate. Her main research focus is in clastic and carbonate sequence stratigraphy, depositional systems, and image analysis.