Monday, September 14, 2009

Westchase Hilton • 9999 Westheimer
Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.

Cost: $28 Preregistered members; $35 non-members & walk-ups

To guarantee a seat, you must pre-register on the HGS website and pre-pay with a credit card.
Pre-registration without payment will not be accepted.
You may still walk up and pay at the door, if extra seats are available.

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The Devil in the Details:

What Controls Vertical and Lateral Variation of Hydrocarbon Source and Shale-Gas Reservoir Potential at Millimeter to Kilometer Scales?

Hydrocarbon source and shale-gas reservoir character varies at the cm-scale vertically and at the km-scale laterally in systematic ways that can be deciphered using process-based models within a sequence-stratigraphic framework. Even in mudstone-dominated strata deposited hundreds of kilometers from coeval shorelines, parasequences exhibit systematic variations in physical, biogenic, and chemical attributes. These variations arise from changing relations among the key sets of processes that influence the production, destruction, and dilution of organic matter.

Paleozoic, Mesozoic, and Cenozoic examples (including the New Albany, Barnett, and Mowry Shales, Monterey and Sisquoc Formations) exhibit major shifts in mudstone properties at sequence boundaries, flooding, and downlap surfaces. These shifts can be recognized independently on seismic, log, core, and thin-section data. They also show systematic vertical and lateral variations in those properties at the parasequence- and parasequence-set scale. Prospective facies tend to occur in discrete packages that are diachronous across a basin, making it essential to employ the various physical sequence-stratigraphic surfaces to correlate appropriately and to decipher the distribution of hydrocarbon potential.

An appreciation of variations at such small scales should enable the selection of appropriate and representative samples, an understanding of how they correlate away from sample control, and the calculation of net source or reservoir.

Location with respect to sediment sources and shorelines is a key factor that can be discerned using close examination of sedimentary structures in thin section and hand specimen, integrated with detailed well-log correlation and geochemical analyses. Parasequences in proximal reaches tend to have total-organic-carbon (TOC) content inversely related to sandstone content, maximum grain size, sandstone-bed thickness, level of bioturbation, and skeletal phosphate content. The maximum TOC is positively correlated with hydrogen index (HI) at small TOC values and inversely correlated with HI at large TOC values. TOC is largest at parasequence bases. All observations in proximal sections indicate that dilution by non-hydrogen-rich material is the dominant control on source potential.

In distal areas, maximum TOC content is positively correlated, but only weakly, with maximum grain size and bed thickness. Maximum TOC content is also positively related to phosphate content, HI, and, counter-intuitively, level of bioturbation. TOC is largest near parasequence tops—the opposite of what is seen in proximal areas. The positive correlation of TOC, HI, and phosphorous content suggests that variations in primary organic production or preservation were the key influence on source character (and not dilution). The positive correlation of TOC and HI with bioturbation index further indicates that production was the controlling factor in this setting. Increased bioturbation and slow sedimentation rates should lead to decreased preservation of organic matter through increased consumption and decreased burial efficiency. The observed accumulation of organic matter under these conditions points to production rates of organic matter in excess of the capacity to consume or degrade it.

An appreciation of variations at such small scales should enable the selection of appropriate and representative samples, an understanding of how they correlate away from sample control, and the calculation of net source or reservoir. These relations influence such economically important factors as evaluation and assessment of net volumes of source or gas-in-place, expected hydrocarbon type and quality, and timing of generation.

HGS General Dinner *continued on page 19*

Biographical Sketch

From Greenwich, Connecticut, **Kevin M. Bohacs** received his B.Sc.(Honors) in geology from the University of Connecticut in 1976 and his Sc.D. in experimental sedimentology from M.I.T. in 1981(where he built and operated the world's largest flume). He joined Exxon Production Research Company in Houston, Texas in 1981, where he is currently a sedimentologist and stratigrapher with the Hydrocarbon Systems Division.

At ExxonMobil Upstream Research Company, Kevin leads the application of sequence stratigraphy and sedimentology to fine-grained rocks from deep sea to swamps and lakes, in basins around the world. As Senior Hydrocarbon Systems Consultant, his primary focus is to keep the “geo” in geochemistry—integrating field work, subsurface investigation, and laboratory analyses. He works closely with exploration affiliates in evaluating their hydrocarbon systems, teaches field schools in sequence stratigraphy, sedimentology, and field safety, and conducts field work for research and exploration.

Kevin has written more than 85 scientific contributions on the stratigraphy and sedimentology of mudstones and hydrocarbon source rocks. He was co-recipient of the AAPG Jules Braunstein Memorial Award for best poster session paper in 1995 for work on coal sequence stratigraphy and the AAPG award for best international paper in 1998 for his work on lacustrine systems.

He has served as AAPG Distinguished Lecturer (1999-2000), Petroleum Exploration Society of Australia Distinguished Lecturer (2001), URC Outstanding Instructor (1994-1998, 2003-2006), and AAPG Distinguished Instructor (2007-2009). He was elected a Fellow of the Geological Society of America (2004), as well as Fellow of the Geological Society (London), The Explorers Club, and the Royal Geographical Society.