Monday, November 10, 2008

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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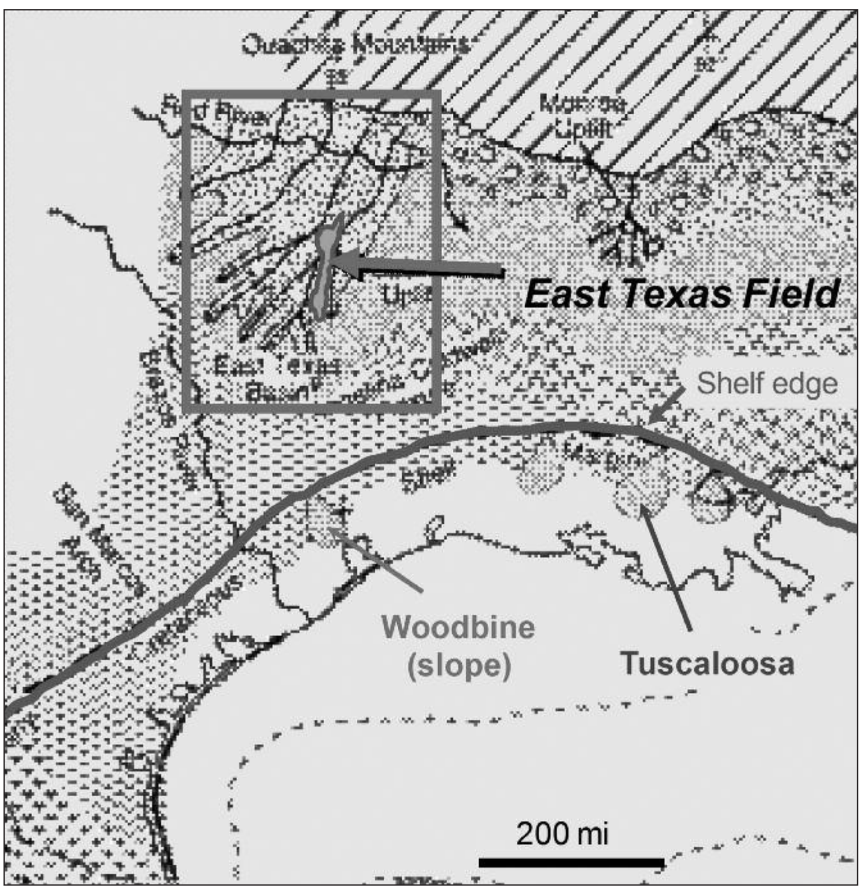
New Interpretations of Reservoir Architecture of the Upper Cretaceous Woodbine Group in East Texas Field: Sequence Stratigraphic and Depositional Perspectives

The East Texas Field, located on the west margin of the Sabine Uplift, is the largest oil field in the lower 48 states. Oil reservoirs occur in west-dipping Woodbine Group conglomerates and sandstones that are truncated by a subregional unconformity below the Austin Chalk, which forms the seal throughout the field. From its discovery in 1930 through mid-2007, the field had produced 5.42 billion stock tank barrels (STB) of oil. The calculated ultimate recovery of approximately 5.49 billion STB and the advanced degree of water encroachment indicate that the field is in the waning stages of production. Given these figures, about 70 million STB are still likely producible under current production practices. However, recent closer evaluation of the amount of by passed pay, deeper Woodbine pay, and poorly swept oil, all indicate that the field has remaining reserves of as much as 550 million STB. Because of this large estimated remaining-reserves volume, the numerous wells that exist in the field for potential recompletion and/or deepening (more than 31,200) , and the currently favorable price of oil, producers are now aggressively targeting recompletions—especially in deeper pay zones in the Woodbine section.

> *Two main development strategies — well deepening and optimized waterfloods — are options for increasing recovery efficiency in the East Texas Field.*



Woodbine Location Map

Although the East Texas Field has been producing for more than 75 years, no modern comprehensive geologic study of the field has been conducted. The present study is the first to integrate core data from the field and adjacent areas with well log analyses. Our main objectives have been to understand the role of sequence stratigraphy in the depositional origin of the producing intervals, to document facies distribution, and to describe facies distribution controls on the potential for additional production. We have achieved these objectives by:

(1) applying sequence-stratigraphic analysis to the Woodbine Group in the East Texas Basin where the succession is complete and extending the analysis to the truncated

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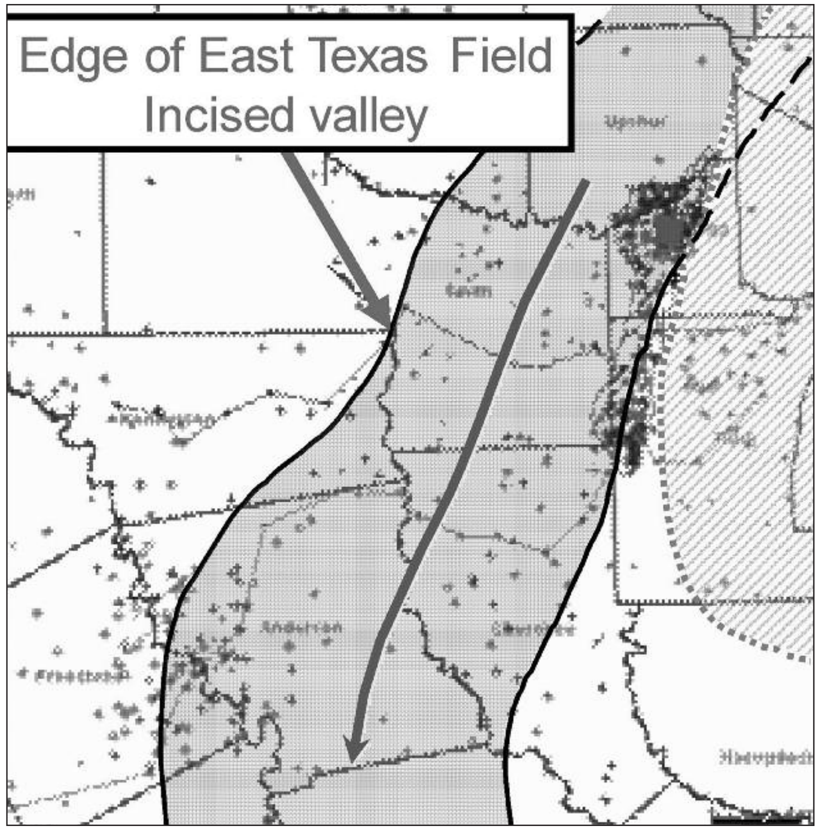
Woodbine section on the adjacent Sabine Uplift to identify principal chronostratigraphic boundaries in the field;

(2) using these boundaries to map coeval sandstone units, identifying reservoir-facies trends in selected pilot study areas, and interpreting depositional facies origin and distribution and Woodbine paleogeography; and

(3) inferring sequence stratigraphic and facies controls on incompletely swept reservoir zones, potential by-passed pay, and deeper pay zones by integrating our findings from the large core and log data set with engineering data.



East Texas Field and Interpreted Incised Valley

The Woodbine Group represents the dominant episode of coarse-siliciclastic deposition during the Late Cretaceous in the East Texas Basin and comprises mostly on-shelf fluvial-deltaic deposits. The succession thins gradually from the axis of the basin westward to the Mexia-Talco Fault Zone and eastward to the Sabine Uplift. Regional sequence-stratigraphic analysis of approximately 225 well logs distributed across the central part of the basin indicates that a maximum of 14 fourth-order sequences compose the Woodbine succession, and the number of sequences systematically decreases in both directions away from the basin center. The oldest five sequences, extending to the west flank of the Sabine Uplift, are truncated by the base-of-Austin unconformity, whereas deposition of the upper Woodbine sequences was limited to a zone approximately 35 miles wide centered on the basin axis. Reservoirs in the field occur in the basal three fourth-order sequences (S1–S3).

Analysis of more than 1,500 feet of 30 whole cores and wireline logs from approximately 500 wells in the north pilot area (NPA) and south pilot area (SPA) of the field indicates that the sandstone body architecture is more complex than that inferred by previous workers. Moreover, the depositional settings of reservoir facies vary considerably from those described in earlier investigations, which inferred stacked meanderbelt-sandstones in the north part of the field grading to sandstones of equivalent wave-dominated deltaic and coastal-barrier systems in the southern part. Our analysis indicates that throughout the NPA, an S3 conglomeratic low-stand incised-valley fill overlies a sandstone-dominated S1 high-stand systems tract, the primary target for recent well deepenings. The entire S2 succession has been removed by valley incision in this area. The Woodbine section in the SPA occurs just east of the approximate depositional limit of the S3 incised-valley-fill system and comprises most or all of the S1 highstand deltaic succession. Sandstone body heterogeneity in the high-stand section is controlled by the fluvial-dominated deltaic depositional architecture, with dip-elongate distributary-channel sandstones pinching out over short distances (typically less than 500 feet) into delta-plain and interdistributary bay siltstones and mudstones.

Two main development strategies — well deepening and optimized waterfloods — are options for increasing recovery efficiency in the East Texas Field. A full understanding of reservoir compartmentalization, fluid flow, and unswept mobile oil in the field should consider the fluvial-dominated deltaic and lowstand valley-fill sandstone-body architecture. For example, production of oil by deepening of existing wells is primarily from thin sandstones in the S1 highstand deltaic succession inferred to contain limited untapped reservoir compartments owing to abrupt lateral and vertical changes in facies and thickness of sandstone bodies. Permeability and porosity data, in conjunction with net-sandstone maps, indicate that primary reservoir facies in the S1 highstand deltaic succession in the SPA occur in thick (greater than 25-foot) distributary channel and channel mouth-bar sandstones. Waterfloods can be better designed to take advantage of the discontinuous reservoir sandstone geometry. Production costs can be reduced by shutting off water-injection wells in shaly areas where there is no appreciable pressure support. ■

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Biographical Sketches

Tucker F. Hentz (tucker.hentz@beg.utexas.edu) is a geologist with the Bureau of Economic Geology specializing in siliciclastic sequence stratigraphy and basin analysis. He received an MS in geology from The University of Kansas in 1982. Since joining the Bureau of Economic Geology in 1982, he has conducted studies in several Mid-Continent and Gulf of Mexico basins, including the Eastern Shelf of the Midland Basin (field mapping of Pennsylvanian and Permian continental strata), Delaware Basin (native sulfur in the Castile Formation), Anadarko Basin (Cleveland Formation and Cherokee Group), Val Verde Basin (Ozona Canyon Formation), Gulf Coast Basin (Wilcox Lobo trend, Miocene of offshore Louisiana), Burgos Basin (Miocene strata), Fort Worth Basin (Bend Conglomerate), and East Texas Basin (Woodbine Group). Mr. Hentz has also worked on several major play atlases of the northern Gulf of Mexico and Mid-Continent published by the Bureau of Economic Geology.

William A. Ambrose (william.ambrose@beg.utexas.edu) is a geologist with the Bureau of Economic Geology specializing in sedimentology and reservoir characterization. He received an MA in geological sciences in 1983 from the University of Texas at Austin. Before joining the Bureau of Economic Geology in 1987, he was involved in regional subsurface studies of the Yegua and Vicksburg Formations and the Wilcox Group in the Texas Gulf Coast. Mr. Ambrose has worked on a variety of projects at the Bureau of Economic Geology, including characterization of Frio fluvial and deltaic reservoirs in South Texas, co-production of gas and hot brine from Oligocene reservoirs in the Texas Gulf Coast, evaluation of coalbed methane reservoirs in Rocky Mountain basins, and reservoir characterization and basin analysis studies in Venezuela and Mexico. He is a past president of the Energy Minerals Division of AAPG.