

Progress Report

December 2010

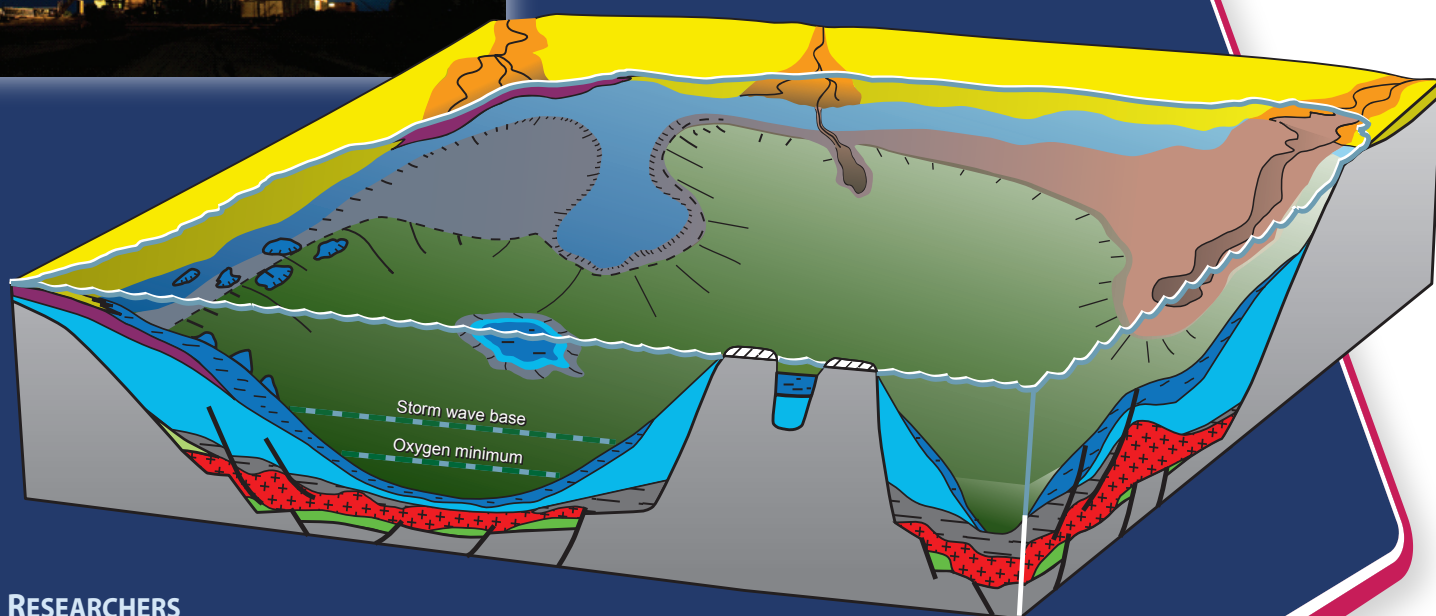


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PROJECT

STARR★

STATE OF TEXAS ADVANCED OIL AND GAS RESOURCE RECOVERY

PROGRESS REPORT, DECEMBER 2010

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EXECUTIVE SUMMARY

The State of Texas Advanced Resource Recovery program, Project STARR, has been successful in its major objective to increase royalty income to the Permanent School Fund and severance taxes to the General Fund through technological and research projects that promote the drilling of profitable oil and gas wells on State Lands and Waters.

The Bureau of Economic Geology (BEG) currently receives funds from the State to analyze State Lands and other Texas properties and then advise and assist operators on how to increase current production or discover new production. The State requires Project STARR to be revenue neutral—that is, Project STARR has to cause an amount of new revenue to flow into the State that equals or exceeds the amount that is appropriated to the program by the Legislature. This progress report summarizes and documents in detail the accomplishments of Project STARR over the last 2 years (September 2008 through August 2010).

Project STARR results have been used to recommend >200 infill and step-out wells and ~60 recompletions over the project's 17-year duration. Project STARR has also identified and worked on several prospects in previously undrilled, deeper strata. To date, Project STARR has completed studies or is currently working on 36 fields. During the 2 years since the last Project STARR report, these studies have created total severance tax revenues for the State in the amount of \$16,568,217, with \$11,975,529 from gas severance taxes and \$4,540,036 from oil severance taxes.

It commonly takes several years between delineation of prospects and actual drilling of wells; therefore, many more millions of dollars of benefits to the State may result from Project STARR's recent recommendations and successes. Over the 17-year life of Project STARR, ~\$200 million has been added from royalties and severance taxes on the increased production, an average of ~\$12 million per year.

Over the last 2 years, Project STARR has helped companies with whom Project STARR has collaborated generate a net amount of ~\$16,568,217 in severance taxes, with a 25% factor applied to gross severance taxes that amount to \$53,549,467. Relative to total income, Project STARR is revenue positive by a factor of ~5.5. The high positive revenue factor is from several thousand successful wells drilled or recompleted in Texas, particularly from the highly productive Barnett shale-gas play in Newark East field, the Haynesville shale-gas play in northeast Texas, Pennsylvanian targets in the Eastern Shelf of the Permian Basin, and the regional Woodbine play in East Texas.

With sustained oil and gas development funding from the State of Texas, Project STARR has an ultimate goal of capturing an incremental 5% of the remaining mobile oil and gas resource on State Lands and Waters that would not be captured without the application of advanced technology and application of sequence-stratigraphic principles. The mobile oil resource on State Lands is 1.6 Bbbl. Achieving the goal of 5% incremental oil would yield 80 MMbbl and provide a return to the Permanent School Fund of \$700 million, assuming an average price of \$70/bbl and a 12.5% royalty.

Similarly, a capture of 5% of the 10 Tcf of remaining gas would yield 500 Bcf and generate \$300 million for the Permanent School Fund, assuming an average price of \$4.00/Mcf and an average 15% royalty. By achieving these levels of incremental recovery, the Project STARR initiative could help generate \$1 billion in royalties to the Permanent School Fund over the long term.

The wellhead value of additional oil and gas reserves would be \$5.6 billion and \$2.0 billion, respectively, for a total of \$7.6 billion. Calculations based on the Railroad Commission of Texas "General Model of Oil and Gas Impact on the Texas Economy" derived from the Comptroller's Input-Output model of the Texas economy can be further utilized to estimate the overall effect of additional oil and gas reserves in terms of economic value, taxes, and jobs created. The economic value of this potential future oil and gas as it cycles through the Texas economy is calculated at \$22.1 billion (wellhead value multiplied by 2.91). Total potential taxes of \$873 million are derived from severance (4.6% oil and 7.5% gas of wellhead value), ad valorem (3.95% of wellhead value), franchise (0.18% of economic value), and sales (2% of economic value) taxes. The number of potential additional jobs created equals 146,160, assuming 19.1 jobs are created per million dollars of wellhead value.

INTRODUCTION

Revenue income to the Permanent School Fund is derived largely from oil and gas royalties from Texas State Lands and from severance taxes on Texas leases (Fig. 1). However, oil and gas royalty income has declined, even though a large hydrocarbon resource base remains on State Lands. In fact, State Lands fields and properties still contain more oil and gas than has been recovered over the decades-long history of State Lands production. Rather than being unobtainable, a large volume of this remaining oil and gas is recoverable through improved scientific understanding and strategic, targeted deployment of advanced recovery technologies. Advanced technology has historically been the realm of major oil and gas companies, but many large companies in their pursuit of economies of scale have abandoned development of mature Texas oil and gas resources. The departure of these large operators has created opportunities for the remaining smaller producers of State Lands fields. Independents, who have no advanced research or development capabilities, are requesting reservoir characterization and exploration assistance from the State of Texas Advanced Oil and Gas Resource Recovery project (Project STARR) (see letters from partners in Appendix A). These independents recognize that without the advanced technology offered by Project STARR, they may miss producing substantial reserves and not recognize additional opportunities on their State Land leases. The Bureau of Economic Geology (BEG), The University of Texas at Austin, with funding from the State of Texas and support from the General Land Office and the Railroad Commission of Texas, strives to provide this requested technical support. Opportunities for increased production and associated reserves have been identified, and with the support of allied operators, these opportunities have been or are being drilled. Recent projects are

described in the present report. Project STARR's revenue neutrality calculations are typically conducted for the trailing 2-year period at the time of reporting. For this report, calculations cover the period from September 1, 2008, through July 31, 2010.

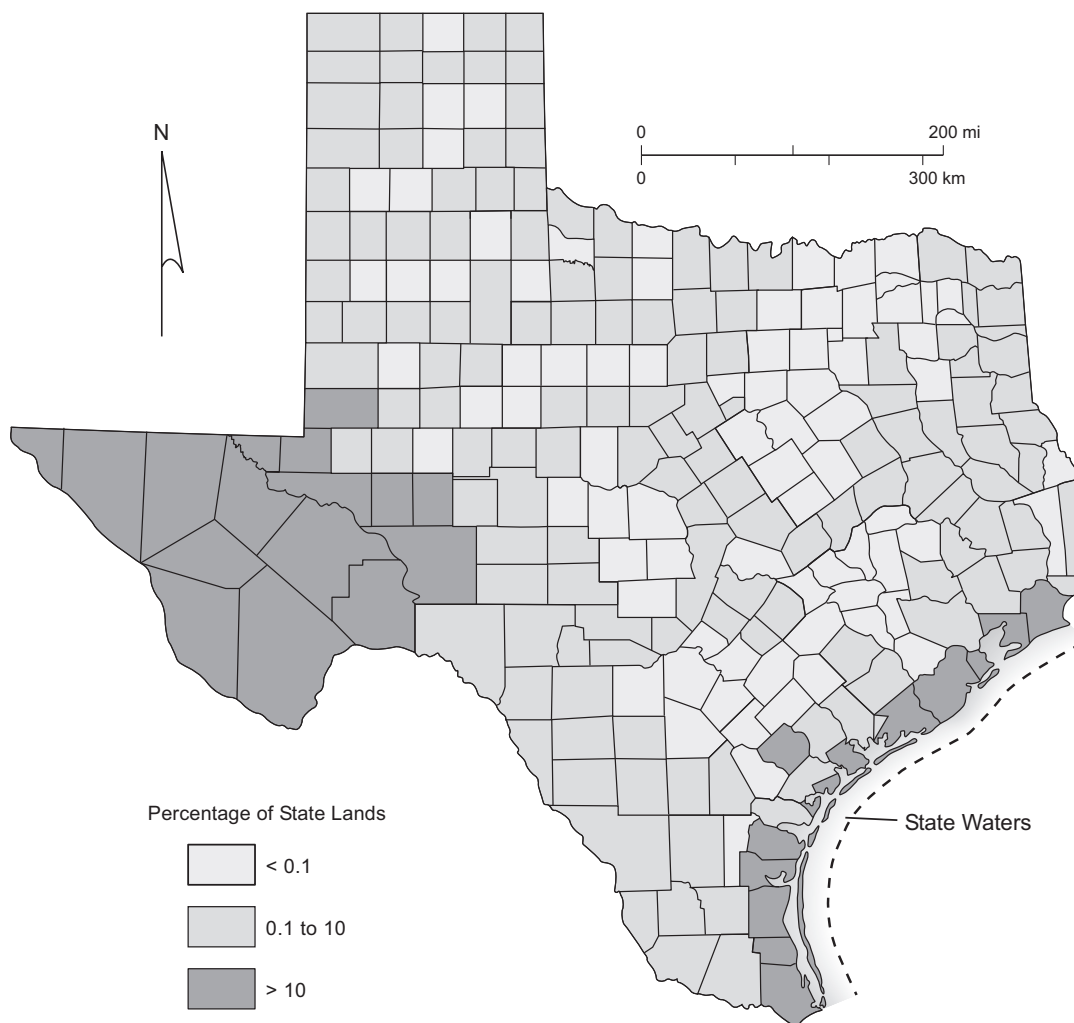


Figure 1. Location of Texas State Lands and State Waters. Onshore counties are shaded according to the percentage of area that is State Lands. Most of onshore State Lands leases occur in the Permian Basin in West Texas and along the Gulf Coast. From Holtz and Garrett (1997).

To date, 36 fields have been chosen for assessment (Fig. 2 and Table 1); 32 Texas operators have been, or are currently, involved in Project STARR (Table 1). Project STARR studies have been used to recommend >200 infill and step-out wells and >60 recompletions over the project's 15-year duration (Tyler et al., 1998; Hardage et al., 2000; Loucks et al., 2002a, b, 2004, 2006; Hammes et al., 2008). Six new field studies were added during the 2008--2010 biennium, and to date three additional field studies have been undertaken for the upcoming 2010--2012 biennium (Fig. 3). Working closely with industry partners, Project STARR has also identified several prospects in

previously undrilled, deeper strata. Acknowledgment letters from six partners are presented in Appendix A. Project STARR also presented workshops on the Cleveland/Marmaton/Atoka trend in the Texas Panhandle, East Texas field, and the regional Woodbine trend in East Texas, the Canyon Group (Pennsylvanian) trend on the Eastern Shelf of the Permian Basin, and Paleozoic reservoirs in the Permian Basin. In addition, the STARR group conducted a 2-day field trip for Gunn Oil to Pennsylvanian outcrops in North Texas. These workshops and field trips were designed to increase operators' knowledge of the geology and engineering of this important Texas gas resource and to promote additional drilling. Since the Project Starr workshops, several thousand wells have been drilled in the Barnett shale-gas play. Currently seven more regional studies are under way (described later) that will increase and stimulate production in these strata and regions.

The enhanced STARR project is currently conducting five regional studies under the New Venture Studies group and three studies under the Unconventional Resources group. These new endeavors have required adding manpower to the project. We now have 16 full- and part-time geoscientists/engineers associated with the project. This technical staff represents a broad range of geotechnical skills.

STARR's Reservoir Characterization group is continuing to apply its advanced methods of identifying additional drilling and completion opportunities in several important fields (Fig. 4), including East Texas (Woodbine Group), Spur Lake and Broken Bone fields (Canyon Group), Gold River North field (Olmos Formation), and primary-producing field areas in the Cleveland/Marmaton/Atoka trend in the Texas Panhandle, as well as the Haynesville shale-gas trend in East Texas.

Highlights of the present biennium (September 2008 – August 2010):

- Project STARR is revenue positive by a net factor of ~5.5 and has helped generate ~\$16.6 million to the Permanent School Fund and the General Fund of the State of Texas during the last biennium. The high positive revenue factor is from several thousand successful wells drilled in the highly productive Barnett shale-gas play in Newark East field and the Haynesville shale-gas play in East Texas, a successful tertiary recovery project in Yates field in West Texas, and two field studies in Pennsylvanian reservoirs on the Eastern Shelf of the Permian Basin.
- Our reservoir characterization group contributed to the successful completion of >80 wells in Gunn Oil's Spur Lake and Broken Bone fields, 9 new reservoir targets in MPG Petroleum's Ritchie Farms field, and 6 successful well deepening in East Texas field.
- A regional study of the Woodbine Group in the East Texas Basin was conducted to gain new insights on new exploration fairways and play opportunities. Results were presented at a workshop in Houston co-hosted by the Petroleum Technology Transfer Council (PTTC) in November 2008.

- A regional study of the Pennsylvanian Atoka, Cleveland, and Marmaton Group in a 3,000-mi² area in the Texas Panhandle provided a play exploration framework for more effective development of low-permeability, tight-gas sandstone reservoirs. In November 2009 results were presented to >60 attendees representing >20 oil and gas operators at an all-day workshop in Farmers Branch, Texas.

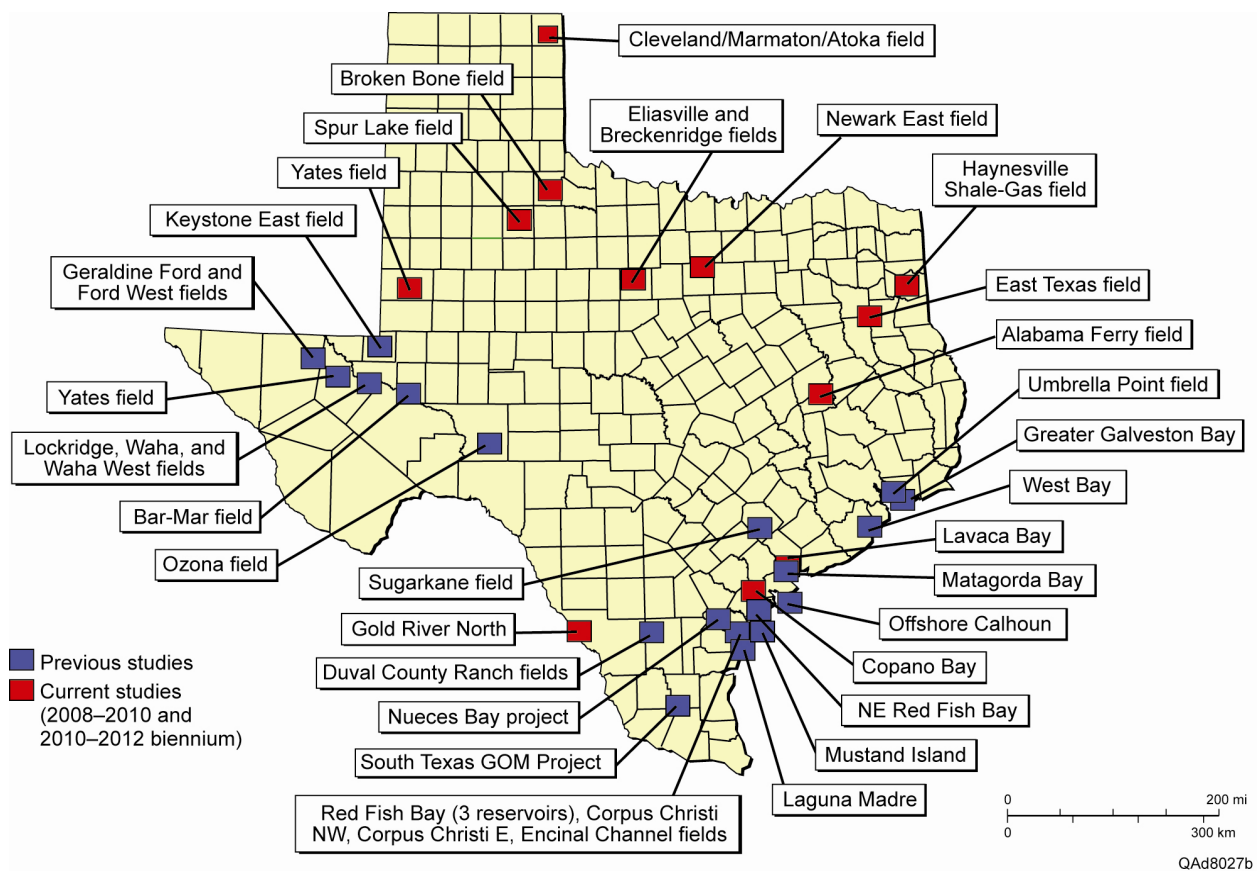


Figure 2. Map showing previous Project STARR field studies (blue squares) and current field studies for the 2008–2010 biennium, as well as new studies for the 2010–2012 biennium (shaded boxes). Thirty-six oil and gas fields have been or are being evaluated by Project STARR.

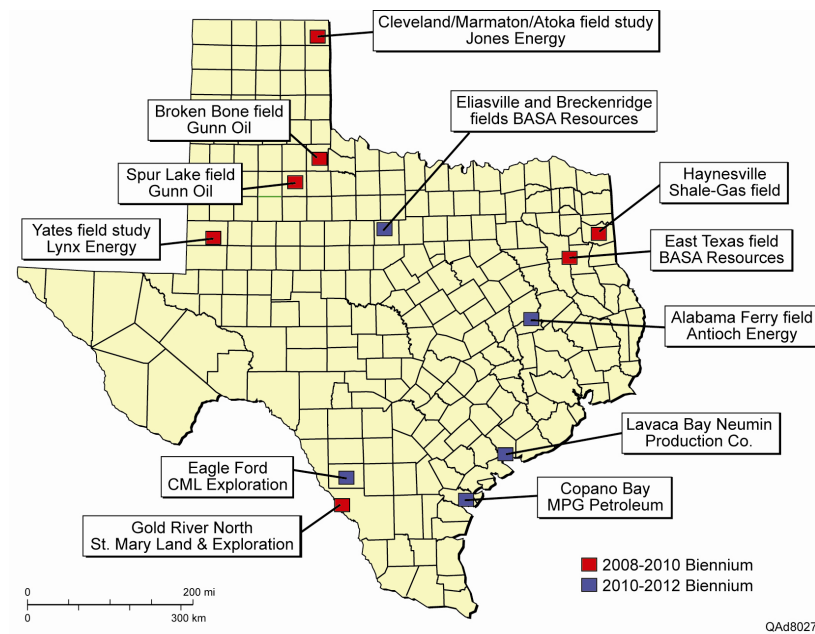


Figure 3. STARR field studies for both the 2008–2010 and upcoming 2010–2012 biennium.

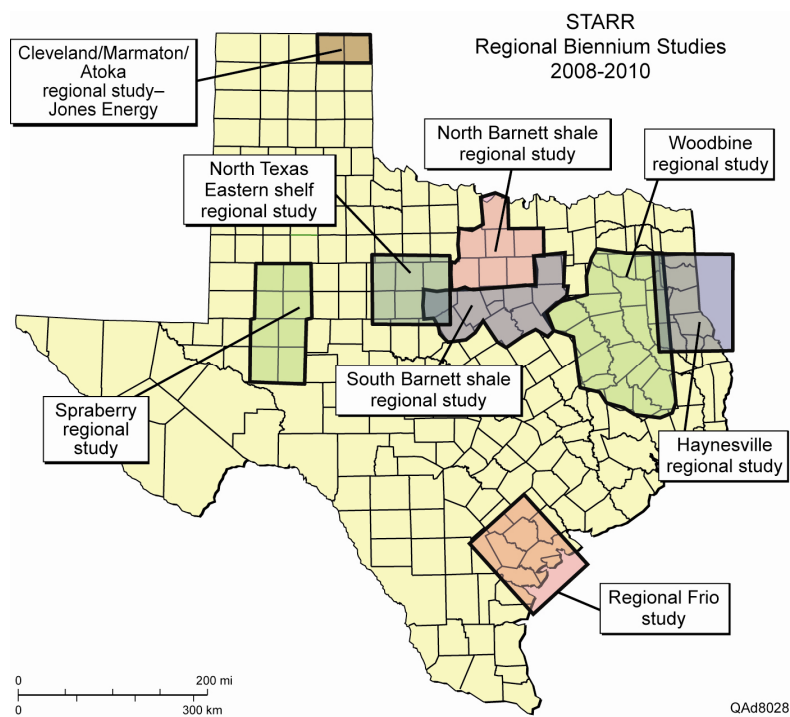


Figure 4. STARR regional studies for the 2008–2010 biennium.

Table 1. Project STARR field studies.

<u>Field</u>	<u>Operator</u>	<u>Period of Project STARR Interaction</u>
Keystone East field	Bass Enterprises, Hallwood Energy, Pioneer Natural Resources, Vista Resources	1995–1999
Geraldine Ford and Ford West fields: (primary funding by U.S. Department of Energy)	Conoco, Incorporated	1995–1997
Lockridge, Waha, and Waha West fields: (primary funding by U.S. Department of Energy and Gas Research Institute)	Shell Oil and Mobil Oil (now ExxonMobil)	1996–1998
Bar Mar field	Hanson Corporation	1997–1998
	Union Pacific Resources (now Anadarko), Cross Timbers Oil Co.	1996–1998
Ozona field	Killam Oil	1998–1999
Duval County Ranch field	Panaco, Incorporated	1998–1999
Umbrella Point field	Pi Energy	1995–1999
Red Fish Bay field (shallow Frio)	Sabco Oil and Gas, Royal Exploration	1996–1997
Corpus Christi East field (Frio)	Sabco Oil and Gas, Royal Exploration	1998–2000
Corpus Christi NW field (Frio)	Sabco Oil and Gas, Royal Exploration	1998–2000
Encinal Channel field (Frio)	Sabco Oil and Gas	1999–2000
Mustang Island 889 field (Frio)	IBC Petroleum, Cinco	2000–2001
Red Fish Bay field (Middle Frio)	Boss Exploration, Cinco	2001–2008
Red Fish Bay field (Deep Frio)	Cabot Oil and Gas	2003–2008
Mustang Island Offshore (Frio)	Cabot Oil and Gas	2003
Northeast Red Fish Bay Project (Frio)	Novus	2003
Laguna Madre (Frio)	Kinder Morgan	2004–2005
Yates field EOR (Permian)	Santos USA Corp	2004–2006
Galveston-Bay Shelf area study (Frio)		2004–2006
Carancahua and Matagorda Bay Projects (Frio, Miocene)	Brigham Exploration Company	2004–2008
West Bay area study (Alligator Point field; Frio, Miocene)	Gulf Energy Exploration	2004–2008
LaSalle, Calhoun offshore (Frio)	Gulf Energy Exploration	2005–present
Gold River North field (Olmos)	Huber	2005–present
	St. Mary's Land and Exploration	2006
Gold River North field (Olmos)	Various operators	2007–present
East Texas field (Woodbine)	Various operators	2006–present
North Newark field (Barnett)	Gunn Oil Co.	2007–present
Spur Lake and Broken Bone fields	Sabco Operating Co.	2007–present
Mustang Island (Frio)	MPG Petroleum	2006–present
Copano Bay	Danmark Energy	2007–present
East Texas field (Moncrief lease)	Texas Crude	2007–present
Sugarkane field	Jones Energy, Ltd.	2006–present
Cleveland/Marmaton/Atoka field	Neumin Production Company	2008–present
Lavaca Bay field	Antioch Energy LLC	2008–present
Alabama Ferry field	Petrohawk, Common Resources, BP	2009–present
Haynesville		2009–present

HISTORICAL BACKGROUND ON THE PERMANENT SCHOOL FUND

In 1839 the Republic of Texas began designating public lands to be used to benefit public schools. The State of Texas now has more than 13 million acres set aside for revenue generation to assist public education (Fig. 1). In the 169 years since that forward-looking decision was made, billions in revenue for public schools has been generated by agricultural and mineral leasing of these lands, with most of the revenue being derived from royalties and rentals paid by oil and gas leases. At the end of fiscal year 2009 the fund was valued at \$22.6 billion (Texas Permanent School Fund Annual Report, 2009, page 22). Land endowment income collected by the General Land Office (GLO), consisting primarily of mineral royalties and bonuses from oil and gas production, was \$319.5 million for fiscal year 2005.

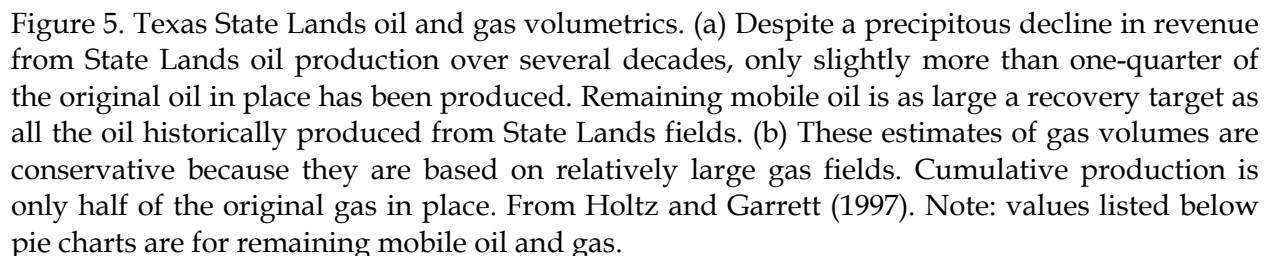
A vast volume of oil and gas remains in State Lands fields (Holtz and Garrett, 1997). Remaining mobile oil on State Lands is estimated to be 1.6 billion barrels (Bbbl) (Fig. 5a), and remaining gas is 10 trillion cubic feet (Tcf) (Fig. 5b). At a conservative value of \$60/bbl oil at an average royalty of 15%, the potential estimated royalty to the Permanent School Fund on this oil is \$14 billion. Similarly for gas, at \$4/Mcf with an average royalty of 15%, the potential estimated royalty to the Permanent School Fund on this oil is \$6 billion (Fig. 5). Hydrocarbons that remain are commonly trapped in geologically complex reservoirs, such as (1) tight-gas sandstones, cherts, and carbonates; (2) gas-shales; (3) deep, high-temperature reservoirs; and (4) structurally complex reservoirs that require advanced technologies for successful, cost-effective recovery. The challenge for the State and for public education is that these oil and gas resources must be produced for their value to be realized. With support from the State of Texas, Project STARR and Texas operators are responding to this challenge.

PROJECT STARR METHODOLOGIES

The philosophy of Project STARR is to work with State Lands operators to (1) deploy advanced recovery strategies and newly developed technologies on a field-by-field basis to ensure maximal recovery efficiency, (2) encourage exploration in underdeveloped areas or reservoir sections, and (3) exploit unconventional hydrocarbon resources.

The most volumetrically significant State Lands oil and gas resources are on the Gulf Coast and in the Permian Basin (Fig. 6). Project STARR's approach is to concentrate on these two mature resource areas, where innovative and cost-effective strategies can best be deployed to stem the decline of production. Thirty-six fields (Fig. 2) have undergone, or are undergoing, characterization and extended development with the cooperation of State Lands operators. This maximization of oil and gas recovery from State Lands fields consists of three critical components: (1) reservoir characterization and advanced resource recovery technology deployment in key reservoirs, (2) identification of prospects in deeper untested sections, and

Regional areas, where more exploration is warranted and where new insights will generate increased interest in deeper and different exploration play types, are selected for regional studies. These areas are analyzed using the latest sequence stratigraphic principles to help us understand potential reservoir distribution and reservoir quality. Studies also highlight underdrilled production trends and new exploration trends. Shale-gas plays are being investigated across Texas as well. This relatively recent unconventional hydrocarbon resource will play an important role in generating future revenue to the Permanent School and General Funds.



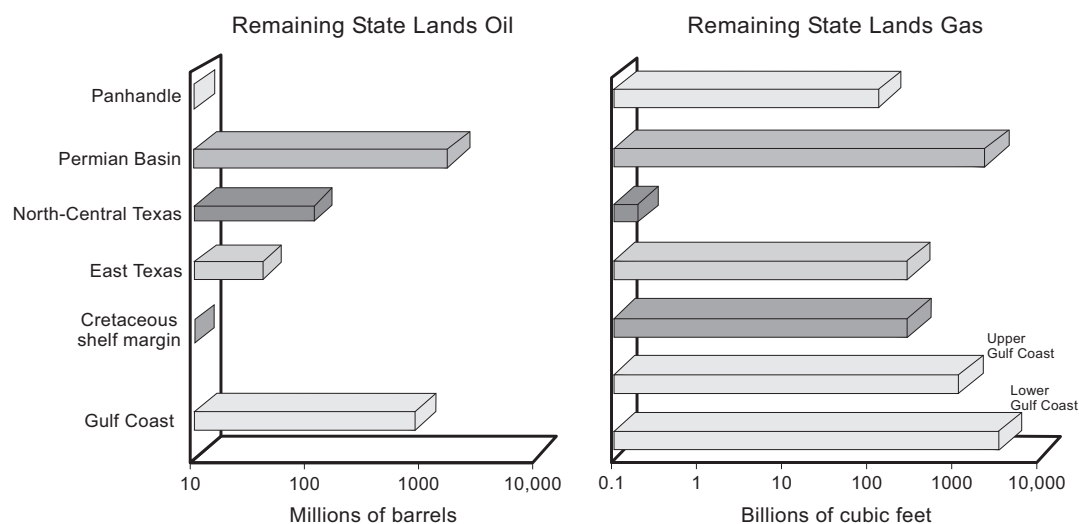


Figure 6. State Lands remaining oil and gas volumes. Gulf Coast and Permian Basin regions have the most potential hydrocarbon reserves. From Holtz and Garrett (1997).

Reservoir Characterization and Advanced Resource Recovery Technology Deployment

The advanced hydrocarbon recovery program applied by Project STARR is based on application of reservoir characterization techniques that delineate unrecovered oil and gas in selected Texas reservoirs. Project STARR staff work with operators to deploy advanced reservoir exploitation plans that are based on a thorough understanding of internal architecture of the reservoir and the effects that depositional systems have on oil and gas accumulation and distribution. Key to this effort is identification of oil and gas reservoirs that offer economic opportunities. Project STARR recruits field operators who are ready to address and redesign, as appropriate, development efforts currently in place on properties that contain these reservoirs. Detailed geologic and engineering characterization projects have created quantitative descriptions of several State Lands reservoirs, identified untapped and bypassed compartments of remaining oil and gas, and defined deeper reservoir targets to drill.

These Project STARR studies include reservoir characterization analyses of the fields displayed in Figures 2 and 4 and listed in Table 1. The optimized recovery strategies recommended by Project STARR in these field studies include step-out wells, well deepening, recompletions, targeted infill drilling, injection profile modification, waterflood optimization, and drilling untested deeper targets under producing fields.

New Venture Regional Studies

Project STARR regional studies are based on applying the latest methodologies of analyzing the stratigraphic architecture of sedimentary basins. We use sequence-stratigraphic principles that have been developed by major oil companies over the past 20 years. We also apply methodologies developed by Project STARR for Gulf of Mexico stratigraphy (Brown et al., 2004, 2005; Hammes et al., 2007). The studies emphasize potential exploration trends and reservoir characteristics in new exploration fairways, thereby contributing to increases in drilling in these areas. Deep to ultradeep reservoirs, such as those in the higher risk, deep-shelf gas play (offshore Tertiary sandstone reservoirs between the depths of 15,000 and 35,000 ft) are an example of where new studies are needed to encourage exploration drilling.

STARR has also conducted other regional studies, including the Upper Cretaceous Woodbine Group in East Texas, the Cleveland/Marmaton/Atoka Groups in the Texas Panhandle, and Pennsylvanian reservoirs on the Eastern Shelf of the Permian Basin. In each of these regional studies, some of the most successful oil and gas discoveries have been in lowstand systems tracts, either in deepwater basin-floor-fan or lowstand prograding-wedge deposits, or in sandy, incised-valley-fill deposits that STARR has mapped on the basin scale.

Unconventional Resources

Unconventional hydrocarbon resources, such as shale gas, tar sands, tight-gas sandstones, cherts, carbonates, and low-pressure gas, are and will continue to be important hydrocarbon resources for the future of Texas. Shale gas is one of the most active exploration plays in Texas, with prospects ranging from far West Texas to the Fort Worth Basin and East Texas. These plays, including the Barnett and Haynesville, are affecting large areas of State Lands in Texas. Project STARR is conducting several studies on shale gas to promote this resource, for it should have a great impact on production of gas from State Lands. In the upcoming biennium, STARR will be investigating the new Eagle Ford shale play, which promises to greatly expand activity in shale-gas and shale-oil reservoirs in Texas.

Transfer of Project STARR Technology to Oil and Gas Operators

Success of the advanced recovery initiative, measured in incremental barrels of oil and additional cubic feet of gas, is important, but equally important is the transfer of successful approaches of improved oil recovery to oil and gas operators. Because technology transfer can facilitate improved efficiencies in exploration and production, Project STARR has developed a technology-transfer approach that includes workshops, presentations, publications, and digital data sets (CD-ROM's). As part of Project STARR's public outreach, 3-D visualizations of STARR field studies that display reservoir architecture have been constructed for presentation to oil and gas companies,

as well as to middle and high school students to raise interest and awareness of oil and gas exploration in Texas.

In collaboration with the General Land Office and the Railroad Commission of Texas, Project STARR personnel have provided assistance and advice to numerous operators on optimal development strategies, appropriate well log suites, styles of reservoir heterogeneity and their effects on oil and gas recovery, and evaluation of exploration targets, as well as regional geology and unconventional resources.

Through technology transfer we envision that many remaining State Lands oil and gas reserves will be explored and developed in future decades to sustain the Texas Permanent School Fund. As a result of this State funding, Project STARR has received several awards (Appendix B) and has provided the public with numerous publications, workshops, and lectures (Appendices C and D). Since the last Project STARR report, we have been responsible for 45 professional papers and 44 abstracts and >70 presentations, as well as several workshops and field trips (Appendices C and D).

Project STARR has also been active in presenting seminars to STARR's industry partners. During the reporting biennium, Project STARR presented private seminars and workshops on State Lands geology to Gulf Energy Exploration, Brigham Oil and Gas Exploration Company, Texas Crude, Neumin Production Company, Danmark Energy, Jones Energy, BASA Resources, Gunn Oil and Gas, Branta Resources, MPG Petroleum, St. Mary's Land and Exploration, Devon, EOG, ExxonMobil, Shell Oil Company, BP, Petrohawk, Exco, Antioch Energy, Carr Resources, Excalibur Energy Corporation, CML Exploration, Vision Resources, Texas American Resources Company, and Ameristate Exploration.

Research Developed from Project STARR Program

Project STARR has made a major effort to produce research using the data available from our industry partners. Through our partners, Project STARR is able to review seismic, wireline-log, and core data sets that are not generally available to the public. With permission from the partner and seismic vendor, Project STARR published research results (see earlier section on Transfer of Project STARR Technology to Texas Oil and Gas Operators).

Project STARR made several major contributions to the understanding of exploration and development of oil and gas plays in Texas, including (1) specific State Lands fields along the Texas Gulf Coast (onshore and offshore), (2) the regional sequence-stratigraphic framework of the Cenozoic System in the Texas Gulf Coast Basin, (3) the Woodbine Formation in East Texas, (4) the Barnett shale play in the Fort Worth Basin, (5) tight-gas reservoirs in the Pennsylvanian Cleveland Formation and Marmaton Group in the Texas Panhandle, and (6) the Haynesville shale play in East Texas:

1. *Understanding growth-faulted, intraslope subbasins by applying sequence stratigraphic principles*—This study of Frio intraslope, growth-faulted subbasins in the Corpus Christi, Texas, area has continued for the last 9 years. New seismic data sets have allowed us to investigate deeper strata and demonstrate through detailed analysis that deposition during relative lowstands of sea level resulted in extensive deep-water reservoirs similar to prolific deep-water reservoirs in the Miocene of the Gulf of Mexico, Brazil, and West Africa. Lowstand depocenters on the low-gradient, upper continental slope comprising basin-floor-fan facies, slope-fan systems, and prograding lowstand-delta systems exerted gravity stress sufficient to cause major sections of outer-shelf and upper-slope strata to fail and develop growth faults. The faults soled out deep in the basin, and rotation of hanging-wall blocks mobilizing deep-water mud forced mud bodies basinward and upward to form mud (sediment) ridges that constitute the basinward flank of intraslope subbasins above the footwall fault blocks. These subbasins are prolific petroleum targets. Lowstand sandstones are principal reservoirs, and synsedimentary tectonics produced anticlinal and fault traps and associated stratigraphic pinch-out traps on the flanks of the anticlinal structures. Understanding the architecture of the faulted subbasins and their chronostratigraphic relationships and depositional processes provides a perspective that can improve deep-gas exploration. We have presented these concepts at numerous professional meetings over the last several years and have published our results in the *AAPG Bulletin* and *Journal of Sedimentary Research*, as well as transactions for GCAGS conferences.
2. *Regional sequence-stratigraphic framework of the Cenozoic Systems in the Texas Gulf Coast*—STARR team members Frank Brown and Bob Loucks completed a major stratigraphic architectural study of the Cenozoic interval on the northwest margin of the Gulf of Mexico basin (Texas coastal area) titled *Chronostratigraphy of Cenozoic Depositional Sequences and Systems Tracts: A Wheeler Chart of the Northwest Margin of the Gulf of Mexico Basin* (BEG Report of Investigations 273 [Brown and Loucks, 2009]). This stratigraphic section contains the Texas State Lands offshore leases, a prolific oil province. Exploration continues in this area, especially in the deep to ultradeep shelf-gas section. A chronostratigraphic chart (Wheeler chart) was constructed showing a sequence stratigraphic framework based on 50 chronostratigraphic (sequence) and lithogenetic (depositional systems) packages. This chronographic chart will promote understanding of the distribution of reservoirs, traps, and seals, which will lead to a more complete understanding of petroleum systems of the Gulf of Mexico.

3. *Woodbine petroleum system* —East Texas field, discovered in 1930, is the largest oil and gas field in the Lower 48 States. It has produced 5.42 Bbbl of 39° API oil from >31,000 wells. The current average well spacing is ~4.3 acres; the field has experienced a long-term trend of depletion over the past few decades. Of the estimated 1.58 Bbbl of remaining oil, 70 MMbbl can be produced under current operating techniques, and 410 MMbbl of remaining mobile oil can be produced by well deepening and strategically targeted water injection. Our analysis of the Lower Cretaceous lower Woodbine Group, the main producer in the field, indicates that the field's sandstone-body architecture is more complex than previously thought. Our sequence stratigraphic, depositional-environment, and engineering analyses determined that remaining oil occurs primarily in deeper, incompletely drilled, deltaic sandstones below coarse-grained fluvial deposits in an upper, incised-valley-fill succession. Apart from STARR's pilot studies in the field, these sandstones have not been systematically studied, and, as a result, they have not yet been appropriately exploited. An extensive article on the results of this study appeared in the *AAPG Bulletin* in February 2009 (Ambrose et al., 2009), and Bureau of Economic Geology Report of Investigations No. 274 (Hentz, 2010), released in July 2010.
4. *Barnett shale-gas play*—The STARR Group has followed up papers previously published in the *AAPG Bulletin* in 2007 with detailed studies on micropore characterization in the *Journal of Sedimentary Research* (2009). More shale-gas studies are in progress, including the Barnett/Woodford in West Texas, the Haynesville shale in East Texas, and the Eagle Ford shale in south-central Texas. Several workshops and presentations on these shale plays are planned for the next biennium. We also published an important review of the state of knowledge of shale and mudrocks (Ruppel and Loucks, 2008), including an introduction to our research findings on nanoscale porosity and its potential importance in gas-shale production.
5. *Cleveland Formation and Marmaton Group, Texas Panhandle*—In early 2010, the STARR group, working with its partner Jones Energy, Ltd., concluded a regional study of the sequence stratigraphy, depositional environments, and related sandstone reservoir trends in the Pennsylvanian Cleveland Formation and Marmaton Group in the Anadarko Basin of the northeastern Texas Panhandle. The objective of this study was to enable Jones Energy to strategically target additional gas wells, primarily in the highly productive "Main" sand developed within incised-valley-fill deposits in Ochiltree and Lipscomb Counties.

Results from this study were presented at an all-day workshop in Farmers Branch, Texas, in November 2009, and a BEG Report of Investigations summarizing the project's results is planned for publication in 2011.

6. *Haynesville shale play in East Texas*—The Upper Jurassic Haynesville shale-gas play is one of the most prolific shale-gas plays in North America, with estimated recoverable reserves in the hundreds of trillions of cubic feet and high initial production rates, with each well expected to produce, on average, 6.5 Bcf. The play has recently expanded from its core area in west Louisiana into East Texas, where the STARR group has been providing regional correlations based on a sequence-stratigraphic framework. Lithology and facies variability in the Haynesville shale is great, owing to the East Texas Basin having been influenced by a carbonate ramp in the west and north, carbonate-dominated islands near the Sabine Uplift, and by clastic influx from the north and northeast. The STARR group has also documented reservoir-facies variability on a fine scale through core description and petrographic analysis from whole-core data. Project results were recently presented at the 29th Annual GCSSEPM Foundation Bob F. Perkins Research Conference in Houston (Hammes et al., 2009), at the 2009 meeting of the Gulf Coast Association of Geological Societies at Shreveport (Hammes, 2009), and at the Houston Geological Society Mudstone Conferences in February 2009 and 2010.

CURRENT PROJECTS

Reservoir Characterization

Copano Bay Reservoir Characterization Study

The STARR team has been partnering with MPG Petroleum since 2007 in its exploration of the Copano Bay area (see Appendix A for a supporting letter by MPG Petroleum). The objective of this project is to assist MPG Petroleum in assembling the geological framework of the Copano Bay study area, as well as to refine 3-D seismic interpretation, provide input in the validation of existing leads, and identify new opportunities (Fig. 7). As a result of the STARR team's interaction with MPG geoscientists, Ritchie Farms Nos. 1 and 2 wells were drilled, resulting in definition of nine hydrocarbon-bearing reservoirs in the field. These wells were marginally successful because the reservoirs were tight and did not produce. Project STARR is currently assisting the operator in selecting potential targets for a third well on MPG's lease hold in the area. Multiple visualizations, including stratal slicing, have been generated to draw upon the lessons

learned from Ritchie Farms Nos. 1 and 2 wells with potential new locations and to identify new objectives at depth. At the same time, seismic interpreters are evaluating deeper targets that could be of interest for future drilling campaigns.

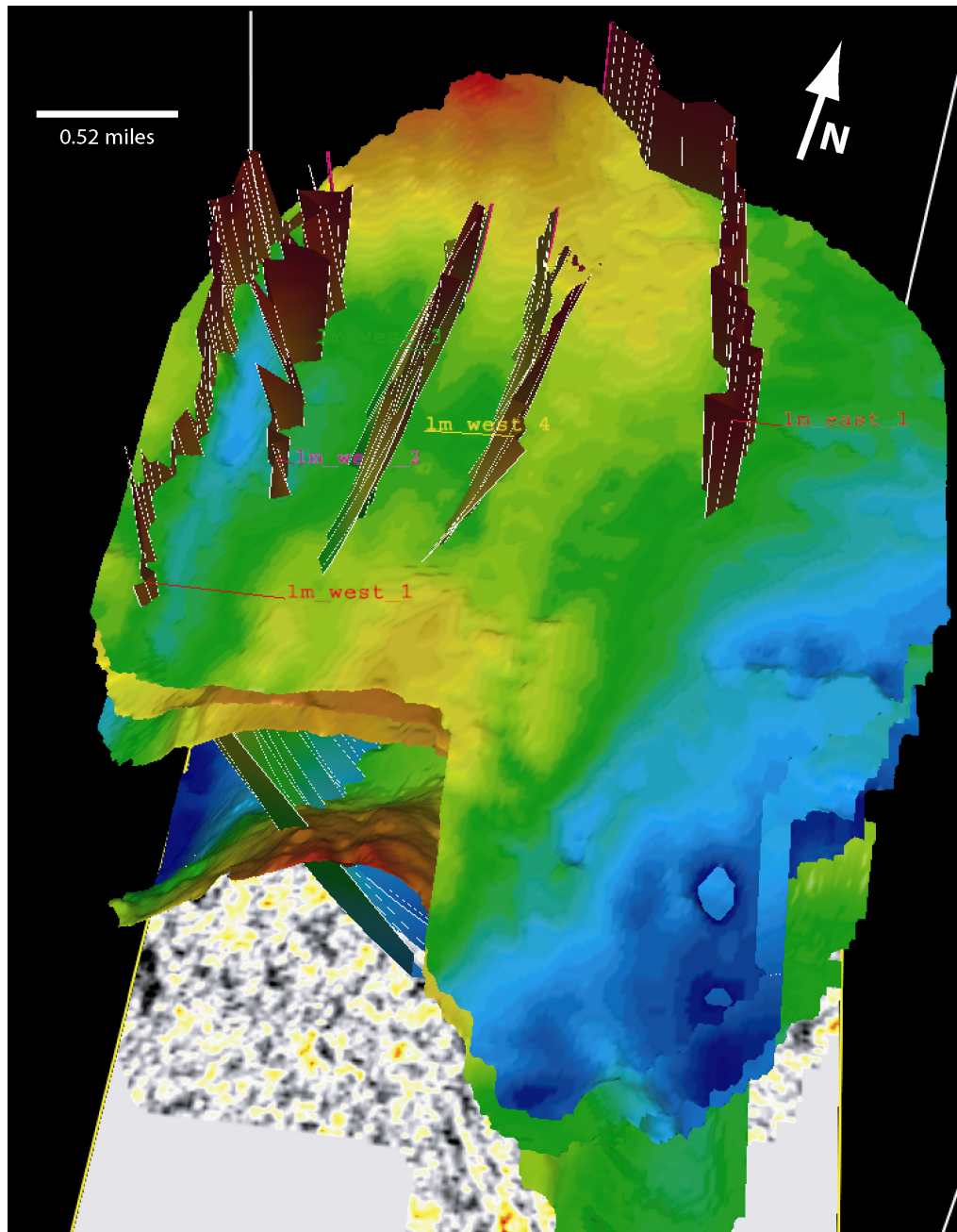


Figure 7. 3-D seismic visualization, generated at the new STARR visualization facility at BEG, showing main structural elements—faults and folds—present in the Copano Bay study area. Copano Bay study area location shown in Figure 2.

Petroleum explorationists in the Gunn Oil Company continue to apply BEG research successfully to the application of sequence stratigraphy to underexploited reservoirs on the Eastern Shelf of the Midland Basin. Gunn Oil Company has been using concepts published in BEG Report of Investigations No. 197 (Brown et al., 1990), as well as Frank Brown's workshop conducted at the Southwestern Section AAPG Convention in Midland in May 2009. In addition, he led a STARR field trip for Gunn Oil geologists and engineers to Pennsylvanian outcrops on the Eastern Shelf of the Permian Basin in October 2009. Exploration concepts and sequence stratigraphic interpretations of these Pennsylvanian outcrops, which are productive in the subsurface, are presented in the guidebook of this field trip in Brown et al. (2009). Gunn Oil selected one of BEG's 16 sequences delineated on the shelf and has been using BEG's published maps of lowstand, sandstone-rich systems to initiate a detailed subsurface study of incised-valley-fill targets. The Tannehill sequence was exploited using 3D seismic data and wireline-log interpretation to identify successful drilling sites. Gunn Oil also noted BEG's delineation of lowstand deltaic lithofacies (prograding deltaic wedges), as well as basin-floor submarine fans within the Tannehill sequence, which it is also successfully targeting. These Gunn Oil discoveries occur within an oil province that many geologists have considered to be essentially beyond further exploitation. To date, Gunn Oil Company has drilled >80 successful new oil and gas wells in several fields on the Eastern Shelf of the Permian Basin for a cumulative production of ~553,000 bbl of condensate and ~772 MMcf using BEG's and STARR's research (Figs. 8 and 9). Gunn Oil geologists acknowledge that BEG's published research and recent review of the geology of the area are responsible for much of their success.

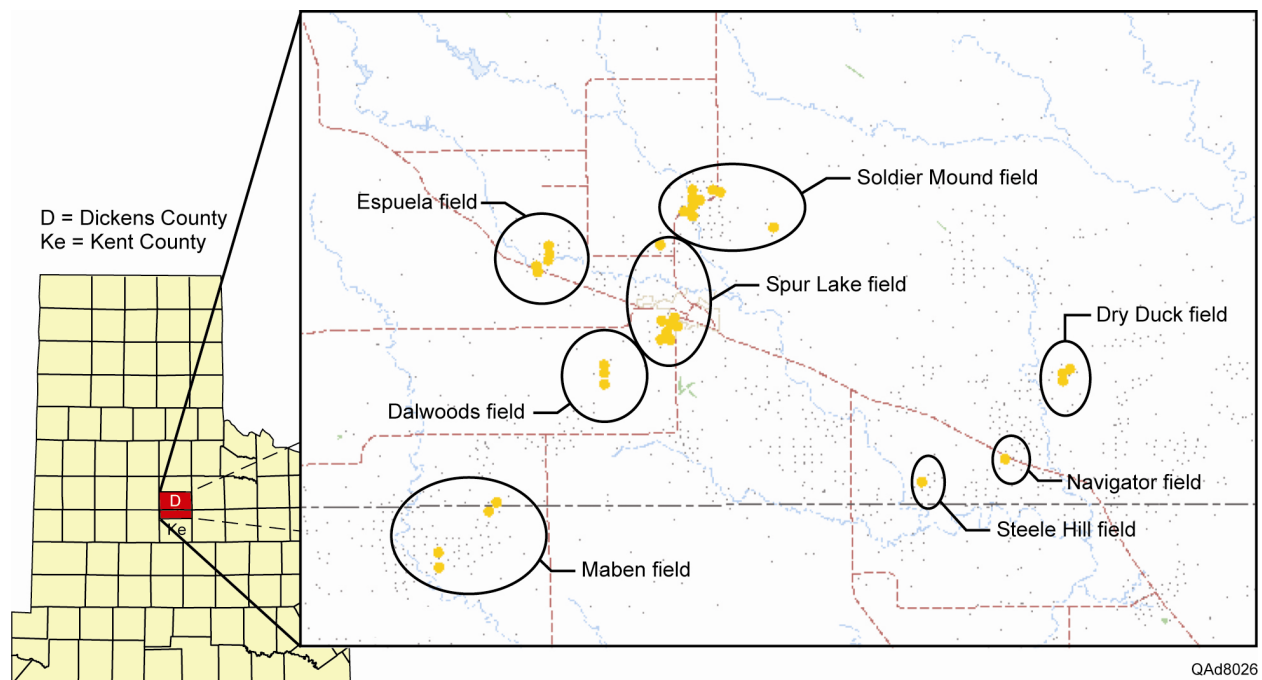


Figure 8. Location map of Gunn Oil wells in Dickens and Kent Counties on the Eastern Shelf in West Texas.

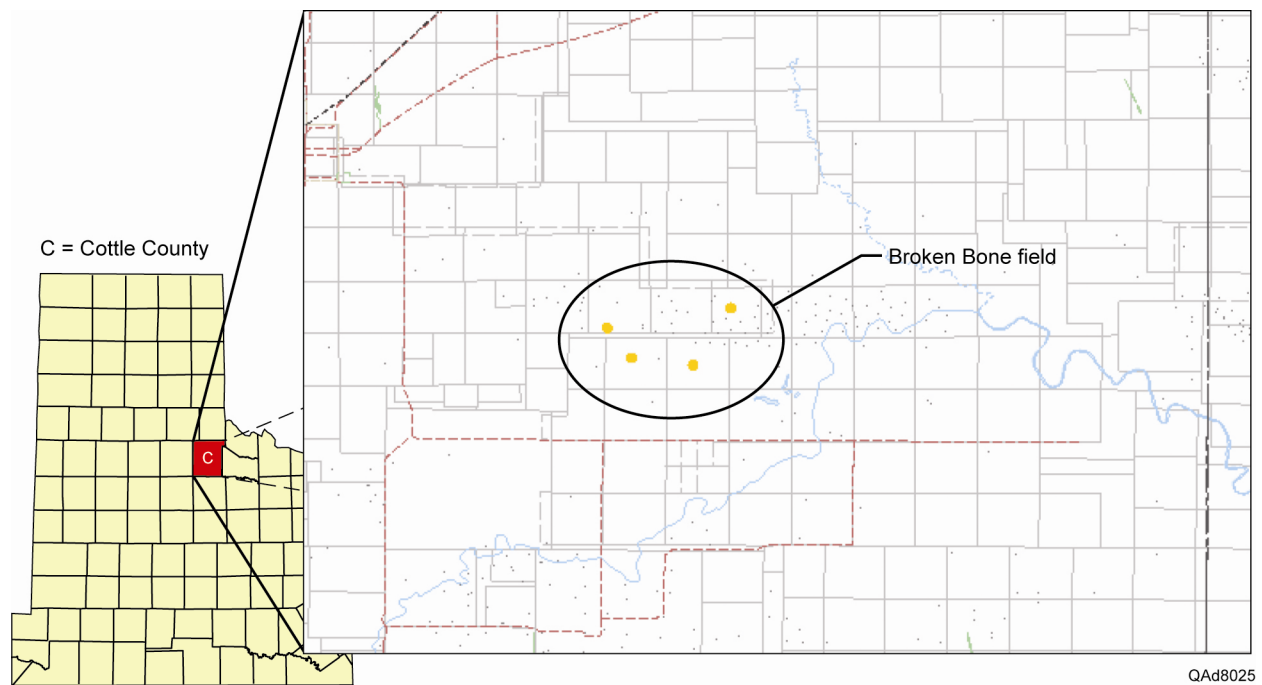


Figure 9. Location map of Gunn Oil wells in Broken Bone field in Cottle County on the Eastern Shelf in West Texas.

New Venture Regional Studies

Woodbine East Texas Regional Study

In 2008 a study was initiated to conduct a regional sequence stratigraphic study of the Woodbine Group in the East Texas Basin (Fig. 10), an outgrowth of an earlier reservoir characterization study of East Texas field. Objectives of the project are to identify major systems tracts, regional depositional setting, major depocenters, lithofacies, and potential reservoirs. Integration of sedimentology, sequence stratigraphy, structure, and production data will provide new insights into new exploration fairways and play opportunities.

A major objective of the study is to link the stratigraphic framework of productive Woodbine sandstones in the downdip trend in Polk County, located along the Upper Cretaceous shelf edge, to that of the Woodbine Group in East Texas field and the adjacent East Texas Basin. Incised-valley-fill systems identified in the lower Woodbine Group in East Texas field (Fig. 11) are hypothesized to have provided pathways for transport of sediment southward to the Woodbine shelf edge in Polk County, where lowstand deltas are inferred to have prograded over a faulted, unstable shelf margin. Our analysis of 14 cores from deep (>13,000-ft) Woodbine wells in Polk County indicates that the Woodbine was deposited in both shelf and slope depositional settings. Additional work involves core-to-log calibrations, identifying the stratigraphic occurrence of pay zones, establishing a sequence stratigraphic framework interpretation from wireline-log correlations, and tying the stratigraphic framework to that of East Texas field and the updip part of the East Texas Basin.

Initial results from this study were presented, along with other findings from a reservoir characterization study of East Texas field, at a workshop at the Houston Core Research Center in November 2008. Additional results were published in Bonnaffé et al. (2008a), Ambrose et al. (2008), and Ambrose et al. (2009).

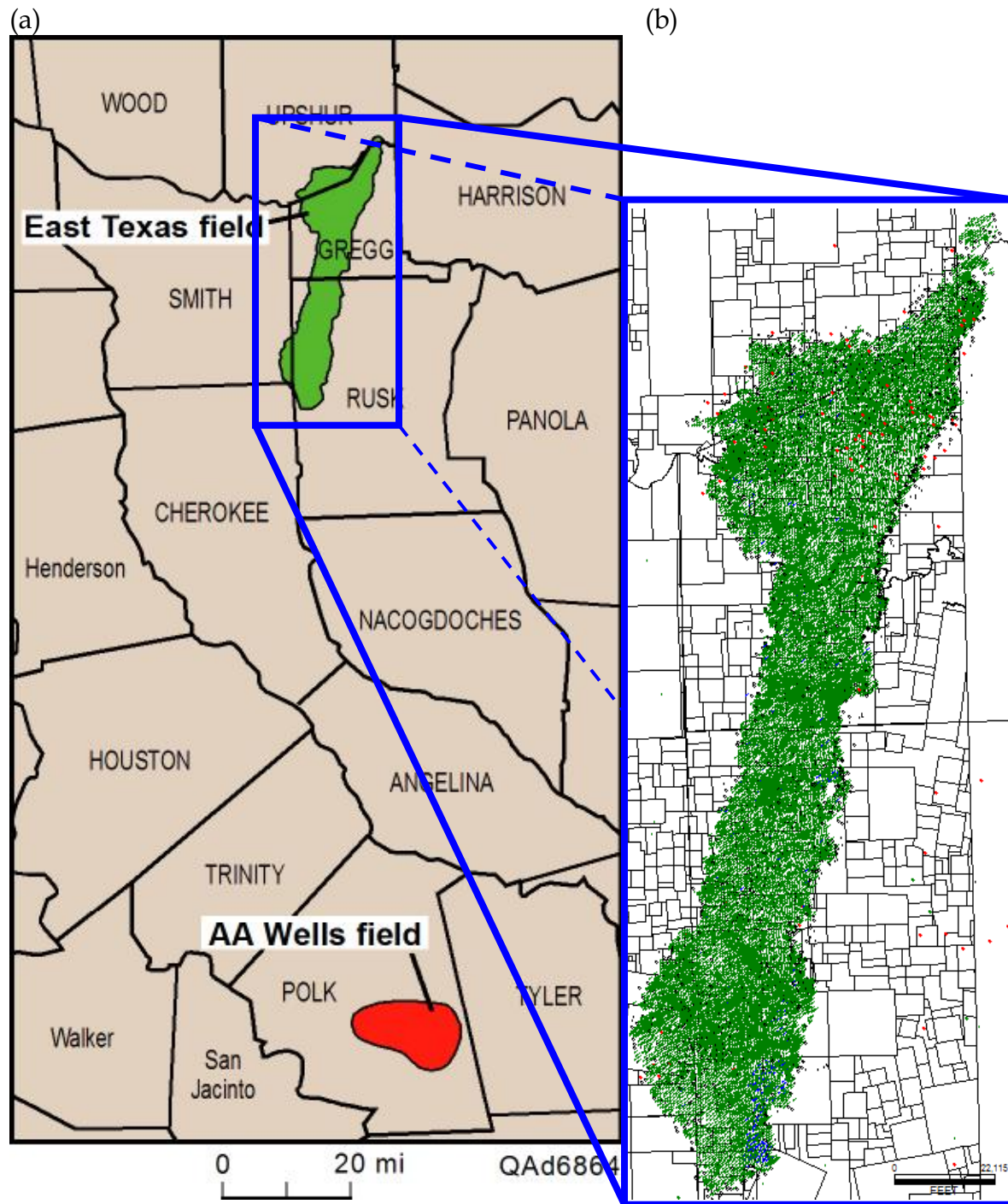


Figure 10. (a) Location of East Texas and AA Wells fields. (b) Close-up of East Texas field, where approximately 31,000 wells have been drilled since its discovery in 1930; 7 Bbbl of oil was in place, 5.3 Bbbl of which has been produced.

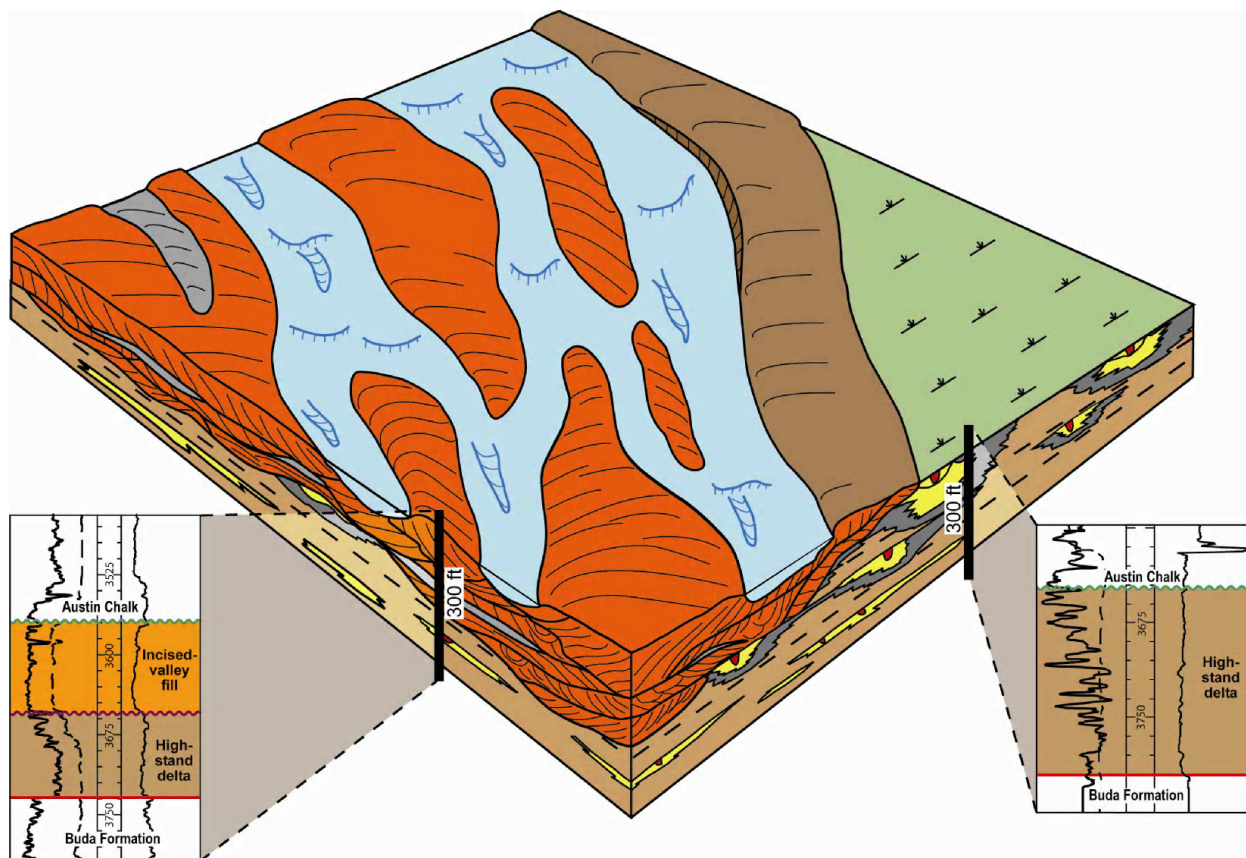


Figure 11. Depositional and reservoir model of the Woodbine showing incised-valley-fill sandstone reservoirs (shown in red/orange). Modified from Ambrose et al. (2009).

South Texas Regional Frio Study

The Oligocene Frio Formation, approximately 15,000 ft thick, is an important oil and gas reservoir on the South Texas Gulf Coast. More than 70 Tcf of gas and 8 Bbbl of oil have been produced from mainly upper Frio sandstones and, more recently, from deeper, lower Frio sandstones. If systems-tract concepts are used, additional reserves are likely to be found in new downdip plays; therefore, an understanding of the regional sequence stratigraphy is critical. Our study focuses on a four-county area in the South Texas coastal area, integrating seismic, wireline-log, and micropaleontologic data (Fig. 12).

The STARR regional Frio study documented six major third-order sequences in the Frio Formation (Figs. 12 and 13). Each of these sequences consists of basin-floor and slope-fan deposits and a prograding wedge deposited off-shelf during third-order sea-level lowstands. Growth faults, associated with thick sediment accumulation, were active primarily during lowstand episodes. Shifting of the depocenters in time, in conjunction with growth-fault activity, resulted in partitioning of reservoir sandstones between the

slope and basin and the shelf. Because genetically similar but progressively younger lowstand depositional systems successively filled each subbasin from northwest to southeast, this sequence-based approach has demonstrated that Frio reservoirs are less continuous than previously thought. Preliminary results from the study were presented at the 2008 GCAGS Convention (Bonnaffé et al., 2008b), and additional results are planned for a workshop for Texas oil and gas operators.

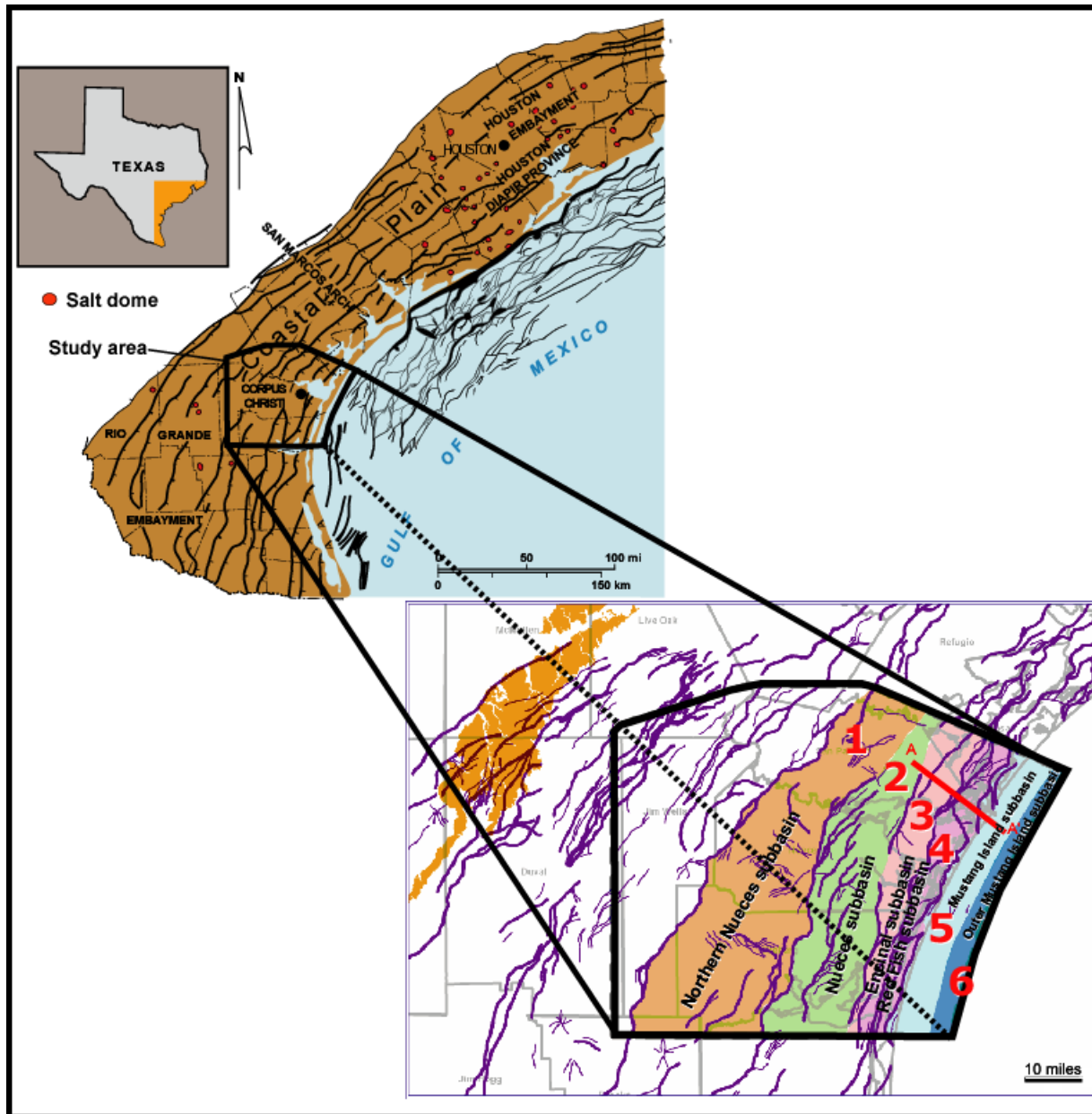


Figure 12. Location map of lower Texas regional Frio study area. Inset shows the six Frio subbasins and cross section A-A' displayed in Figure 13.

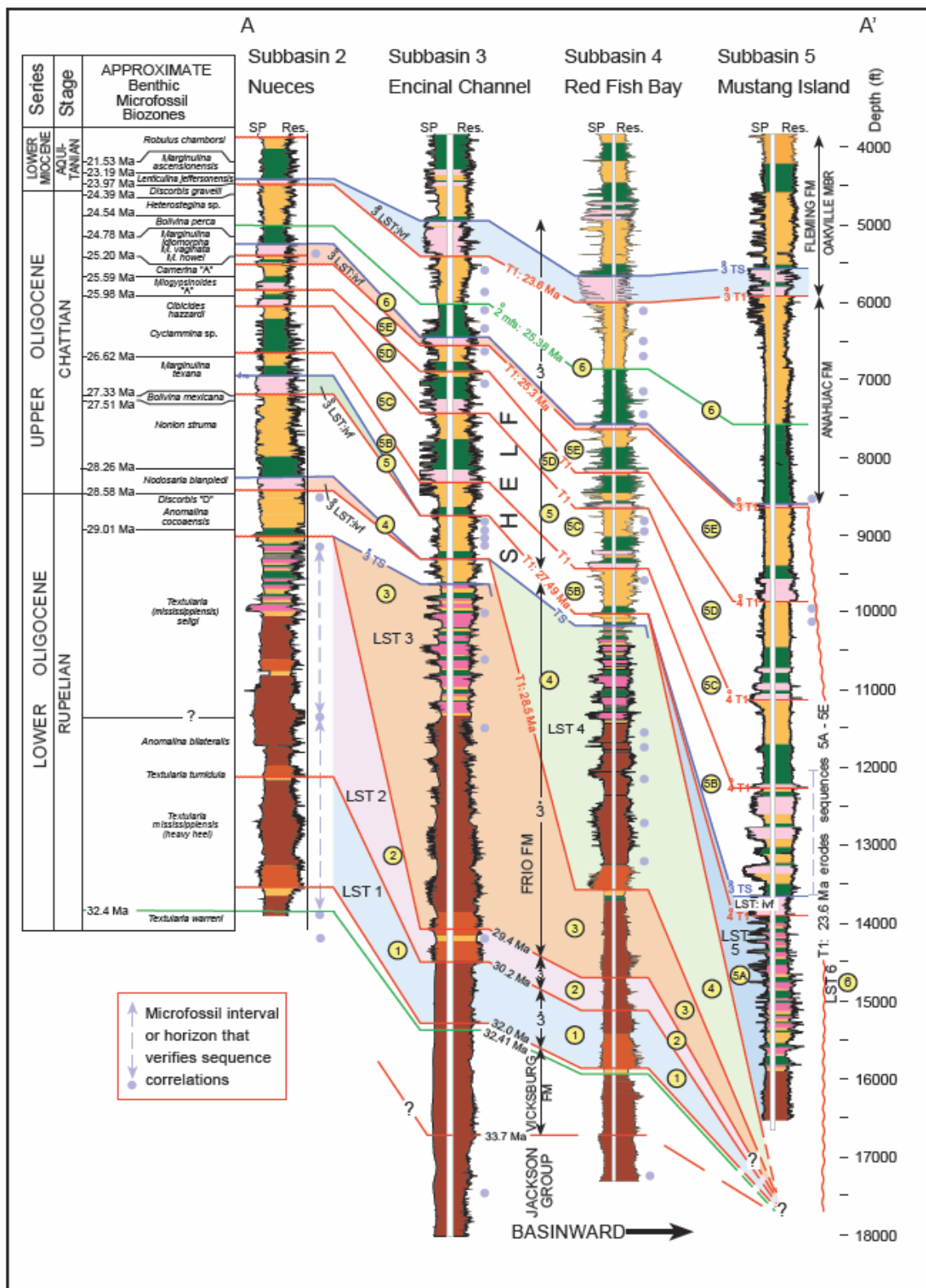


Figure 13. Cross section A-A' of Frio subbasins 2 through 5 (see Fig. 12 for location) showing progressively younger strata from NW to SE. From Brown et al. (2004).

Regional Cleveland and Marmaton Gas Project

In early 2010 the STARR Group, partnering with Jones Energy, Ltd., concluded a regional study of the sequence stratigraphy, depositional environments, and related sandstone reservoir trends in the Pennsylvanian Cleveland Formation and Marmaton Group in the Anadarko Basin of the northeastern Texas Panhandle (Fig. 14). Jones Energy is currently the primary producer from the very active Cleveland tight-gas-sandstone play in Ochiltree and Lipscomb Counties, Texas, and Ellis County, Oklahoma. BEG, having previously conducted a basin-scale study of the Cleveland (Hentz, 1994a, b), is in an optimal position to carry out a focused analysis of the unit over its most productive areas. The objective of this study is to enable Jones Energy to strategically target additional gas wells, primarily in the highly productive “Main” sand developed within incised-valley-fill deposits in Ochiltree and Lipscomb Counties (Fig. 15). This project was supported by depositional-facies analysis of available Cleveland cores. Results from this study were presented in an all-day workshop in Farmer’s Branch, Texas, in November 2009. These presentations were published in Carr et al. (2009), and a BEG Report of Investigations summarizing the project’s results is planned for 2011.

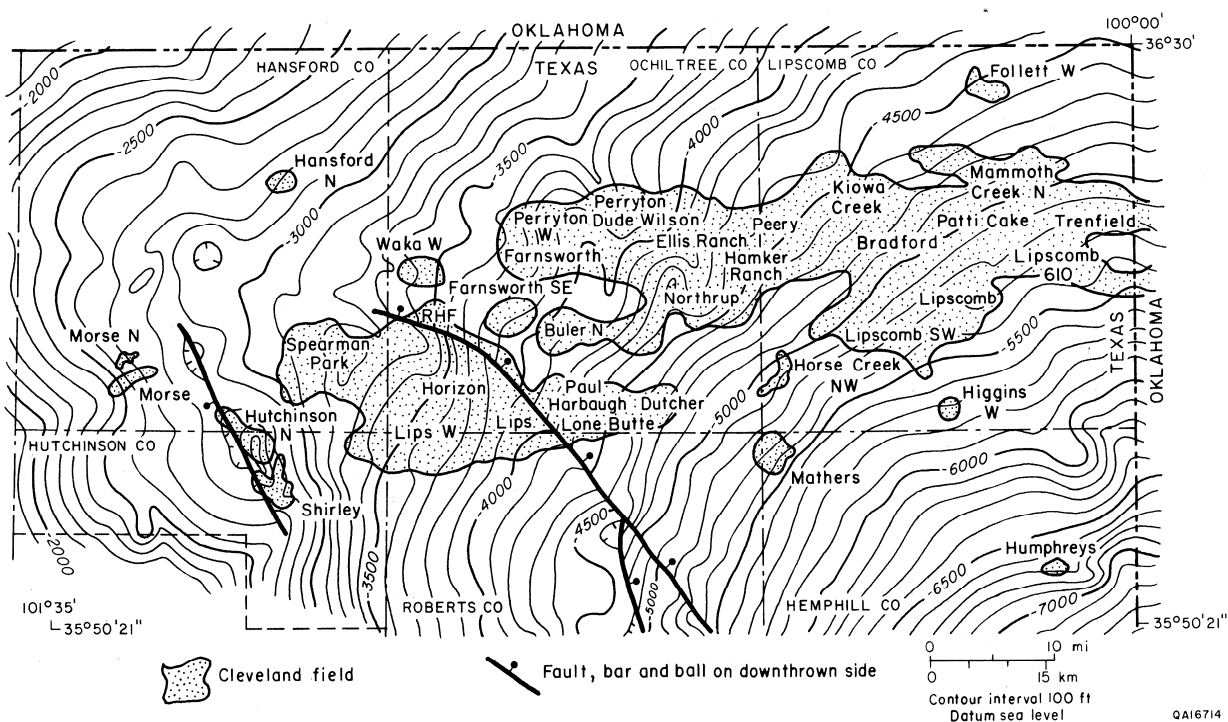


Figure 14. Map of major Cleveland gas fields superimposed on structure-contour map of the top of the Upper Pennsylvanian Cleveland Formation, Texas Panhandle. All fields except Morse, Mathers, Higgins West, Humphreys, and Follett West have produced >1 Bcf of gas since their discovery. Modified from Hentz (1994a).

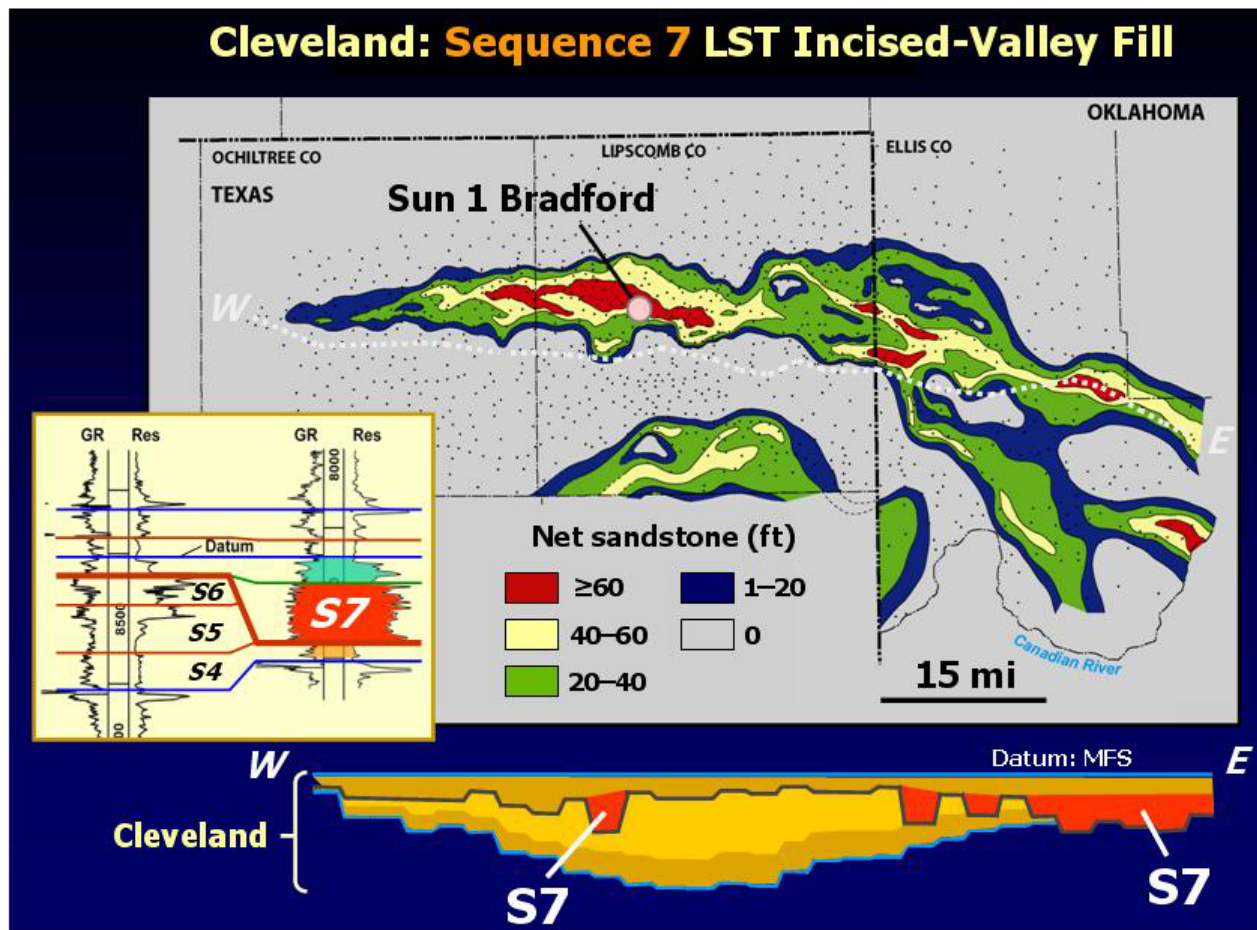


Figure 15. Gross-sandstone-thickness map of incised-valley-fill deposits in the middle Cleveland S7 lowstand systems tract in the Texas Panhandle. Modified from Hentz et al. (2009).

Eastern Shelf of the Permian Basin Study

The Eastern shelf project in North-Central Texas (Fig. 16) involves outcrop and subsurface studies for developing depositional models to better explain the geometry and distribution of subsurface oil-bearing sandstone reservoirs. Previously completed surface and subsurface investigations were used to update exploration concepts on this buried shelf (Fig. 17). By revisiting the earlier study by Brown et al. (1990), STARR recognized that untapped hydrocarbons existed in the region, and STARR used the published net sandstone maps of incised-valley-fill lithofacies to promote the untapped resource. These maps included all Upper Pennsylvanian and Lower Permian elongate valley fill (16 stratigraphic levels) within the 25 counties that compose the Eastern Shelf. Recently our revisited results were presented at local North-Central Texas professional

geological societies, a workshop at the 2009 annual meeting of the Southwest Section of AAPG and on a field trip to North Texas (Brown et al., 2009). As a result of these activities, operators began to apply the new approaches in their exploration. A number of new hydrocarbon plays were developed by these operators, who began to make new discoveries using these sequence stratigraphic ideas (e.g., Gunn Oil Company, Spur Lake field).

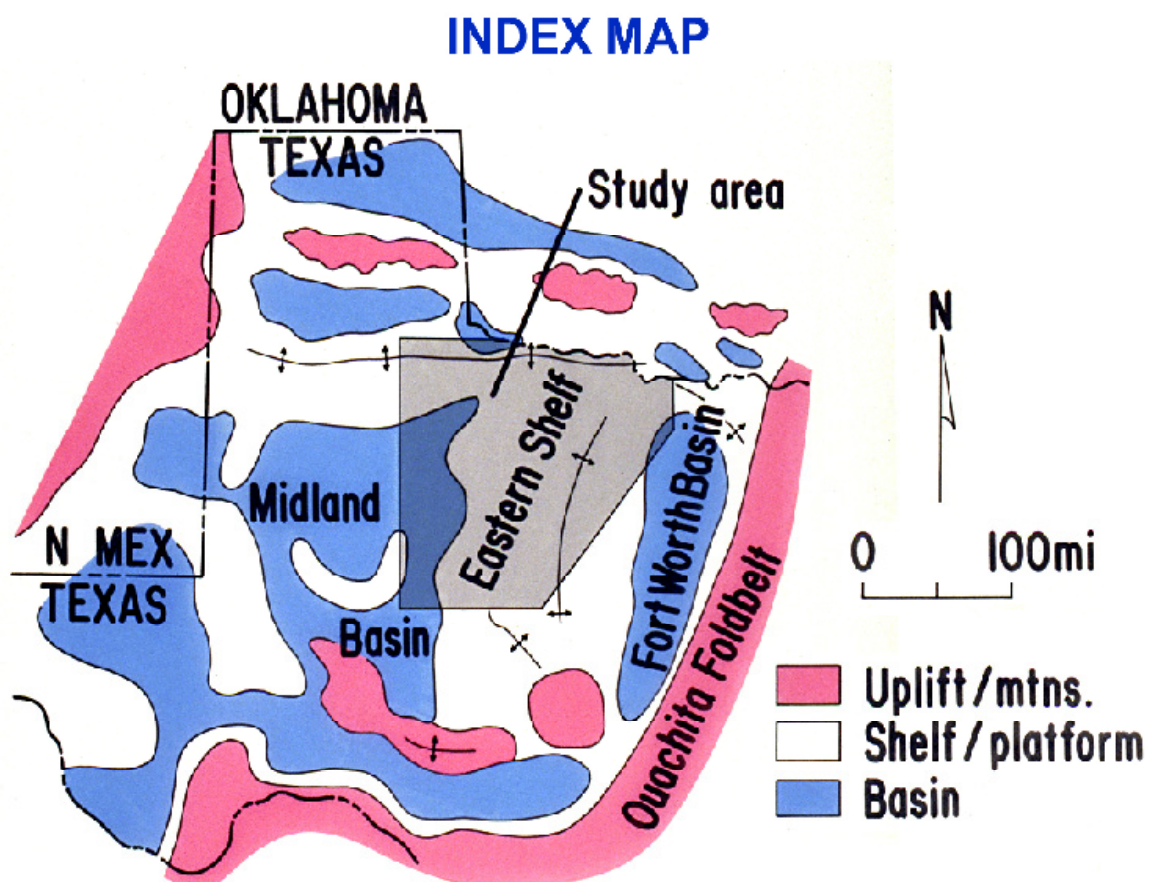


Figure 16. Location map of Eastern Shelf study located on Eastern Shelf of Midland Basin. Modified from Brown et al. (1990).

CISCO FACIES, EASTERN SHELF, NORTH-CENTRAL TEXAS

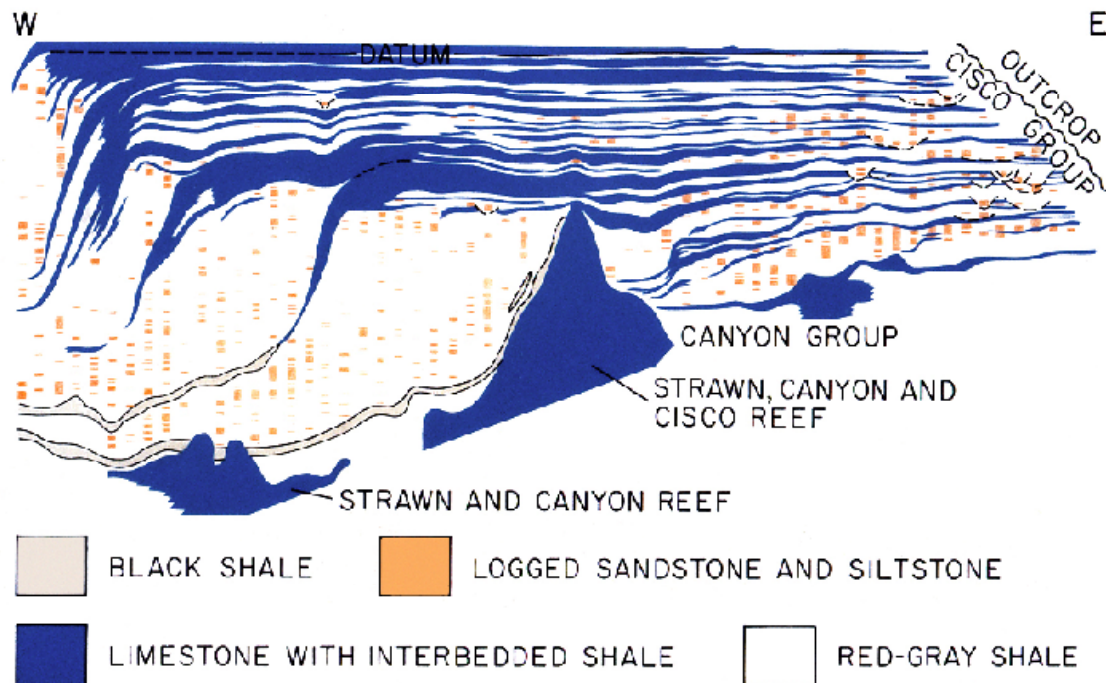


Figure 17. Sequence stratigraphic cross section of Cisco facies across Eastern Shelf showing locations of sandstone reservoirs (orange). Modified from Brown et al. (1990).

Yates/Seven Rivers Gas-Sand Project

In the fall of 2006 workers with the Permian Basin Geologic Synthesis Program partnered with the STARR group and Lynx Operating Company to initiate regional- and reservoir-scale studies of stratigraphy, depositional environments, well log responses, mineralogy, and sandstone gas-reservoir trends in the Upper Permian Yates and Seven Rivers Formations in the northwestern Midland Basin and northeastern Central Basin Platform areas of Texas (Fig. 18). Lynx is currently the primary producer from the Upper Permian gas-sandstone play in Gaines County, Texas. BEG, who has been conducting a basin-scale study of the entire Permian section in the Permian Basin of Texas and New Mexico, is perfectly suited to conduct analysis of the Yates/Seven Rivers unit over its productive area and to define the geographic limits of the play in the region. The ultimate goal of the investigation was to explain the apparently unpredictable production characteristics of the Yates, to better predict most favorable production trends, to develop criteria that enable optimization of development

procedures, and to predict the distribution of nitrogen, which is a common component of Yates natural gas. To date, success has been realized in developing depositional models, identifying false-gas effects (Fig. 19) in well logs arising from halite cements in sandstone, recognizing that favorable reservoirs occur preferentially in clay-bearing sandstone, and realizing that the presence of Fe-bearing minerals (e.g., chlorite) presents a potential for irreversible formation damage if inappropriate completion practices are undertaken. This study was supported by depositional-facies and diagenesis analysis of available Yates cores provided by both Lynx and BEG. Results from this study were presented in core workshops and in oral presentations at Permian Basin Geologic Synthesis annual meetings in February 2006 and February 2009, at a Lynx-sponsored Yates symposium in Midland in June 2008, at a UT Department of Geosciences seminar in October 2008, at a Panhandle Geological Society luncheon in Amarillo in November 2008, and at a Southwest AAPG meeting in Midland in April 2009. An executive summary of Yates/Seven Rivers studies to date was presented to Lynx in December 2009.

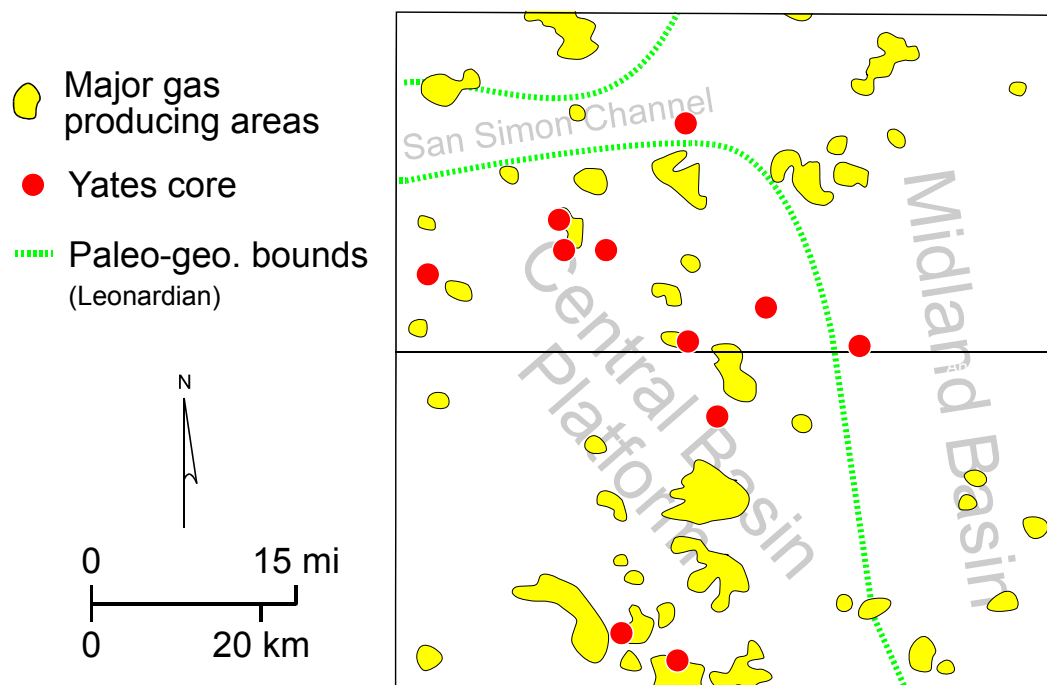


Figure 18. Yates/Seven Rivers gas reservoirs and locations of Yates cores in Gaines and Andrews Counties, Texas Panhandle. Also shown are major structural elements of the Permian Basin. Gas reservoirs are in muddy sandstone sealed at the base and top by impermeable evaporite beds.

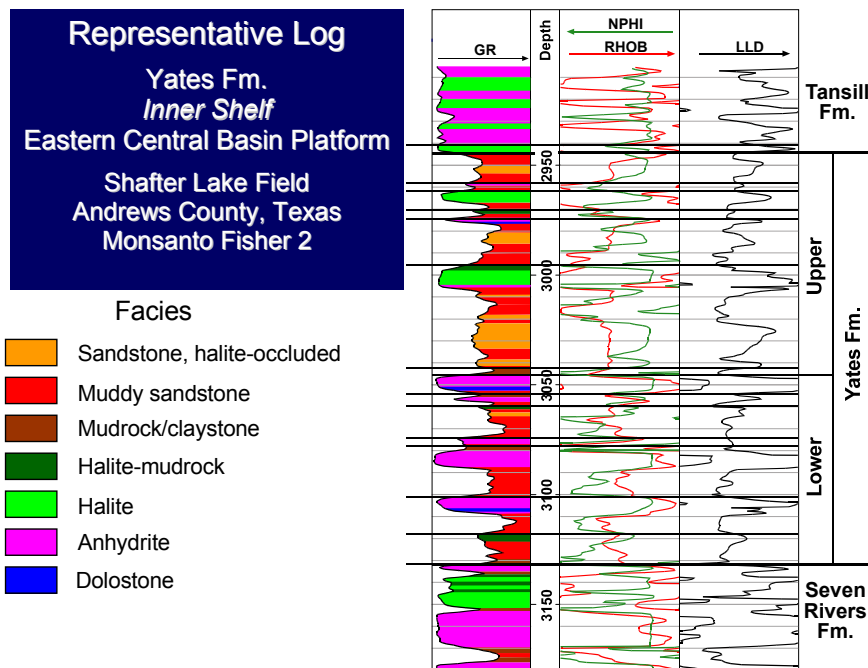


Figure 19. Representative well log of Yates/Seven Rivers Formations, Texas Panhandle. False-gas effect (crossover) evident on NPHI/RHOB logs at 3,020–3,035 ft.

Unconventional Resources

Northern Fort Worth Basin Barnett Shale-Gas Trend Project

The Mississippian Barnett Shale of the northern Fort Worth Basin (NFWB) (Fig. 20) is a shale-gas system composed of a mixture of laminated siliceous mudstone, laminated argillaceous lime mudstone (marl), and skeletal argillaceous lime packstones. The shale is its own source, reservoir, and seal. Newark East field, the largest gas field in Texas, is developed in this Barnett shale-gas system. The Barnett Formation continues to be an active target for shale gas in the NFWB, as well as in the adjacent Permian Basin. Much effort has been devoted to understanding exploration methods, completion techniques, organic content, and maturation in this system. However, little has been published on the sedimentology, lithofacies, or depositional setting of these rocks. To help maximize the resources from this shale-gas system, Project STARR has analyzed Barnett strata in

the NFWB using wireline logs, cores, and outcrops. Our work has established an understanding of the regional depositional setting (Fig. 21), lithofacies, and pore networks (fractures and nanopores) within the system. Our analysis has helped define exploration limits of production and provide data for defining completion techniques. Especially important has been STARR's research on pore networks in the Barnett Shale. Our group was the first to define and image these nanopores (Fig. 22), and many companies have followed our research lead and concepts pertaining to this subject. We published results of our work on the pore networks in the Barnett Shale in the *Journal of Sedimentologic Research* (Loucks et al., 2009).

STARR has produced several publications, as well as workshops and field trips, to disseminate results on the NFWB Barnett Shale (Loucks and Ruppel, 2008). Each of these seminars has had maximum enrollment, and the course notes were published as a BEG CD-ROM. We also have presented numerous talks at national professional societies, as well as local geological societies. Four of the presentations have won awards. Several papers have been published in the *AAPG Bulletin* and in the *Journal of Sedimentary Research*.

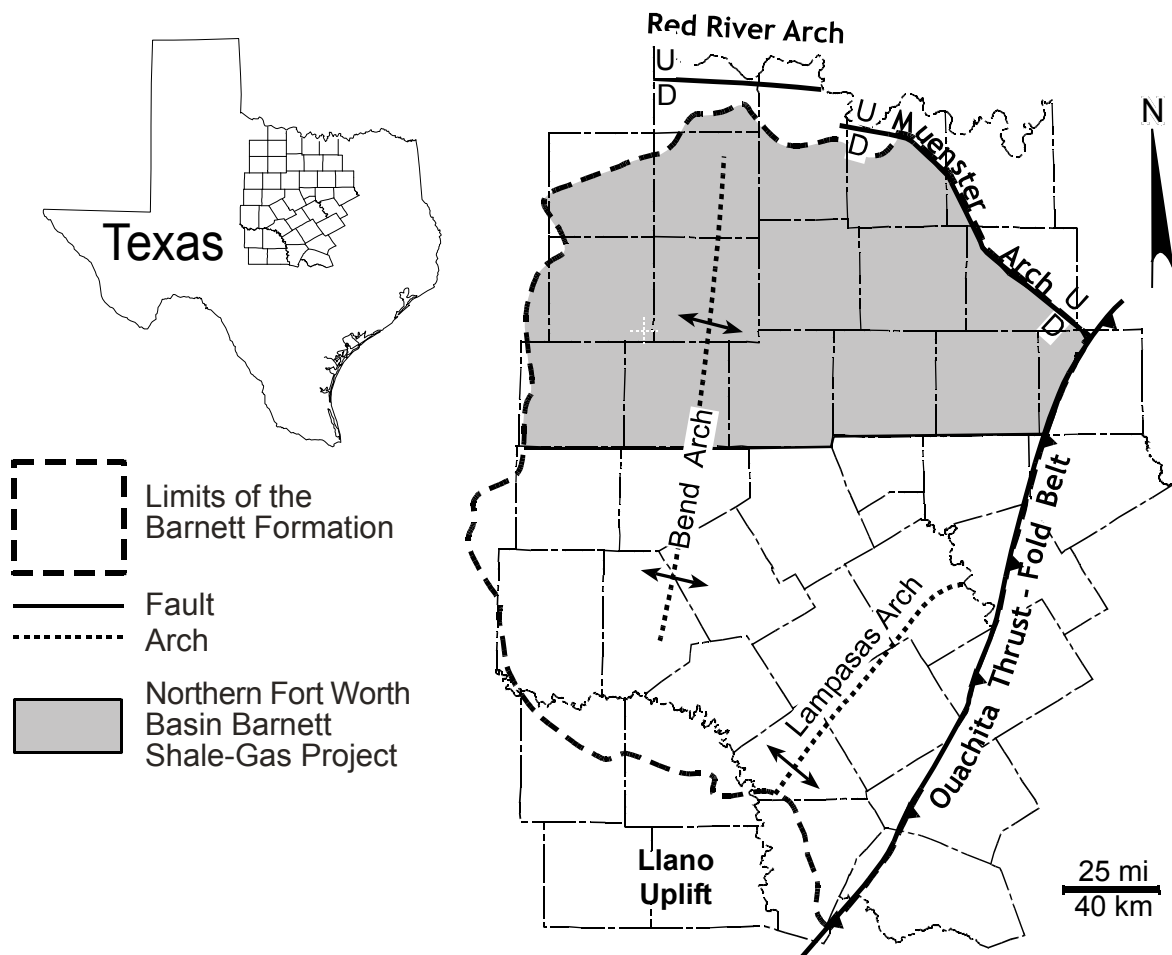


Figure 20. Map showing location of Northern Fort Worth Basin Barnett Shale-Gas Project.

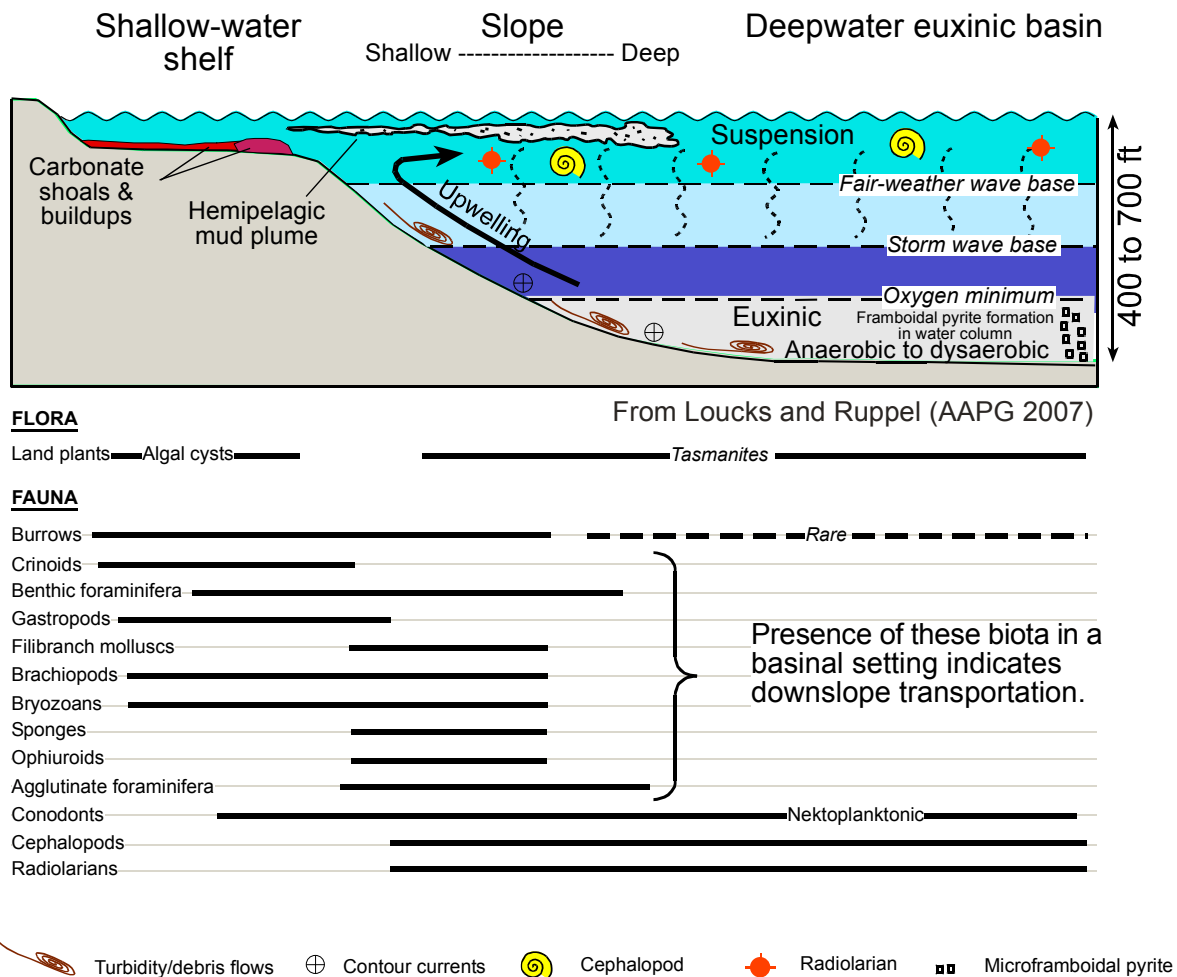


Figure 21. Generalized model of the Barnett Formation showing depositional profile, depositional processes, and estimated distribution of biota.

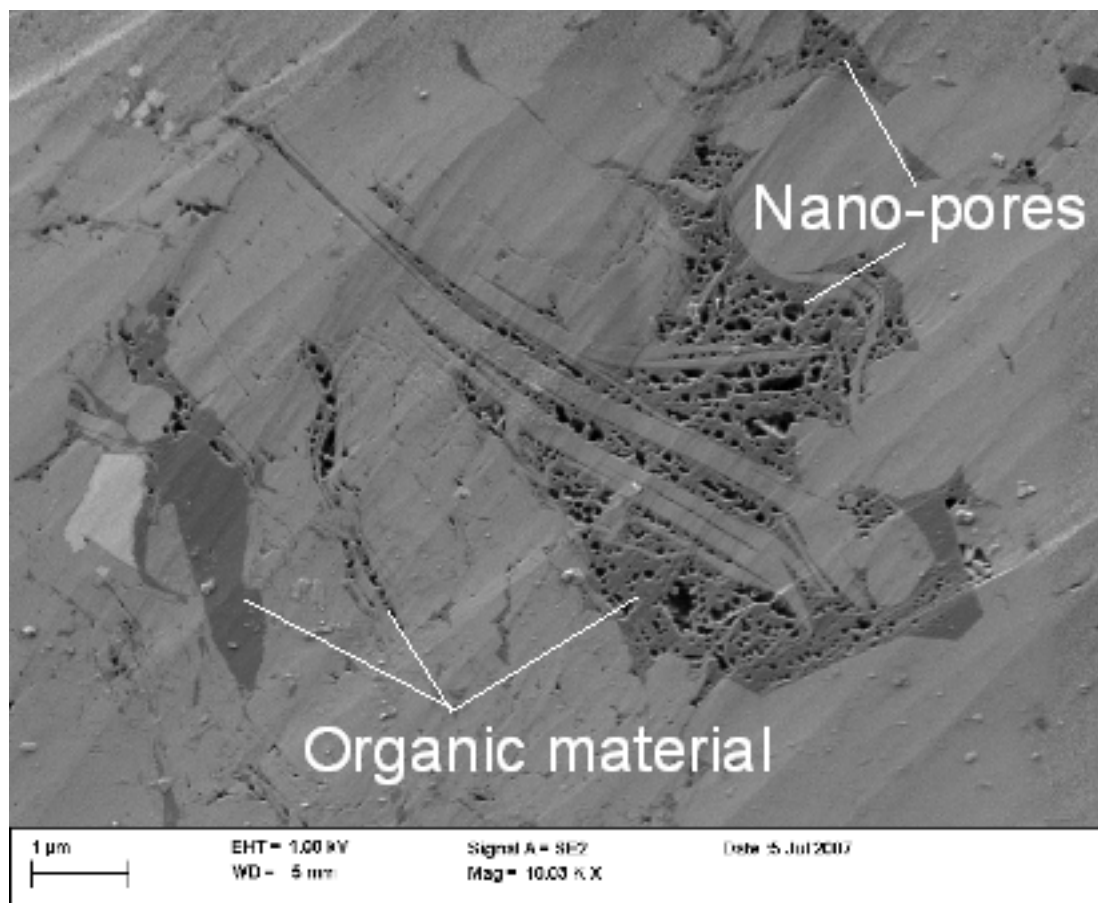


Figure 22. Nanopores in the Barnett Shale are associated with organic material.

Southern Fort Worth Basin Barnett Shale-Gas Trend Project

The Mississippian Barnett Shale of the Fort Worth Basin is a shale-gas system that has been extensively drilled in the north part of the basin. The Barnett Newark East gas field in the north part of the basin is the largest gas field in Texas. Project STARR has completed a regional study of the Barnett depositional setting, lithofacies, and pore networks in the northern area, and we have published our results. At present, the shale-gas play extends into the southern area of the basin (Fig. 23), where success is less certain. To help increase knowledge and success in the southern area, Project STARR is studying the depositional setting, lithofacies, and pore networks in this part of the basin. We are making progress in logging 30 cores (Fig. 23) through the complete Barnett section in the Llano-Hill County area. These cores are shedding new information on the depositional systems and regional stratigraphic architecture in this area. We have also correlated wireline logs and integrated them with cores to establish the stratal architecture of the area (Fig. 24). Initial results show that the depositional setting in the southern area is similar in many ways to that of the northern area, and the same depositional model developed for the northern area can be used. Because of the

density of cores in the area, we will be able to define the stratigraphic architecture to a finer scale than is possible in the northern Fort Worth Basin, where core is limited. To aid in the correlations we are using a relatively new chemostratigraphic technique. Multiple chemical analyses are being conducted at the 1-ft scale on each core using a portable Bruker™, hand-held, energy dispersive, X-ray fluorescence spectrometer. The multiple curves generated will allow correlations that are not possible with conventional logs.

A limiting parameter of the Barnett Shale in the southern area is that it thins, and the Ro (maturity level) in some areas is too low to have generated hydrocarbons. However, some success is occurring in the north and east parts of this project area. We have presented individual workshops to several companies, including ExxonMobil, Matador Resources, and Devon Energy, and a multiple-company workshop consisting of lectures and a core workshop at a BEG seminar. This study will lead to several published papers that will influence drilling in the Barnett shale-gas system in the southern Fort Worth Basin.

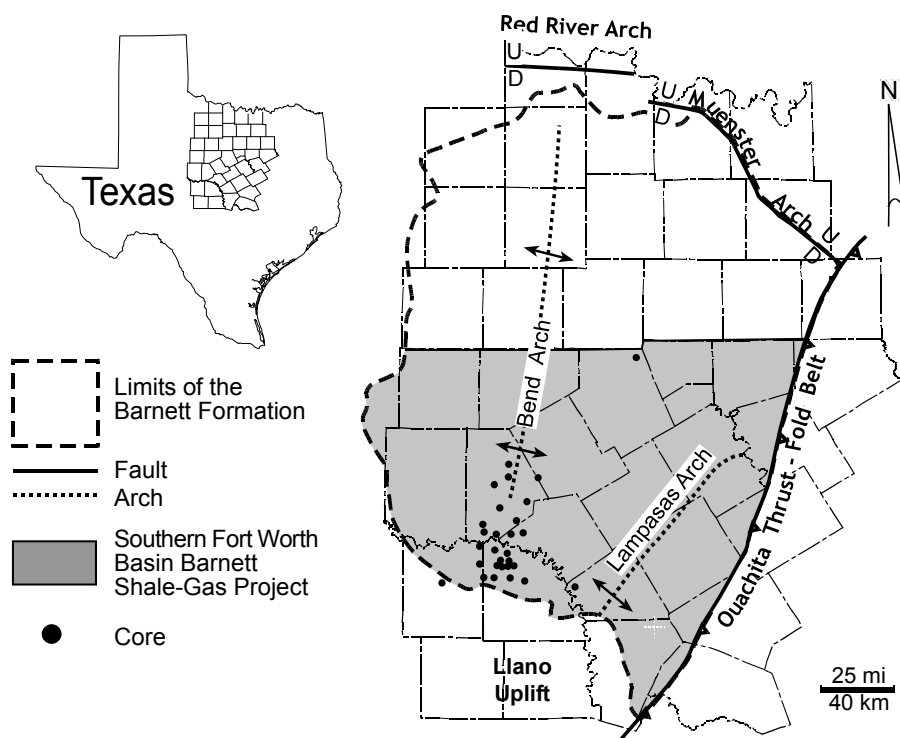


Figure 23. Map showing location of Southern Fort Worth Basin Barnett Shale-Gas Project and cores used in the study.

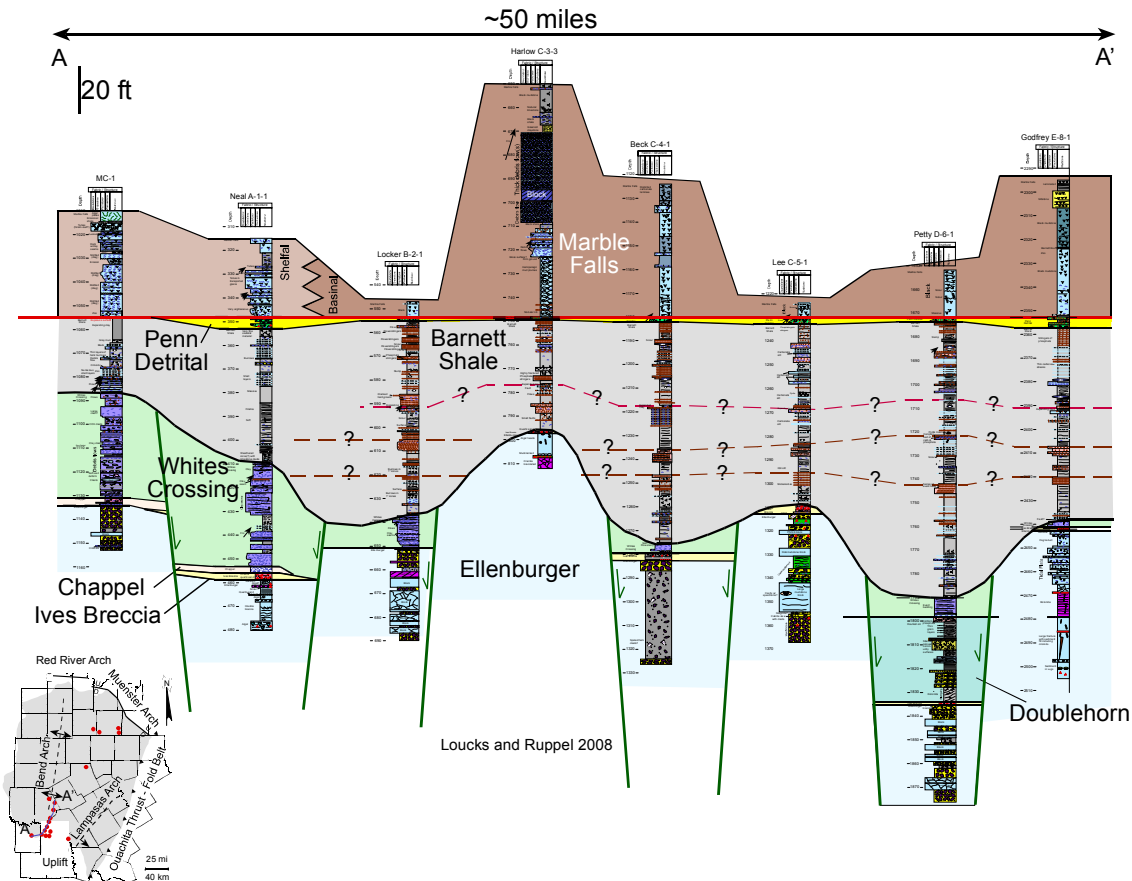


Figure 24. Stratigraphic cross section of Barnett Shale in southern Fort Worth Basin based on core.

Haynesville Regional Study (Northeast Texas)

The Upper Jurassic Haynesville shale-gas play has evolved into one of the most prolific shale-gas plays in North America, with estimated recoverable reserves in the hundreds of trillions of cubic feet and high initial production rates, with each well expected to produce an average of 6.5 Bcf. The play has recently expanded from its core area in west Louisiana into East Texas. The Haynesville Shale basin is influenced by a carbonate ramp in the west and north and carbonate-dominated islands near the Sabine Uplift, as well as by clastic influx from the north and northeast. This variable basin configuration, combined with second- and third-order sea-level fluctuations, exerts a pronounced influence on the lithology and reservoir facies of the shale. The Haynesville Shale was deposited during a second-order transgression (Fig. 25), in which carbonates formed on the shelf and preexisting highs and organic-rich shales formed in the basin (Hammes and Carr, 2009). Overlying Tithonian Bossier shales and sands represent highstand

deposits, with distal parts of the upper Tithonian Cotton Valley late-highstand siliciclastic wedge downlapping onto the second-order maximum flooding surface that defines the top of the Haynesville. Lithology and facies in the Haynesville vary considerably (Figs. 26 and 27). They include siliceous mudstones that contain as much as 80% detrital quartz, clays, and skeletal carbonaceous mudstones that contain as much as 50% carbonates with an average total organic content (TOC) of up to 4%. TOC variations are partly controlled by increased clastic influx from the north, where silica-dominated lithologies are most abundant, and carbonate platforms in the west and south, where carbonate-dominated lithologies are more abundant. Considering variation in lithologies is important for fracture stimulation, production, and petrophysical interpretations because these parameters are affected by varying clay, pyrite, and organic content, potentially skewing porosity, TOC, and resistivity calculations into higher values.

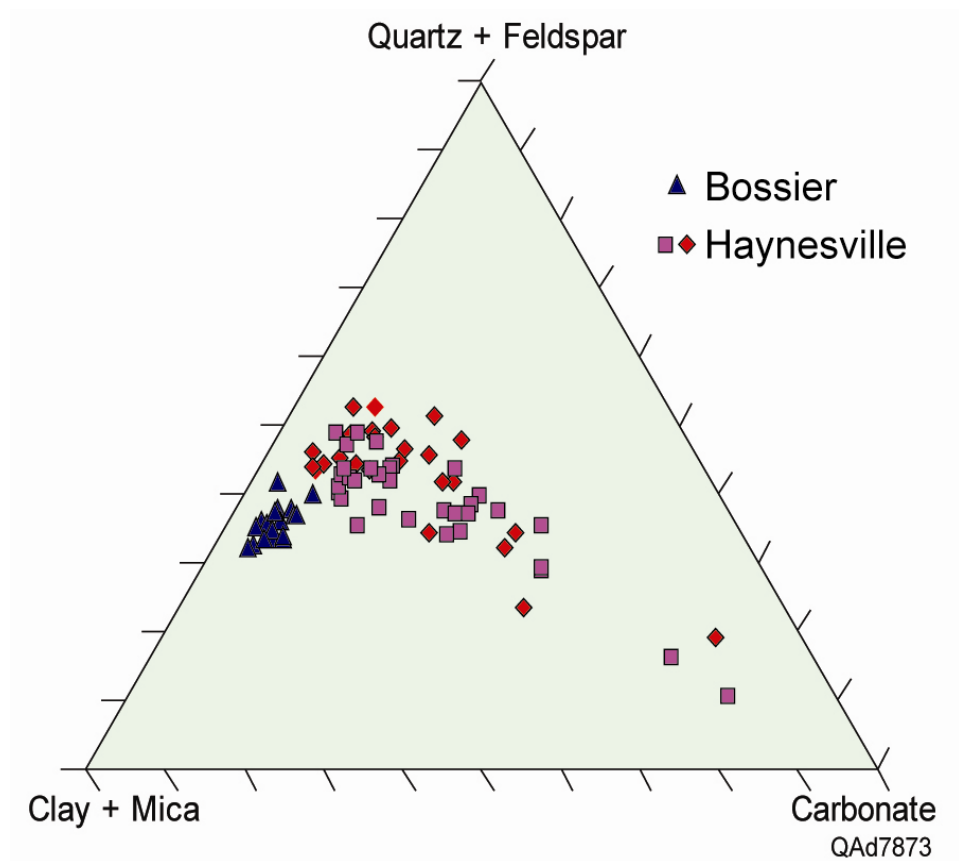


Figure 26. Ternary diagram showing Bossier and Haynesville mineralogical data from XRD. Haynesville mudstones contain abundant carbonate, whereas Bossier mudstones are dominantly clay and quartz, indicating a shift from transgressive carbonate-dominated environment to progradation of clastics owing to highstand deposition in the Bossier. From Hammes et al. (2009).

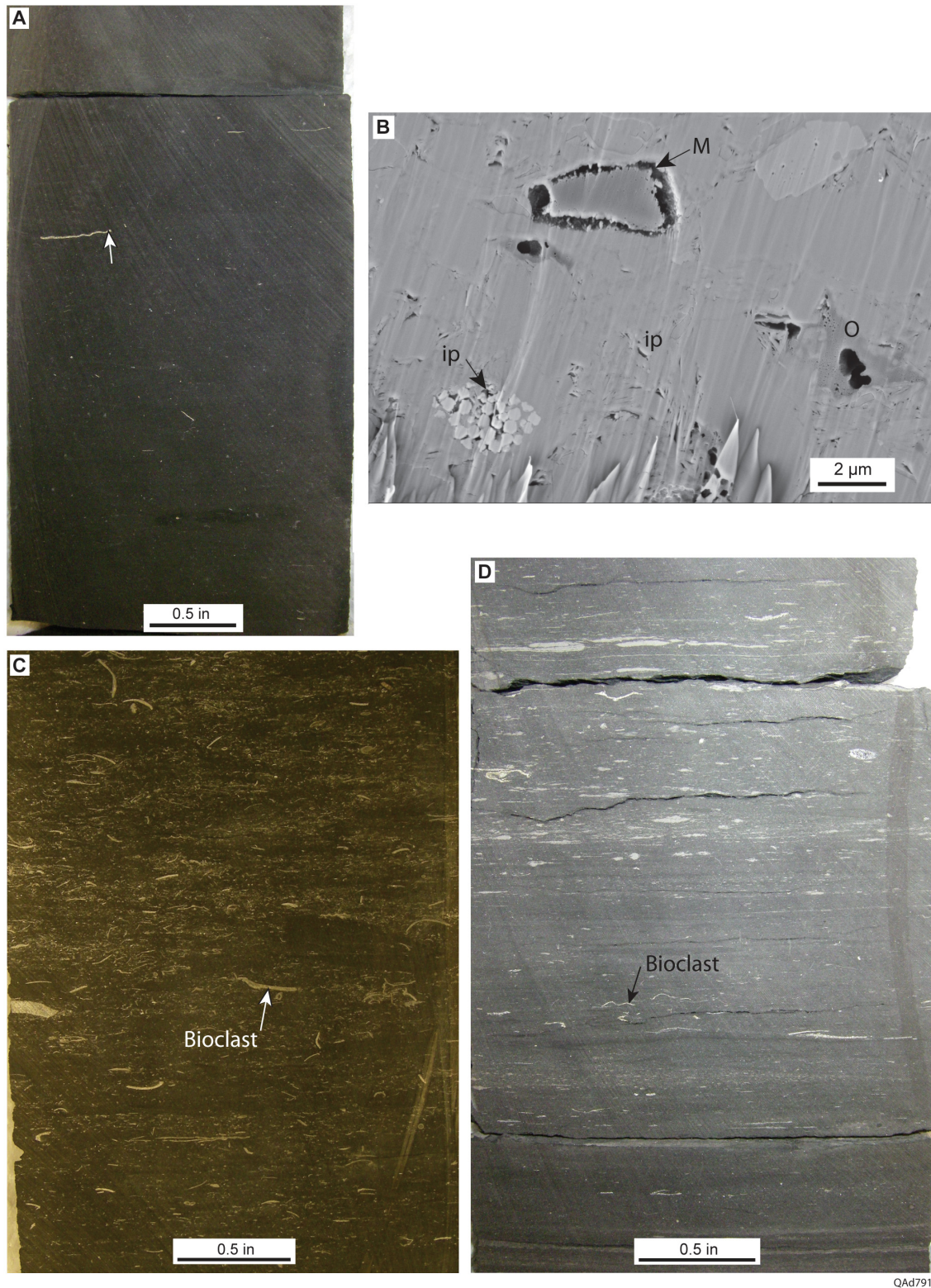


Figure 27. Haynesville core photographs, showing variations in rock type and nanopores in organics and interparticle pores. (A) Unlaminated siliceous mudstone, (B) SEM photomicrograph, (C) bioturbated calcareous mudstone, and (D) laminated calcareous mudstone.

PROJECT STARR'S RETURN ON STATE INVESTMENT FOR CURRENT BIENNIUM (SEPTEMBER 2008–AUGUST 2010)

Production data from the Railroad Commission of Texas show that Project STARR-related wells have provided \$16,568,217 in revenue from severance taxes during the past 2 years (Table 2). Revenue numbers for Table 2 are calculated using royalty factors per lease (supplied by the Texas General Land Office) and estimated value of gas, condensate, or oil during each month produced. We calculated average monthly prices using data from the website of the Energy Information Administration (EIA) of the U.S. Department of Energy (<http://www.eia.doe.gov/>). From that website we downloaded two spreadsheets, one containing average monthly U.S. wellhead prices for natural gas, and the other containing Cushing, Oklahoma, monthly prices for West Texas Intermediate crude oil. Production values per lease came from the Railroad Commission's ACTI Texas Oil and Gas Production database (<http://driller.rrc.state.tx.us/Apps/WebObjects/acti>). Relative to royalty income, with severance taxes discounted by a factor of 25% for regional studies, Project STARR is revenue positive by a factor of 5.5.

The rate of decline in oil and gas production on Texas State Lands is symptomatic of the hydrocarbon production decline in the entire state and nation over the past few decades and is typical for mature provinces. In 1997, a report by the Railroad Commission of Texas titled "Texas Natural Resources Study: A Status Report of the Hydrocarbon Industries of Texas" (Matthews et al., 1997) projects that rates of hydrocarbon production will decline dramatically to low levels within the next decade. Advanced reservoir characterization and technology can help reduce this rate of decline and aid in recovering more hydrocarbons from mature fields before abandonment. Current projections indicate that Project STARR is helping operators generate significant revenue for the Permanent School Fund and the State.

Table 2: Summary of royalty revenue to the Permanent School Fund and severance tax to the State. Credit is in accordance with methodology approved by the State of Texas Comptroller's office. Time period covered is 9/1/2008 through 7/31/2010.

Field Name	RRCID for each Well per-Project	Lease Royalty Factor	Condensate/Oil Well Head Value (\$)	Condensate/Oil Royalty (\$)	Condensate/Oil Severance Tax (\$)	Gas Well Head Value (\$)	Gas Royalty (\$)	Gas Severance Tax (\$)	Revenue (\$)
CLEVELAND/MARMATON/ATOKA REGIONAL	47 Wells		\$59,216,683.44	\$0.00	\$1,361,983.72	\$16,759,717.09	\$0.00	\$217,876.32 25% Oil Severance Tax (\$) \$340,495.93	\$1,579,860.04 25% Gas Severance Tax (\$) \$54,469.08
HAYNESVILLE REGIONAL	68 Wells		\$659,445.60	\$0.00	\$16,167.25	\$163,295,162.84	\$0.00	\$2,122,837.12 25% Oil Severance Tax (\$) \$3,791.81	\$2,139,004.37 25% Gas Severance Tax (\$) \$530,709.28
NEWARK EAST NORTH BARNETT REGIONAL	3,045 Wells		\$100,137,680.95	\$0.00	\$2,303,166.66	\$2,232,851,579.67	\$0.00	\$29,027,070.54 25% Oil Severance Tax (\$) \$75,791.67	\$31,330,237.20 25% Gas Severance Tax (\$) \$7,266,767.64
NEWARK EAST SOUTH BARNETT REGIONAL	628 Wells		\$7,377,219.86	\$0.00	\$169,676.06	\$748,563,162.19	\$0.00	\$9,736,455.98 25% Oil Severance Tax (\$) \$42,419.02	\$9,906,132.04 25% Gas Severance Tax (\$) \$2,434,114.00
NORTH TEXAS EASTERN SHELF REGIONAL	93 Wells		\$6,813,584.67	\$0.00	\$313,424.89	\$3,178,063.78	\$0.00	\$238,354.78 25% Oil Severance Tax (\$) \$78,356.22	\$561,779.68 25% Gas Severance Tax (\$) \$69,688.70
WOODBINE REGIONAL	44 Wells	1.93%	\$79,030,368.33	\$14,239.48	\$3,635,396.94	\$3,161,717.22	\$0.00	\$237,128.79 25% Oil Severance Tax (\$) \$908,849.24	\$3,872,525.73 25% Gas Severance Tax (\$) \$69,282.20
BROKEN BONE FIELD	4 Wells		\$1,110,112.32	\$0.00	\$51,065.17	\$3,089,988.85	\$0.00	\$231,749.16	\$282,814.33
CALHOUN OFFSHORE FIELD	5 Wells	20%, 25%, 16%	\$0.00	\$0.00	\$0.00	\$2,730,841.55	\$503,478.98	\$204,813.12	\$204,813.12
CLEVELAND/MARMATON/ATOKA FIELD	13 Wells		\$12,828,304.45	\$0.00	\$295,051.00	\$10,018,215.75	\$0.00	\$130,236.80	\$425,287.81
COPANO BAY FIELD	1 Well		\$16,790.40	\$0.00	\$726.36	\$1,731.34	\$0.00	\$129.85	\$856.21
EAST TEXAS FIELD	6 Wells		\$8,889,546.37	\$0.00	\$408,919.13	\$428,289.34	\$0.00	\$32,121.70	\$441,040.83
GOLD RIVER NORTH FIELD	12 Wells	1%, 11.25%	\$9,135.88	\$222.70	\$420.25	\$345,214.76	\$8,580.00	\$25,891.11	\$26,311.36
HAYNESVILLE FIELD	7 Wells		\$12,664.34	\$0.00	\$291.28	\$46,532,608.74	\$0.00	\$604,923.91	\$605,215.19
SPUR LAKE FIELD	38 Wells		\$39,152,571.97	\$0.00	\$1,801,018.31	\$376,894.35	\$0.00	\$28,267.08	\$1,829,285.39
YATES FORMATION FIELD	16 Wells		\$713,933.77	\$0.00	\$32,840.95	\$4,299,541.99	\$0.00	\$322,465.65	\$355,306.60
4,027 Wells			\$315,967,042.35 Oil Wellhead Value Grand Total	\$14,462.18 Oil Royalty Grand Total	\$4,540,036.34 Oil Severance Tax Grand Total	\$3,236,027,719.46 Gas Wellhead Value Grand Total	\$512,058.95 Gas Royalty Grand Total	\$11,975,529.28 Gas Severance Tax Grand Total	\$53,549,469.90 Revenue Grand Total
									Estimate of Revenue Neutrality: \$ 16,568,217
									STARR Biennial Funding: \$ 3,000,000.00
									STARR Funding Multiple: STARR Funding/(10% of Royalty, plus Severance Tax): 5.52

Severance-Tax Distribution in STARR Regional and Field Studies

Oil severance taxes generated from STARR regional studies in the 2008–2010 biennium, discounted with a 25% factor for STARR credit, are dominated by two plays—the North Barnett-Newark east shale and the Woodbine East Texas (Fig. 28). The north part of the Barnett shale play in the Fort Worth Basin is oil prone, in contrast to the south part of the basin (Pollastro et al., 2007), accounting for the large contribution of this play to oil severance taxes. Although oil production from the Woodbine Group dates back to 1930 in East Texas field, it also continues to produce from a great number of fields to the south and southwest of the field (Galloway et al., 1983).

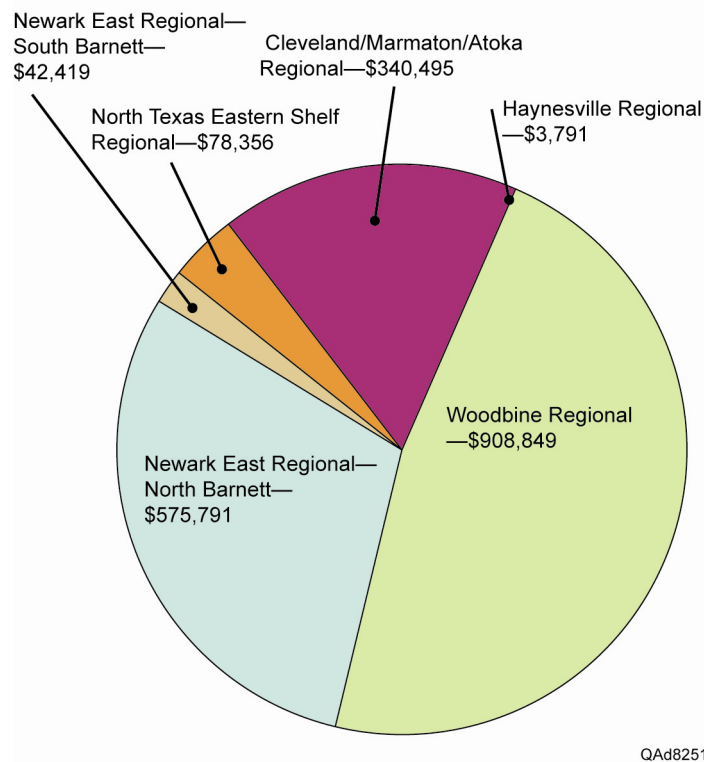


Figure 28. Oil severance taxes with 25% factor from STARR regional studies, 2008–2010 biennium.

Oil severance taxes from STARR field studies, which do not have the 25% factor applied for STARR credit, are dominated by the Pennsylvanian Spur Lake field in West Texas (Fig. 29). The large contribution from this field is due mainly to the great number of wells drilled by Gunn Oil Company, using concepts developed by Brown et al. (1990). The oil-severance-tax contribution from East Texas field, the second- largest from STARR field studies in the 2008–2010 biennium, is the result of six successful well deepening into Woodbine highstand deltaic “stringer” sands. This development concept is described in detail in Ambrose et al. (2009).

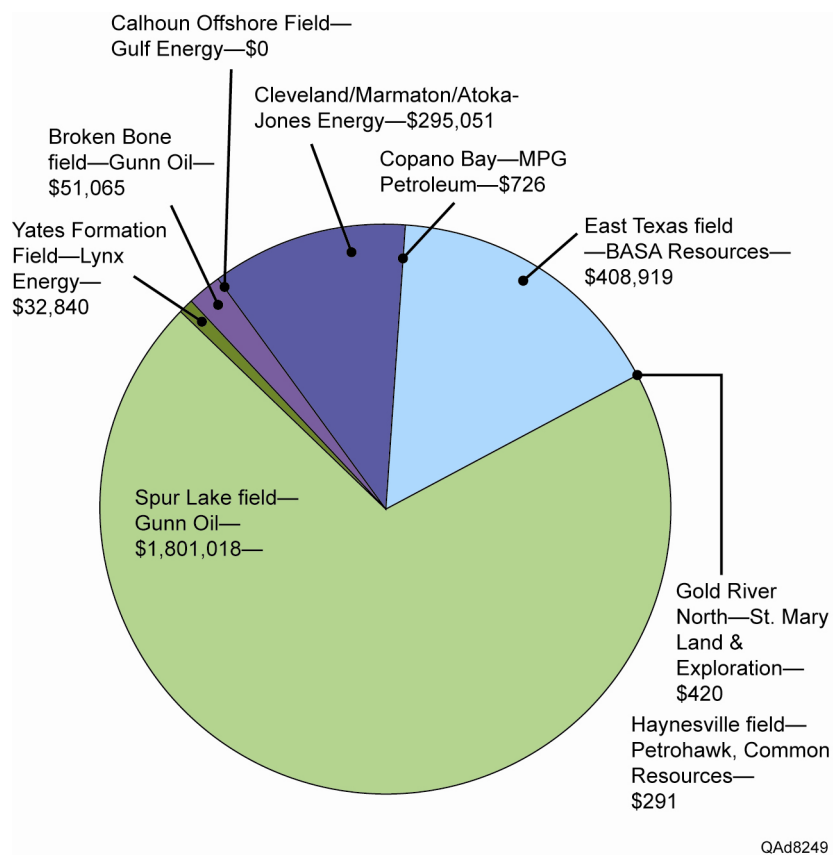
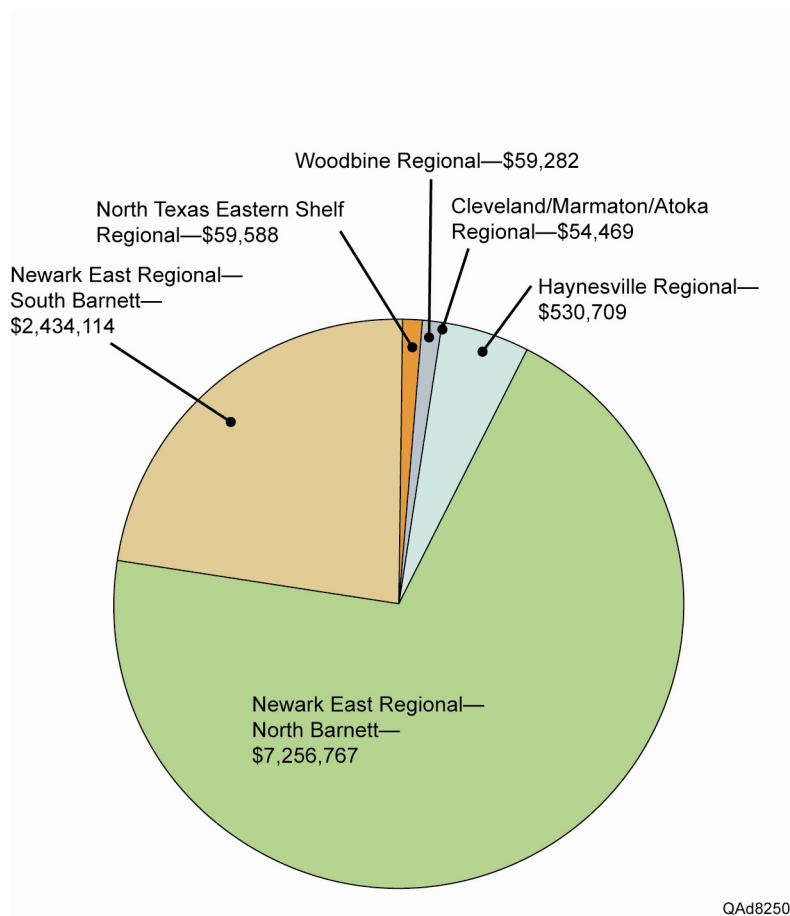


Figure 29. Oil severance taxes from STARR field studies, 2008–2010 biennium.

Gas severance taxes generated from STARR regional studies in the 2008–2010 biennium reflect the current and ongoing importance of unconventional shale-gas plays in Texas, where the North and South Barnett regional plays together account for 98% of all STARR-related gas severance taxes, despite relatively stringent credit criteria (Fig. 30).



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Figure 30. Gas severance taxes with 25% factor from STARR regional studies, 2008–2010 biennium.

Gas severance taxes generated from STARR field studies in the 2008–2010 biennium, as with regional studies, reflect the predominance of unconventional shale-gas plays. The Haynesville Shale in East Texas, described by Hammes (2009) and Hammes et al. (2009), accounts for 38% of all gas-severance taxes from STARR field studies, whereas associated-gas resources from conventional reservoirs in the Yates field study on the Eastern Shelf of the Permian Basin represents 18%, and Broken Bone field on the Eastern Shelf of the Permian Basin represents 15% (Fig. 31).

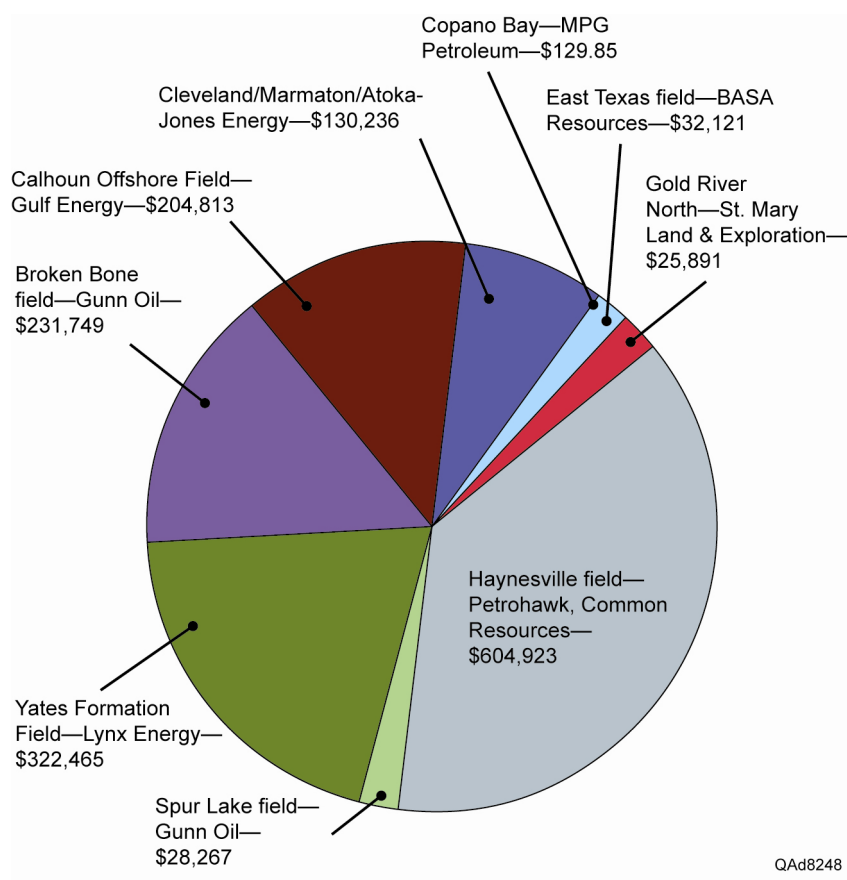


Figure 31. Gas severance taxes from STARR field studies, 2008–2010 biennium.

PROJECT STARR'S PROJECTION OF STATE INVESTMENT WITH ONGOING AND NEW PROJECTS FOR THE 2010-2012 BIENNIUM

Royalty revenue to the Permanent School Fund for the next reporting biennium (September 2010 through August 2012) from incremental oil and gas production is projected to remain at high levels. This estimate is based on many new wells anticipated to be drilled in Texas shale-gas plays, including the Barnett, Haynesville, and the recently initiated Eagle Ford trend study. Regional plays in conventional oil and gas reservoirs such as the Woodbine Group, the Pennsylvanian on the Eastern Shelf of the Permian Basin, and the tight-gas Cleveland/Marmaton/Atoka Groups are expected to remain active and to contribute substantial oil and gas production in the next biennium. Ongoing reservoir-characterization studies in various fields in Texas have the potential for several infill and step-out wells in East Texas field. Extension of STARR's Frio reservoir characterization projects to the southwest in Lavaca Bay, in concert with Neumin Production Company, is targeting productive, gas-prone, lowstand slope-fan reservoirs in growth-fault-bounded compartments (Ambrose et al., 2010).

New project initiatives by STARR, such as an ambitious subsurface study of the prolific Spraberry trend in West Texas in association with Pioneer Resources, promise to offer new insight into reservoir architecture and controls on reservoir continuity and productivity in one of the largest producing areas from low-permeability, deepwater sandstone trends in the U.S. This study employs a large data set, including core, well logs, and production data. It covers a key productive area in the Spraberry trend, where large volumes of unrecovered oil still reside in extensive and fine-grained deepwater-fan deposits that require hydraulic fracturing to recover additional oil.

A new reservoir-characterization study of carbonate reservoirs in the Pennsylvanian Caddo Formation in Stephens County, in conjunction with BASA Resources, is designed to improve waterflood performance and recover additional volumes of mobile oil. This new STARR study includes abundant cores, well logs, and a 3D seismic survey to characterize and visualize reservoir rock types, geometries, and flow units to better predict pathways of injected water and to maximize oil recovery.

An innovative new STARR project in Alabama Ferry field in Leon County involves nitrogen flooding of carbonate reservoirs in the Upper Cretaceous Glen Rose Formation. This project, conducted with Antioch Energy LLC, includes more than 30 whole cores and well logs to describe and characterize high-porosity and high-permeability ooid-grainstone deposits in the field that are thought to contain additional recoverable oil resources.

In early 2010, Project STARR initiated a subsurface study of the Upper Cretaceous Eagle Ford Shale, a proven major oil- and gas-shale play that extends continuously from the Rio Grande almost to the Louisiana border (Hentz and Ruppel, 2010). Because production from this organic-rich shale started in only 2008 in South Texas, basic aspects of the new play's full subsurface extent, rock attributes, and reservoir characteristics remain largely unknown north of its present area of production. This study, in association with a consortium of active Eagle Ford exploration companies,

involves a large data set of subsurface well logs, rock cores, 3-D seismic survey, geophysical profiles, geochemical analyses, and petrological information to help guide industry operators more accurately target optimal producing areas in the play.

With sustained oil and gas development funding from the State of Texas, Project STARR has an ultimate goal of capturing an incremental 5% of the remaining mobile oil and gas resource on State Lands and Waters that would not be captured without the application of advanced technology and sequence stratigraphic principles. The mobile oil resource on State Lands is 1.6 Bbbl, and the goal of 5% incremental oil would yield 80 MMbbl and provide a return to the Permanent School Fund of \$700 million, assuming an average price of \$70/bbl and a 12.5% royalty. Similarly, a capture of 5% of the 10 Tcf of remaining gas would yield 500 Bcf and generate \$300 million for the Permanent School Fund, assuming an average price of \$4.00/Mcf and an average 15% royalty. By achieving these levels of incremental recovery, the Project STARR initiative could help generate \$1 billion in royalties to the Permanent School Fund over the long term.

The wellhead value of additional oil and gas reserves would be \$5.6 billion and \$2.0 billion, respectively, for a total of \$7.6 billion. Calculations based on the Railroad Commission of Texas "General Model of Oil and Gas Impact on the Texas Economy" derived from the Comptroller's Input-Output model of the Texas economy can be further utilized to estimate the overall effect of additional oil and gas reserves in terms of economic value, taxes, and jobs created. The economic value of this potential future oil and gas as it cycles through the Texas economy is calculated at \$22.1 billion (wellhead value multiplied by 2.91). Total potential taxes of \$873 million are derived from severance (4.6% oil and 7.5% gas of wellhead value), ad valorem (3.95% of wellhead value), franchise (0.18% of economic value), and sales (2% of economic value) taxes. The number of potential additional jobs created equals 146,160, assuming 19.1 jobs are created per million dollars of wellhead value.

PROJECT STARR REVENUE NEUTRALITY METRICS

Project STARR must demonstrate revenue neutrality to the State of Texas Comptroller's Office each reporting biennium in order to be considered for funding in the next biennium. Starr's revenue neutrality is calculated for 2 years, spanning half of the last and half of the current legislative biennia. For the 2008–2010 biennium we calculated our revenue neutrality from September 1, 2008, through July 31, 2010. This 2-year interval was chosen because our progress report is typically being submitted before the end of the current legislative biennium (i.e., 2010–2011 biennium). Both royalties to the Permanent School Fund and State severance tax can be accounted for in revenue neutrality calculations on the basis of the metrics presented in Table 3. This metrics table was developed in conjunction with the State of Texas Comptroller's Office in 2004 and slightly modified following discussion with the Comptroller's Office in 2006. Five major types of projects are noted in Table 3.

Table 3. Project STARR revenue neutrality metrics.

Type of STARR Recommendation	Expiration period following recommendation (Initial/incremental production must begin before recommendation expires)	Time period for credit following initial production	Royalty Credit (Royalties to PSF)*	Severance Tax Credit
1. Drilling new infill or step-out well in established field	4 years	2 years	100%	100%
2. Drilling new infill or step-out well in established field with multiple reservoir intervals	4 years	2 years following completion of each additional reservoir interval	100%	100%
3. Recompletion - missed pay well in established field	4 years	2 years	100%	100%
4. Enhanced oil recovery (EOR) field project	4 years	2 years following date selected by STARR within a 5-year period from initial operator action	100% of incremental production	100% of incremental production
5. Exploration well	4 years	2 years	100%	100%
5.a. Subsequent development wells following discovery of new field	2 years following initial production from exploration well	2 years	100%	100%
5.b. Copycat wells following discovery of new field	2 years following initial production from exploration well	2 years	25%	25%

* Project STARR receives revenue neutrality credit only for the fraction of royalty that goes into the General Revenue Fund of the State of Texas. State Land royalties initially go into the Permanent School Fund, and a percentage of that fund is transferred to the General Revenue Fund each year. Project STARR receives credit for the amount that is provided to the General Revenue Fund each year.

RECOMMENDATIONS

Project STARR has been successful by focusing on field-scale studies that are limited in their geographic extent. This concentrated focus on small, reservoir-sized areas leads to immediate incremental royalty revenue flow into the Permanent School Fund because specific areas and specific reservoir depths can be identified where State Lands operators can take recommended actions to increase production. The addition of regional (including unconventional) studies has generated additional funds as operators have taken advantage of research and leads offered by these studies through workshops and publications.

We recommend that the Project STARR program **remain at \$1.5 million per year or \$3 million for the next biennium.** The present funding is at a level that allows us to have a strong team with the necessary skills to generate prospects and regional studies. The State was fortunate to have this team in place so that new incremental production (resulting from STARR's efforts) had a high value owing to recent unprecedented increases in oil and gas prices.

Overall, Project STARR has been successful interacting with State Lands' operators to help them increase their production. Our success rate with the operators is reflected in the revenue generated. We strongly believe that continued funding support for Project STARR will be more than offset by increase in royalties to the Permanent School Fund and severance tax to the State of Texas.

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APPENDIX A

2008–2010 Letters of Cooperation

The following are letters from partner companies with whom Project STARR has collaborated over the last several years. The letters support the strong interaction between Project STARR and industry.

777 NORTH ELDRIDGE PARKWAY SUITE 1000
HOUSTON, TEXAS 77079
281-677-2300
FAX 281 677 2910



September 9, 2008

Dr. Ursula Hammes
PI STARR project
Bureau of Economic Geology
The University of Texas at Austin
University Station, Box X
Austin, Texas 78713-8924

Re: Acknowledgment of STARR support

Dear Dr. Hammes:

On behalf of St. Mary Land & Exploration Company and the team here in Houston, I would like to thank you and the STARR team for your ongoing support of our project in the Gold River North area, Webb County. Your insight into the regional geology and the detailed understanding of the local conditions continue to help us in our exploitation efforts. We appreciate very much your help in the understanding of the sequence stratigraphy and reservoir potential. Your team's sedimentological interpretations of our seismic data and core description of depositional facies have provided us with encouragement to drill more wells in the future. We are currently drilling and are planning to drill additional wells with encouragement from the STARR team.

My colleagues and I look forward to our continued relationship in Webb County. Thank you again for the support of your team.

Warmest Regards,

A handwritten signature in black ink, appearing to read "D. Purcell".

David K. Purcell
Chief Geophysicist, Houston
St. Mary Land & Exploration Company



August 29, 2008

Ursula Hammes, Ph.D.
Bureau of Economic Geology
The University of Texas at Austin
10100 Burnet Road, Bldg. 130
Austin, Texas 78758

Re: STARR Team Support

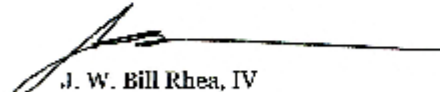
Dear Dr. Hammes:

On behalf of Gulf Energy Exploration Corp., I would like to personally thank you and the STARR team members for your ongoing support of our projects, one being offshore Calhoun County and the other in West Bay of Galveston and Brazoria Counties. Your assessment of the 3D seismic volume in both has been crucial in understanding the regional geology and the detailed understanding of the local conditions and reservoir characteristics.

The STARR team's involvement not only enhanced our understanding of the geologic picture but also in proving up new reserves. We are currently in the process of establishing an extensive exploratory and development drilling program in these two areas.

Again, many thanks.

Sincerely yours,
Gulf Energy Exploration Corp.



J. W. Bill Rhea, IV
President, Chief Executive Officer

9101 Burnet Road, Suite 203 • Austin, TX 78758
512.335.4800

TEXAS CRUDE ENERGY, INC.

(713) 599-9900

• 2801 BUFFALO SPEEDWAY

• HOUSTON, TEXAS 77056

• FAX: (713) 599-9910

MAILING ADDRESS: P.O. BOX 56586

HOUSTON, TEXAS 77256-5586

October 31, 2008

Dr. Ursula Hammer
Bureau of Economic Geology
University Station
Box X
Austin, TX 78713-8924

Dear Ursula:

On behalf of Texas Crude Energy we wanted to thank you and the STARR team for your interaction with our staff during the past 2 years. We were successful in discovering a new field by completing a well in the Austin chalk of the Suqarkane Cretaceous gas field in Live Oak and Karnes counties and anticipate to drill several more wells in the near future. Your regional knowledge and insight into different plays in Texas has led to valuable discussions and opportunities. Texas Crude thanks the BEG and STARR for their support and contributions to our oil and gas exploration efforts and we look forward to future collaboration.

Sincerely,



Douglas E. O'Brien
VP Exploration
Texas Crude Energy Inc.
Office 713 5999900
Fax 713 5999910

GUNN OIL COMPANY
P.O. Box 97508
Wichita Falls, Texas 76307
Phone 940-723-5585

Dr. Ursula Hammes
Project Director
STARR Project
Bureau of Economic Geology
Jackson School of Earth Sciences
The University of Texas at Austin
P. O. Box X, UT Station
Austin, Texas 78713

May 25, 2010

Dear Dr. Hammes:

I would like to acknowledge the contribution made to our oil and gas exploration programs in North West Texas by research carried out and published by the State of Texas Advanced Resource Recovery project (STARR) at the Texas Bureau of Economic Geology. The published research by the Bureau has contributed to our discovery of oil and gas in several counties in our region of Texas. We hope that the STARR program will continue to receive State of Texas support. We and other independent companies do not have major geologic research programs and therefore, results of the Bureau's research on new methods of exploration has been very helpful in our efforts to discover new reserves in Texas.

The Bureau's studies, publications and presentations have provided education and exposure to many recent advances in petroleum exploration that can successfully applied to our region. Attached is a list of producing leases that were discovered by applying the concepts and techniques that the Bureau has provided to the geoscience community and oil & gas industry.

Sincerely,

Gregg A. Norman
Senior Geologist
Gunn Oil Company

BASA Resources Inc
14875 Landmark, Suite 400
Dallas, Texas 75254
214-559-4200

Dr. William Ambrose
Project Director
STARR Project
Bureau of Economic Geology
Jackson School of Earth Sciences
The University of Texas at Austin
P. O. Box X, UT Station
Austin, Texas 78713

June 7, 2010

Dear Dr. Ambrose:

I would like to acknowledge the contributions made to our oil and gas exploration programs in the East Texas Oil Field by research carried out and published by the State of Texas Advanced Resource Recovery project (STARR) at the Texas Bureau of Economic Geology. The published research by the Bureau has contributed to our discovery of oil in Gregg County, Texas. We hope that the STARR program will continue to receive funding from the State of Texas. We and other independent companies do not have the benefit of major geologic research programs and therefore, results of the Bureau's research on various methods of exploration has been very helpful in our efforts to discover new reserves in Texas.

The Bureau's studies, publications and presentations have provided an education and insight to many recent advances in petroleum exploration that has been successfully applied to our areas of interest. Attached is a graph of the producing Akin lease that shows improved production by applying the concepts and techniques that the Bureau has provided to the oil & gas industry. This demonstrates the STARR program's ability to turn academic studies into economic success.

Respectfully,

Jim Barton
Geosciences Manager
BASA Resources Inc

JONES

(512)328-2953
FAX 328-5394

June 7, 2010

Mr. William A. Ambrose
Mr. Tucker F. Hentz
STARR Project
Bureau of Economic Geology
Jackson School of Earth Sciences
University of Texas at Austin
University Station, Box X
Austin, Texas 78713-8924

Dear Mr. Ambrose and Mr. Hentz:

I would like to thank you and acknowledge the contributions made to our oil and gas exploration and development efforts in the Texas Panhandle region by the studies carried out and published by the State of Texas Advanced Resource Recovery project (STARR) at the Texas Bureau of Economic Geology. The research published on the Cleveland, Marmaton, and Atoka Group reservoirs has assisted in our understanding of reservoir conditions in Lipscomb and Ochiltree Counties as well as Ellis County, Oklahoma and enabled modifications to our ongoing horizontal drilling efforts. Companies of our size do not have large staff resources or major geologic research programs and therefore, results of the Bureau's research on new methods of exploration has been very helpful in our efforts to discover new reserves in the State of Texas. We hope that the STARR program will continue to receive support from the State of Texas.

The Bureau's research, publications, and presentations have provided valuable education and exposure to many recent advances in petroleum exploration that can be successfully applied to our areas of operation. Attached is a list of producing properties that were discovered by using concepts and techniques that the Bureau has made available to the geosciences community and the oil and gas industry.

Sincerely,



Chris G. Goss
Geosciences Development Manager
Jones Energy, Ltd.

JONES ENERGY, LTD.
807 LAS CIMAS PARKWAY
SUITE 350
AUSTIN, TX 78746

June 14, 2010

Dr. Ursula Hammes, Ph.D., Manager
STARR Project
Bureau of Economic Geology
The University of Texas at Austin
University Station, Box X
Austin, Texas 78713-8924

Re: State of Texas Advance Resource Recovery (STARR): Technology Center for Oil and Gas Recovery Optimization

Dear Dr. Hammes:

As STARR Client 4, MPG Petroleum, Inc. wishes to thank you and your colleagues at the Bureau of Economic Geology for your continued collaboration on the MPG Petroleum, Inc. "Pearl" and "Ritchie Farms" Prospects.

As a result of our collaboration, the test well of the Ritchie Farms Prospect was drilled, resulting in the definition of nine (9) distinct hydrocarbon-bearing reservoirs. These reservoirs have deepened the known hydrocarbon window in this area and are tied directly to amplitude anomalies observed on the 3D seismic data set. Although the reservoirs were found to be 'tight', lacking sufficient porosity and permeability to result in commercial production, MPG Petroleum, Inc. is encouraged to continue to explore the potential of the Ritchie Farms due to the multiple reservoirs identified, all of which flowed high gravity oil, condensate and high Btu gas.

Current collaborative efforts involve the recent reprocessing of the 3D seismic data set by MPG Petroleum, Inc. STARR researchers are currently applying reservoir characterization and specialized geophysical techniques to the reprocessed data, such as 'stratal slicing' to identify reservoir 'sweet spots'. Extensive mapping of the 3D seismic data and excellent, interactive illustrative presentations have been constructed by Dr. Lorena Moscardelli, Dr. Ursula Hammes with other research members of the BEG assisting.

The endeavor of MPG Petroleum, Inc. through its continued collaboration with the STARR initiative of the Bureau of Economic Geology, is to explore for and discover world-class sized oil and gas reserves under the Pearl Prospect.

Best regards,

MPG Petroleum, Inc.

Margaret P. Graham
President

APPENDIX B

Project STARR Awards

Project STARR has been honored to receive several Excellence in Geoscience awards:

Ambrose, W. A., Hentz, T. F., Bonnaffé, F., Loucks, R. G., Brown, L. F., Jr., Wang, F. P., and Potter, E. C., 2010, Wallace E. Pratt Award, American Association of Petroleum Geologists. This is the best-paper award for the world's premier petroleum journal, the *AAPG Bulletin*, for the article titled "Sequence-Stratigraphic Controls on Complex Reservoir Architecture of Highstand Fluvial-Dominated Deltaic and Lowstand Valley-Fill Deposits in the Upper Cretaceous (Cenomanian) Woodbine Group, East Texas Field: Regional and Local Perspectives."

Ambrose, W. A., Hentz, T. F., Bonnaffé, F., Loucks, R. G., and Wang, F. P., 2009, Thomas A. Philpot Excellence of Presentation Award, Gulf Coast Association of Geological Societies for oral presentation titled "Strategies for Optimized Oil Recovery in Fluvial-Dominated Deltaic Reservoirs in the Lower Woodbine Group, East Texas Field."

Ambrose, W. A., 2009, EMD Distinguished Service Award, Energy Minerals Division of the American Association of Petroleum Geologists.

Loucks, R. G., 2008, Jackson School of Geosciences Outstanding Research Award.

Loucks, R. G., 2008, Energy Mineral Division's President's Certificate for Excellence in Presentation, AAPG Annual Convention, for presentation titled "Shell and Grain Layers in the Barnett Shale: Event Deposition or in-situ Accumulations?"

Moscardelli, L., 2010, Publication Award, Bureau of Economic Geology: exemplary publication of scientific or economic impact.

APPENDIX C

One of the major goals of Project STARR is to disseminate results and new concepts developed by the program. During the last reporting biennium (2006-2008), the following articles, abstracts, and lectures were produced.

Articles

William A. Ambrose

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Florence Bonnaffé

- Bonnaffé, F., Ambrose, W. A., Hentz, T. F., Wang, F. P., and Loucks, R. G., 2008, Three-dimensional architecture of lowstand incised-valley deposits in the Woodbine Group, northern East Texas Field: *Gulf Coast Association of Geological Societies Transactions*, v. 58, p. 135-141.

Bonnaffe, F., Hammes, U., Carr, D. L., and Brown, L. F., Jr., 2008, High-resolution sequence stratigraphic correlations of the Oligocene Frio Formation in south Texas, *in* Gulf Coast Association of Geological Societies Transactions, v. 58, p. 125–142.

L. Frank Brown, Jr.

Brown, L. F., Jr., and Loucks, R. G., 2009, Chronostratigraphy of Cenozoic depositional sequences and systems tracts: a Wheeler chart of the northwest margin of the Gulf of Mexico basin: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 273, 28 p. + chart.

David L. Carr

Carr, D. L., and T. F. Hentz, 2009, Sequence stratigraphy and organic richness of the Lower Pennsylvanian Atoka Series, Northwest Anadarko Basin, Texas, and Oklahoma Panhandle: AAPG Search and Discovery Article #90090, AAPG Annual Convention and Exhibition, Denver, Colorado.

H. S. Hamlin

Hamlin, H. S., 2009, Ozona sandstone, Val Verde Basin, Texas: synorogenic stratigraphy and depositional history in a Permian foredeep basin: AAPG Bulletin, v. 93, no. 5, p. 573–594.

Ursula Hammes

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Hammes, U., Hamlin, H. S., and Eastwood, R., 2010, Facies characteristics, depositional environments, and petrophysical characteristics of the Haynesville and Bossier shale-gas plays of East Texas and northwest Louisiana: Houston Geological Society Bulletin, May, p. 59–63.

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Tucker F. Hentz

Hentz, T. F., and Ambrose, W. A., 2010, Cleveland and Marmaton tight-gas reservoirs (Pennsylvanian), northwest Anadarko Basin: sequence stratigraphy, depositional framework, and production controls on tide-dominated systems: Houston Geological Society Bulletin, v. 52, no. 9, p. 25–29.

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Robert G. Loucks

- Day-Stirrat, R. J., Dutton, S. P., Milliken, K. L., Loucks, R. G., Aplin, A. C., Hillier, S., and van der Pluijm, B. E., 2010, Fabric anisotropy induced by primary depositional variations in the silt: clay ratio in two fine-grained slope fan complexes: Texas Gulf Coast and northern North Sea: *Sedimentary Geology*, v. 226, p. 42–53.
- Dutton, S. P., and Loucks, R. G., 2010, Diagenetic controls on evolution of porosity and permeability in lower Tertiary Wilcox sandstones from shallow to ultradeep (200–6700 m) burial, Gulf of Mexico Basin, U.S.A.: *Marine and Petroleum Geology*, v. 27, p. 69–81.
- Hull, D. C., and Loucks, R. G., 2010, Depositional systems and stratal architecture of the Lower Cretaceous (Aptian) Pearsall Shale-Gas System in South Texas: *Gulf Coast Association of Geological Societies Transactions*, v. 60.
- Loucks, R. G., 2008, Origin and modification of Lower Ordovician Ellenburger Group paleokarst breccias and fractures in Central and West Texas, *in* Sasowsky, I. D., Feazel, C. T., Mylroie, J. E., Palmer, A. N., and Palmer, M. V., *Karst from recent to reservoirs: Karst Waters Institute, Special Publication 14*, p. 130–135.
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- Loucks, R. G., Reed, R. M., Ruppel, S. C., and Hammes, U., 2010, Preliminary classification of matrix pores in mudrocks: *Gulf Coast Association of Geological Societies Transactions*, v. 60.
- Loucks, R. G., Reed, R. M., Ruppel, S. C., and Jarvie, D. M., 2009, Morphology, genesis, and distribution of nanometer-scale pores in siliceous mudstones of the Mississippian Barnett Shale: *Journal of Sedimentary Research*, v. 79, p. 848–861.
- Loucks, R. G., and Ruppel, S. C., 2008, Lower Ordovician Ellenburger Group collapsed-paleocave facies and associated pore network in the Goldrus Unit #3 core, Barnhart field, Texas (ext. abs.), *in* Sasowsky, I. D., Feazel, C. T., Mylroie, J. E., Palmer, A. N., and Palmer, M. V., *Karst from recent to reservoirs: Karst Waters Institute, Special Publication 14*, p. 127–129.
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Eric C. Potter

- Potter, E., and Ruppel, S. C., 2009, West Texas Permian Basin, *in* Laubach, S. E., and Tinker, S. W., eds., 2009, *Earth's art: celebrating the Centennial of the Bureau of Economic Geology, 1909–2009: The University of Texas at Austin, Bureau of Economic Geology*, p. 70–71.

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Stephen C. Ruppel

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Ruppel, S. C., and Loucks, R. G., 2008, Black mudrocks: lessons and questions from the Mississippian Barnett Shale in the southern Midcontinent: *The Sedimentary Record*, v. 6, no. 2, p. 4–8.

Fred P. Wang

Wang, F. P., 2008, Production fairway speed rails in gas shales, *in* 7th Annual Gas Shale Summit, Dallas, Texas, May 7.

Wang, F. P., 2010, Engineering characteristics of East Texas field: north and south pilot studies, *in* Hentz, T. F., ed., Sequence stratigraphy, depositional facies, and reservoir attributes of the Upper Cretaceous Woodbine Group, East Texas field: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations 274, p. 95–112.

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Hongliu Zeng

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Abstracts

William A. Ambrose

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Caroline L. Breton

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L. Frank Brown, Jr.

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David L. Carr

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Dallas B. Dunlap

Dunlap, D. B., Moscardelli, L., Hornbach, M., and Wood, L. J., 2009, Potential causal mechanisms for MTC generation from the Northwest African Shelf (abs.): American Association of Petroleum Geologists Annual Convention Official Program, v. 18, p. 59.

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Julia F. W. Gale

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Gale, J. F. W., Reed, R. M., Becker, S. P., and Ali, W., 2009, Natural fractures in the Barnett Shale in the Delaware Basin, Pecos Co., West Texas: comparison with the Barnett Shale in the Fort Worth Basin (abs.): American Association of Petroleum Geologists Annual Convention Official Program, v. 18, p. 52.

Ali, W., Gale, J. F. W., Ruppel, S. C., and Loucks, R. G., 2008, Lithofacies, depositional environment and burial history of the Barnett Shale in the Delaware Basin, Pecos Co., West Texas, and comparison with the Barnett Shale in the Fort Worth Basin (abs.), in West Texas Geological Society Fall Symposium, WTGS digital publication #08-120, p. 48.

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H. S. Hamlin

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Robert G. Loucks

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Robert M. Reed

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Reports

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Workshops

- Ambrose, W. A., and Hentz, T. F., 2009, Woodbine core review, AA Wells field, Polk County, Texas: core workshop presented to Border to Border Exploration, L.L.C., January 21: The University of Texas at Austin, Bureau of Economic Geology, 17 p.
- Ambrose, W. A., Hentz, T. F., Bonnaffe, F., Loucks, R. G., Potter, E. C., and Clift, S. J., 2008, Sequence stratigraphy and depositional systems of the Woodbine Group in East Texas field: PTTC Texas/Southern New Mexico Region Workshop, Sequence Stratigraphy and Depositional Systems of the Woodbine Group in East Texas Field: The University of Texas at Austin, Bureau of Economic Geology, Workshop Workbook, No. SW0018, variously paginated.
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- Hamlin, H. S., 2009, Applications of cores to Permian Basin reservoir characterization: core workshop presented at Southwest Section, American Association of Petroleum Geologists, Annual Meeting, Midland, Texas.
- Hamlin, H. S., 2010, Cores from Spraberry and Dean sandstone oil reservoirs in the Midland Basin, West Texas: core workshop presented to Chesapeake Energy, Austin, Texas.
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- Loucks, R. G., 2009, Applications of cores to Permian Basin reservoir characterization: presented at Southwest Section, American Association of Petroleum Geologists, Annual Meeting, Midland, Texas.
- Ruppel, S. C., Loucks, R. G., and Gale, J. F. W., 2008, Barnett, Woodford, and related mudrock successions in Texas cores and outcrops: a core workshop prepared for the 2008 AAPG/SEPM Annual Convention: The University of Texas at Austin, Bureau of Economic Geology, 82 p.
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Lectures

William A. Ambrose

- Oil-recovery strategies related to depositional architecture in fluvial-dominated deltaic and bedload fluvial reservoirs in the lower Woodbine Group in East Texas field: presented to the East Texas Geological Society, Tyler, Texas, March 17, 2010.
- Sequence stratigraphy and depositional systems in the Pennsylvanian Cleveland and Marmaton tight-gas sandstones, Anadarko Basin: presented to RIPED, Austin, Texas, December 18, 2009.
- Gas hydrates overview: presented at the 29th Annual Gulf Coast Section SEPM Foundation Bob F. Perkins Research Conference, Houston, Texas, December 7, 2009.
- Tidal depositional systems: Cleveland and Marmaton examples: presented at the Ellison Miles Institute, Farmers Branch, Texas, November 10, 2009.
- Strategies for optimized oil recovery in fluvial-dominated deltaic reservoirs in the Lower Woodbine Group in East Texas field: presented at the Gulf Coast Association of Societies 2009 Annual Convention, Shreveport, Louisiana, September 28, 2009.
- Sequence stratigraphy and depositional framework of the Frio Formation and Anahuac-Miocene section, Lavaca Bay, Texas: presented to Neumin Production Company, Austin, Texas, July 28, 2009.
- Facies architectural elements and sandstone-body continuity in highstand, fluvial-dominated deltaic reservoirs in the Upper Cretaceous Woodbine Group, East Texas field: presented at the Annual AAPG Convention, Denver, Colorado, June 9, 2009.
- East Texas Woodbine Project, STARR program: presented at the Bureau of Economic Geology Industry Day Meeting, Austin, Texas, April 15, 2009.
- Highstand deltaic and lowstand valley-fill deposits in the Woodbine Group, East Texas field: presented to Excalibur Energy Corp., Austin, Texas, February 25, 2009.
- Highstand deltaic and lowstand valley-fill deposits in the Woodbine Group, East Texas field: presented to Border to Border Exploration, L.L.C, Austin, Texas, January 21, 2009.
- Core review of the Cleveland Formation, Lipscomb County, Texas: presented to Jones Energy, Inc., Austin, Texas, December 17, 2008.
- Sequence Stratigraphy and Depositional Systems of the Woodbine Group in East Texas Field: Core Workshop: BEG-PTTC Workshop No. SW0018 presented at Houston Research Center, Houston, Texas, November 18, 2008.
- Introduction to depositional systems, with application to East Texas field: presented to PTTC Texas/Southern New Mexico Region workshop, Sequence Stratigraphy and Depositional Systems of the Woodbine Group in East Texas Field: Core Workshop, Houston, Texas, November 18, 2008.

L. Frank Brown, Jr.

Regional sequences, systems tracts and paleogeography, during Late Pennsylvanian and Early Permian Periods, Eastern Shelf of the West Texas Basin: presented at the Bureau of Economic Geology, October 7, 2009.

David L. Carr

Sequence stratigraphy and organic richness of the Lower Pennsylvanian Atoka Series, Northwest Anadarko Basin, Texas and Oklahoma Panhandle: presented at the 2009 Annual AAPG Convention, Denver, Colorado, June 8, 2009.

Reconnaissance of the Atoka Group (Middle Pennsylvanian) Northwest Anadarko Basin: presented at the Ellison Miles Institute, Farmers Branch, Texas, November 10, 2009.

Organic richness petrophysics of Lower Pennsylvanian Atoka Series, Northwest Anadarko Basin, Texas, and Oklahoma Panhandle: presentation to Jones Energy. Ltd., Austin, Texas, December 17, 2008.

Dallas B. Dunlap

Causal mechanism for MTC generation on the northwest African shelf: presented at the AAPG Annual Convention, Denver, Colorado, June 9, 2009.

Utilizing multiple attributes and techniques for detailed analysis of seismic structure and facies: presented at the Annual QCL IA Meeting, Albuquerque, New Mexico, September 2008.

Qilong Fu

Core description, lithofacies analysis and depositional environmental interpretation of Pennsylvanian Caddo carbonate rocks in Stephens County, Texas: presented to BASA Resources, Inc., Austin, March 25, 2009.

Julia F. W. Gale

Natural fractures in the Barnett Shale in the Delaware Basin, Pecos Co., West Texas: comparison with the Barnett Shale in the Fort Worth Basin: presented at North Texas Geological Society Luncheon Meeting, Irvine, Texas, January 15, 2009.

Applications of cores to Permian Basin reservoir characterization: presented at Southwest Section, American Association of Petroleum Geologists Annual Meeting, Midland, Texas, April 25, 2009.

H. S. Hamlin

Hamlin, H. S., and H. S. Nance, 2009, Slump and debris-flow facies from mixed carbonate/clastic slopes, Permian Basin, West Texas: poster presented at the 4th International Symposium on Submarine Mass Movements and Their Consequences, Austin, Texas, November 8-10, 2009.

Ursula Hammes

Sequence stratigraphy, depositional environment, and possible extent of the Haynesville Shale, east Texas: presented at the Houston Geological Society Mudrock Conference, Houston, Texas, February 10, 2009.

Sequence stratigraphy, depositional environments, and geochemistry of the Haynesville shale-gas play in east Texas: presented to the Fort Worth Geological Society, Fort Worth, Texas, April 13, 2009.

Sequence stratigraphy, depositional environments, and production fairways of the Haynesville shale-gas play in east Texas: presented at the Annual AAPG Convention, Denver, Colorado, June 8, 2009.

Sequence stratigraphy and core facies of the Haynesville mudstone, East Texas: presented at the 59th Annual GCAGS Conference, Shreveport, Louisiana, September 27, 2009.

Sequence stratigraphy and core facies of the Haynesville mudstone, East Texas: presented at the 59th Annual GCAGS Conference, Shreveport, Louisiana, September 28, 2009.

Addressing conventional parameters in unconventional shale-gas systems; depositional environment, petrography, geochemistry, and petrophysics of the Haynesville Shale: presented at the 29th Annual GCSSEPM Foundation Bob F. Perkins Research Conference, Houston Texas, December 7, 2009.

New insights into facies, depositional environments, sequence stratigraphy, and geochemical and petrophysical parameters of the Haynesville Shale of East Texas and Louisiana: presented at the Houston Geological Society Mudrock Conference, Houston Texas, February 9, 2010.

Influence of facies variations on exploration, production, and resource assessment in gas-shale plays: a geologic and petrophysical evaluation of the Haynesville Shale, East Texas, USA: presented at the Society of Exploration Geophysicists and Society of Petroleum Engineers monthly meeting, Austin, Texas, April 2010.

Geochemistry and depositional environment of the Haynesville and Bossier mudrocks of east Texas and northwest Louisiana: presented at the AAPG Short Course "Assessment of Unconventional Shale Resources Using Geochemistry," April 11, 2010.

Facies characteristics, depositional environment, and petrophysical characteristics of the Haynesville and Bossier shale-gas plays of east Texas and northwest Louisiana: presented at the Society of Independent Professional Earth Scientists monthly meeting, Houston, Texas, May 20, 2010.

Depositional environment, stratigraphy, and petrophysical and reservoir characteristics of the Haynesville and Bossier shale-gas plays of east Texas and northwest Louisiana: presented at the Society of Exploration Geophysicists and Society of Petroleum Engineers monthly meeting, Austin, Texas, June, 2010.

Depositional environment, stratigraphy, and petrophysical and reservoir characteristics of the Haynesville and Bossier shale-gas plays of east Texas and northwest Louisiana: presented at the SEG/SPE/AAPG Workshop on Shales: seal, reservoir, and source, Austin, Texas, June 2010.

Tucker F. Hentz

Regional lithostratigraphy of Eagle Ford Shale: Maverick Basin to East Texas Basin: presented to the industry representatives of the Mudrock Systems Research Laboratory, Austin, Texas, June 14, 2010.

The Eagle Ford system, stratigraphy, rock attributes, pore character, geophysics, and geochemistry: presented to the industry representatives of the Mudrock Systems Research Laboratory, Austin, Texas, June 14, 2010.

Sequence-stratigraphic framework, type logs, and correlation tops in the Cleveland Formation play area: Ochiltree and Lipscomb Counties, Texas, and Ellis County, Oklahoma: presented to Cordillera Energy, Austin, Texas, May 12, 2010.

Cleveland and Marmaton tight-gas reservoirs (Pennsylvanian), northwest Anadarko Basin: sequence stratigraphy, depositional framework, and production controls on tide-dominated systems: presented to the Houston Geological Society, Houston, Texas, May 26, 2010.

Review of drilling opportunities in the Woodbine Group of Moncrief survey, East Texas field: presented to Danmark Energy, L.P., March 11, 2010.

Sequence stratigraphy, depositional fabric, and production controls of the Marmaton and Cleveland Formations, Anadarko Basin: presented to Bureau of Economic Geology Colloquium, Austin, Texas, March 5, 2010.

Regional lithostratigraphic framework of the Eagle Ford Group, Maverick Basin (South Texas) to East Texas Basin (East Texas): presented to the industry representatives of the Mudrock Systems Research Laboratory, Austin, Texas, January 12, 2010.

Sequence stratigraphy and depositional fabric of the Marmaton and Cleveland Formations, Anadarko Basin: presented to the Petroleum Technology Transfer Council, Texas/Southern New Mexico Region workshop "Sequence Stratigraphy, Depositional Systems, and Production Trends in the Atoka Series and Mid-Pennsylvanian Cleveland and Marmaton Formations, Western Anadarko Basin," Dallas, Texas, November 10, 2009.

Reservoir framework of Woodbine Group stringer sands of the southwest Castleberry Survey, East Texas field: presented to BASA Resources, Inc., September 17–18, 2009.

Sequence stratigraphy, reservoir attributes, and production trends of the Atoka Group and Cleveland Formation: presented to Jones Energy, Austin, Texas, June 24, 2009.

New sequence stratigraphic and depositional perspectives on reservoir architecture of the Upper Cretaceous Woodbine Group in East Texas field: presented to the Dallas Geological Society, Dallas, Texas, May 12, 2009.

Regional sequence and reservoir framework, Cleveland tight-gas sandstone play, northwest Anadarko Basin: presented to Texas American Resources Co., Austin, Texas, April 28, 2009.

Overview of Cleveland tight-gas sandstone project, Anadarko Basin: presented to Texas American Resources Co., Austin, Texas, April 8, 2009.

Cleveland-reservoir attributes of the Jones Energy focus area, central Lipscomb County: presented to Jones Energy, Austin, Texas, March 25, 2009.

Core workshop: Atoka and Cleveland intervals of the northwest Anadarko Basin: presented to Jones Energy, Austin, Texas, December 17, 2008.

Sequence stratigraphic model of East Texas field: presented to the Petroleum Technology Transfer Council, Texas/Southern New Mexico Region workshop “Sequence Stratigraphy and Depositional Systems of the Woodbine Group in East Texas Field,” Houston, Texas, November 18, 2008.

New interpretations of reservoir architecture of the Upper Cretaceous Woodbine Group in East Texas field: sequence stratigraphic and depositional perspectives: presented to the Houston Geological Society, Houston, Texas, November 11, 2008.

Detailed sequence-stratigraphic context of Cleveland Formation reservoirs, east-central Lipscomb County, Texas: presented to Jones Energy, Austin, Texas, November 7, 2009.

Mid-project results of the Cleveland and Marmaton tight-gas sandstones, northwest Anadarko Basin: presented to Jones Energy, Austin, Texas, October 30, 2008.

Robert G. Loucks

Shale sedimentation: presented at the Marathon Oil Company Shale Development Workshop, Houston, Texas, October 19, 2009.

Shale pore structure: presented at the Marathon Oil Company Shale Development Workshop, Houston, Texas, October 19, 2009.

Mineralogy and diagenetic history of the Upper Cretaceous Woodbine Sandstone in the giant East Texas field: presented at the Gulf Coast Geological Societies Annual Convention, Shreveport, Louisiana, September 28, 2009.

Geology of the Mississippian Barnett shale-gas play in Texas: regional setting, sedimentology, and pore networks: presented as Bureau Centennial Lecture, Houston, Texas, August 20, 2009.

Ancient geologic controls on rock heterogeneity in quarries in the Marble Falls/Burnet, Texas area: presented at Texas Section Summer Meeting of the Association of Environmental and Engineering Geologists, Marble Falls, Texas, July 18, 2009.

H. S. Nance

Slumps and debris-flow facies from mixed carbonate/clastic submarine slopes, Permian Basin, West Texas: presented at 4th International Symposium of Submarine Mass Movements and their Consequences, Austin, Texas, November 8, 2009.

Middle Permian slope/basin systems in the Delaware Basin core-to-well log correlations and regional extrapolations: presented at Permian Basin Geological Synthesis Annual Meeting, Austin, Texas, October 9, 2009.

Yates Formation (late Guadalupian) facies tracts, and depositional and diagenetic models, Permian Basin: presented at SW AAPG, Midland, Texas, April 27, 2009.

Bone Spring Formation (Leonardian) slope and basinal carbonates and siliciclastics: presented at SW AAPG Core Workshop, Midland, Texas, April 25, 2009.

Yates Formation (Late Guadalupian) carbonates, evaporites, and siliciclastics, Permian Basin Region, Texas: presented at Permian Basin Geological Synthesis Annual Meeting, Austin, Texas, February 9, 2009.

Upper Permian Yates Formation oil- and gas-reservoir facies northwest and northeast Central Basin Platform, Texas: presented at BEG Symposium, The University of Texas at Austin, Austin, Texas, December 2008.

Chris Ogiesoba

Understanding lithologic significance of amplitude envelope within Oligocene and Miocene Strata, South Gulf Coast: presented to Geophysical Group, Jackson School Institute for Geophysics, The University of Texas at Austin, Austin, Texas, October 2, 2009.

Seismic interpretation of mass-moved sediments within the upper Oligocene Frio Formation, South Texas Gulf Coast: poster presented at American Association of Petroleum Geologists Annual Convention, Austin, Texas, July 7, 2009.

Seismic imaging of large channels in the Miocene interval, South Texas Gulf Coast: presented to Geophysical Group, Jackson School Institute for Geophysics, The University of Texas at Austin, Austin, Texas, October 24, 2008.

Eric C. Potter

Bureau of Economic Geology research activities in East Texas: presented at TIPRO workshop, Kilgore, Texas, May 4, 2010.

Enhanced oil recovery in Texas: how northeast Texas might benefit from CO₂ capture and sequestration: presented at NETAC Ozone Season Awareness Luncheon, Longview, Texas, April 28, 2009.

Stephen C. Ruppel

Understanding black shale successions: lessons and questions from the Barnett Shale and other Paleozoic mudrock systems: presentation of Bureau Centennial Lecture, Reston, Virginia, 2009.

Understanding black shale successions: lessons and questions from the Barnett Shale and other Paleozoic mudrock systems: presentation of Bureau Centennial Lecture, Houston, Texas, 2009.

Understanding black shale successions: lessons and questions from the Barnett Shale and other Paleozoic mudrock systems: presentation of Bureau Centennial Lecture, Oklahoma City, Oklahoma, 2009.

Understanding black shale successions: lessons and questions from the Barnett Shale and other Paleozoic mudrock systems: presentation of Bureau Centennial Lecture, Socorro, New Mexico, 2009.

Geological approaches to carbonate reservoir model construction: presented at the Reservoir Studies Group of the Society of Petroleum Engineers Luncheon, Midland, Texas, September 2008.

Fred P. Wang

Pore network and fluid flow in gas shales: invited talk presented at the SIPES Seminar, Dallas, Texas, May 17, 2009.

Pore network and fluid flow in gas shales: invited talk presented at the SIPES Seminar, Austin, Texas, April 9, 2009.

A new look at gas shales – why do they produce so well?: presented at the 8th Annual Gas Shale Summit, Dallas, Texas, March 31, 2009.

Laura C. Zahm

Cores from the Glen Rose Formation, Alabama Ferry field, Texas: presented to Antioch Energy LLC, Austin, Texas, October 26, 2009.

Cores from the Glen Rose Formation, Alabama Ferry field, Texas: presented to Antioch Energy LLC, Austin, Texas, December 7, 2009.

Exploration potential of the Glen Rose Formation in the East Texas Basin: presented to Peter Bartok (Bartok, Inc.), Austin, Texas, June 18, 2010.

Field Trips

Brown, L. F., Jr., Ambrose, W. A., and Carr, D. L., 2009, Pennsylvanian depositional systems in north-central Texas: Supplement to Guidebook 14, 34 p. + 60 figures.

Loucks, R. G., Controls on rock heterogeneity in quarries in the Marble Falls/Burnet area: Texas Section Summer Meeting of the Association of Environmental and Engineering Geologists, Marble Falls, Texas, July 18, 2009.

Zahm, L. C., Cretaceous of the Gulf Coast: Reservoir Carbonate Research Laboratory Spring Field Trip, May 2010.

APPENDIX D

Past Publications of Project STARR

- Ambrose, W. A., Hentz, T. F., Wang, F. P., Bonnaffé, Loucks, R. G., and Potter, E. C., 2007, Core Workshop: Woodbine Group, East Texas Field, *in* Ambrose, W. A., and others, Pilot Study of East Texas Field: Geology, Engineering, and Potential Exploitation Workshop: The University of Texas at Austin, Bureau of Economic Geology, State of Texas Advanced Resource Recovery and Petroleum Technology Transfer Council Workshop No. SW0017, 21 p.
- Ambrose, W. A., Potter, E. C., and Briceno, Romulo, 2008, An “unconventional” future for natural gas in the United States: *Geotimes*, v. 53, no. 2, p. 37–41.
- Asquith, G. B., Dutton, S. P., and Cole, A. G., 1997, Delaware effect and the Ramsey Sandstone, Ford Geraldine Unit, Reeves and Culberson Counties, Texas, *in* DeMis, W. D., ed., Permian Basin oil and gas fields: turning ideas into production: West Texas Geological Society Publication 97-102, p. 71–74.
- Asquith, G. B., Dutton, S. P., Cole, A. G., Razi, M., and Guzman, J. I., 1997, Petrophysics of the Ramsey Sandstone, Ford Geraldine Unit, Reeves and Culberson Counties, Texas, *in* DeMis, W. D., ed., Permian Basin oil and gas fields: turning ideas into production: West Texas Geological Society Publication 97-102, p. 61–69.
- Barnaby, R. J., Ramamoorthy, R., and Holtz, M. H., 1994, Resource optimization through characterization of downdip Frio shoreface/shelf sandstone reservoirs: Red Fish Bay field, South Texas: *GCAGS Transactions*, v. 44, p. 71–77.
- Barnaby, R. J., Ramamoorthy, R., and Holtz, M. H., 1998, Resource optimization through geological and petrophysical characterization of downdip Frio shoreface/shelf sandstone reservoirs: Red Fish Bay field, South Texas: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 248, 61 p.
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Past Project STARR Workshops and Presentations

- Canyon sandstones—a geologically complex natural gas play in slope and basin facies, Val Verde Basin, Southwest Texas: presented by Scott Hamlin to the South Texas Geological Society, San Antonio, Texas, March 1996.
- Identifying Reserve Growth Potential through Integrated Geologic and Engineering Reservoir Characterization was held at the 1996 Annual Convention of the Gulf Coast Association of Geological Societies (GCAGS) at San Antonio, Texas, October 2–4, 1996.
- Reservoir Characterization of Permian Deep-Water Sandstones, Bell Canyon Formation, Geraldine Ford Area, West Texas (Delaware Basin), co-hosted by the West Texas Geological Society, Midland, Texas, March 1997.
- Methodology of 3-D computer modeling in restricted platform carbonate reservoirs, example from Keystone East Holt field: presented by Mark Holtz at the West Texas Society of Petroleum Engineers meeting, Midland, Texas, October 2, 1997.
- Reservoir characterization of Keystone East field, STARR Project: presented by Mark Holtz at the West Texas Geological Society Fall Symposium, Midland, Texas, October 31, 1997.
- Reservoir characterization of channel-levee and lobe deposits Bell Canyon Formation, Geraldine Ford field, West Texas (Delaware Basin): presented by S. P. Dutton at the Bureau of Economic Geology Seminar, November 12, 1997.
- Petrophysics of the Ramsey Sandstone, Ford Geraldine Unit, Reeves and Culberson Counties, Texas: presented by G. B. Asquith on November 12, 1997, at the Amarillo chapter of the Society of Professional Well Log Analysts, December 2, 1997, at The University of Texas at El Paso, and December 3, 1997, at New Mexico State University at Las Cruces.
- State of Texas Advanced Oil and Gas Recovery Program—Project STARR: presented by Roger Tyler at the Society of Independent Professional Earth Scientists, Austin, Texas, November 13, 1997.
- Reservoir characterization of a deep-water channel-levee and lobe system, Bell Canyon Formation, Ford Geraldine Unit, West Texas (Delaware Basin): presented by S. P. Dutton to Texas Tech University, Geoscience Colloquium, Lubbock, Texas, November 14, 1997.
- The Reservoir Characterization Ford Geraldine Unit: Permian Bell Canyon Formation, West Texas workshop and two-day field trip titled “Facies Architecture of Submarine Channel-Levee and Lobe Sandstones: Permian Bell Canyon Formation, Delaware Mountains, West Texas,” co-sponsored by The U.S. Department of Energy, the State of Texas Advanced Resource Recovery Project, and the Petroleum Technology Transfer Council, Carlsbad, New Mexico, November 21, 1997.
- Petrophysics of the Ramsey Sandstone, Ford Geraldine Unit, Reeves and Culberson Counties, Texas: presented by G. B. Asquith at the Permian Basin Well Log Society, Midland, Texas, January 15, 1998.
- Incorporation of core data into reservoir characterization of a deep-water channel-levee and lobe deposit, Ford Geraldine Unit, Delaware Basin: core display presented by S. P. Dutton at the Sixth Archie Conference on Improving Reservoir Productivity Using Static and Dynamic Delineation Methods, Kerrville, Texas, February 10, 1998.
- Reservoir characterization of a deep-water channel-levee and lobe system, Bell Canyon Formation, Ford Geraldine Unit, West Texas (Delaware Basin): core display presented by S. P. Dutton at the Permian Basin Section SEPM Core Workshop on DOE-Sponsored Studies of Permian Producing Fields, Midland, Texas, February 26, 1998.
- Reservoir characterization of Keystone East Holt field: presented by Mark Holtz at the Southwest Section of the American Association of Petroleum Geologists, Wichita Falls, Texas, March 31, 1998.
- State of Texas Advanced Resource Recovery Project (STARR): presented by Roger Tyler at the Railroad Commission of Texas, Regional Technology Transfer Conference, Houston, Texas, April 8, 1998.
- Slope and basin-floor depositional systems, Ozona Sandstone, Val Verde Basin, Southwest Texas: presented by Scott Hamlin at the Bureau of Economic Geology Seminar, April 15, 1998.
- Reservoir characterization of Keystone East Holt field; modeling restricted platform carbonate: presented by Mark Holtz at the Bureau of Economic Geology Seminar, April 22, 1998.

Integrated strategies for carbonate reservoir reserve growth: an example from the Ellenburger Group, Permian Basin, West Texas: presented by R. P. Major, G. B. Asquith, B. A. Cain, B. A. Hardage, D. E. Lancaster, and H. Zeng: sponsored by the West Texas Geological Society, Midland, Texas, April 23, 1998, and Houston Geological Society, Houston, Texas, June 25, 1998.

STARR—The State of Texas Advanced Resource Recovery Program: presented by Roger Tyler at the Society of Independent Professional Earth Scientists (SIPES) Convention, July 23, 1998, Durango, Colorado.

State of Texas Advanced Resource Recovery Project (STARR): presented by Roger Tyler at the Railroad Commission of Texas, Regional Technology Transfer Conference, Midland, Texas, May 13, 1998.

Reservoir characterization and advanced resource recovery technology on Texas State Lands: poster session presented at the Gulf Coast Association of Geological Societies Annual Convention, Corpus Christi, Texas, October 1998.

Identifying fault compartmentalization in the middle Frio sandstones, Redfish Bay, South Texas: presented by Randy Remington at the Bureau of Economic Geology Research Seminars, 2002.

Project STARR—The State of Texas Advanced Resource Recovery Program: presented by Robert Loucks at the Texas Alliance of Energy Producers Annual Convention, Wichita Falls, Texas, April 2002.

Project STARR—The State of Texas Advanced Resource Recovery Program: presented by Robert Loucks at the Desk and Derrick Club Annual Convention, Austin, Texas, April 2002.

Origins of growth-faulted subbasins in South Texas and associated hydrocarbon reservoirs: presented by STARR Group to Cabot Oil Co., Houston, TX, 2003.

Origins of growth-faulted subbasins in South Texas and sequence stratigraphic analysis of the associated sediment fill: presented by Bob Loucks at the University of Oklahoma's Shell Oil Company Invited Colloquium series, Norman, OK, 2003.

Sequence stratigraphy of growth-faulted subbasin in the Frio Formation along south Texas Gulf Coast: presented by Frank Brown at the Bureau of Economic Geology Research Seminars, 2003.

STARR Program: presented by Ramón Treviño and Ursula Hammes at the General Land Office Summer Lease Sale, 2003.

Overview of the Block 889 Area, Offshore Mustang Island, Texas: presented by Ramón Treviño at the STARR/PTTC forum at the Bureau of Economic Geology Houston Research Center, 2004.

Origins of growth-faulted subbasins in South Texas and sequence stratigraphic analysis of the associated sediment fill: presented by Bob Loucks at the STARR/PTTC forum at the Bureau of Economic Geology Houston Research Center, 2004.

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Regional controls on reservoir quality in shallow-buried, lower Tertiary sandstones along the Texas Gulf Coast: presented by Bob Loucks at Brigham Oil and Gas Luncheon Seminar, Austin, Texas, September 2004.

Reservoir characterization of the Red Fish Bay field in the Corpus Christi area, Oligocene Frio Formation: presented by Ursula Hammes at the STARR/PTTC forum at the Bureau of Economic Geology Houston Research Center, 2004.

Project STARR: presented by Bob Loucks to the San Antonio SIPES Chapter, San Antonio, Texas, September 17, 2004.

Project STARR: presented by Bob Loucks at the Houston Geological Society North American Explorations dinner meeting, Houston, Texas, September 27, 2004.

Understanding growth-faulted, intraslope subbasins and associated reservoir targets by applying sequence stratigraphic principles: examples from the South Texas Oligocene Frio Formation: presented by Ramón Treviño at the Houston Geological Society North American Explorations dinner meeting, Houston, Texas, September 27, 2004.

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A multiple origin approach to understanding the development of breccias and fractures in Ordovician carbonate reservoirs: presented by Bob Loucks at South Texas Geological Society meeting, San Antonio, Texas, October 7, 2004.

Understanding growth-faulted, intraslope subbasins and associated reservoir targets by applying sequence stratigraphic principles: examples from the South Texas Oligocene Frio Formation: presented by Bob Loucks to the Department of Geological Sciences, The University of Texas at Austin, Austin, Texas, October 18, 2004.

Regional controls on reservoir quality in shallow buried lower Tertiary sandstones along the Texas Gulf Coast: presented by Bob Loucks to Pioneer Oil Company, Dallas, Texas, October 19, 2004.

Approaches to reservoir quality prediction: presented by Bob Loucks to Veritas DGS, Houston, Texas, October 29, 2004.

Regional controls on reservoir quality in shallow buried lower Tertiary sandstones along the Texas Gulf Coast: presented by Bob Loucks to Veritas DGS, Houston, Texas, October 29, 2004.

Sequence stratigraphy of the South Texas Oligocene: understanding the relationship between shale tectonism and lowstand deposition: presented by Ramón Treviño to Corpus Christi Geological Society, Corpus Christi, Texas, December 15, 2004.

Sequence architecture and structural setting of a growth-faulted subbasin, Frio Formation, South Texas: presented at BEG Friday seminar series 2005, Austin, Texas.

Incised valleys from seismic geomorphology and stratal slicing, a Gulf Coast example: presented by Hongliu Zeng to the Austin chapter of SIPES (Society of Independent Professional Earth Scientists), Austin, Texas, January 9, 2005.

Three-dimensional architecture of a coalesced, collapsed paleocave system in the lower Ordovician Ellenburger Group, Central Texas: luncheon talk presented by Bob Loucks to Dallas Geological Society, Dallas, Texas, January 11, 2005.

Gas reservoir compartmentalization in lowstand prograding-wedge deltaic systems: Oligocene Upper Lower Frio Formation, South Texas: presented by Ursula Hammes at Baylor University, Department of Geological Sciences seminar series, February 18, 2005.

Sequence stratigraphy of the South Texas Oligocene: the relationship between shale tectonism and lowstand deposition: presented by Ramón Treviño to Austin SIPES, Austin, Texas, April 20, 2005.

Paleocollapse megastructures (suprastratal deformation) related to Lower Ordovician Ellenburger coalesced, collapsed-paleocave systems in the northern Fort Worth Basin, Texas: presented by Angela McDonnell to ExxonMobil, Houston, June 12, 2005.

Mapping sandstone distribution in high-frequency sequences using seismic sedimentology in Corpus Christi Bay, Texas: presented by Hongliu Zeng at BEG seminar, Austin, Texas, September 30, 2005.

Mapping sandstone distribution in fourth- and fifth-order sequences using seismic sedimentology in Corpus Christi Bay, Texas—an exploration tool: presented by Hongliu Zeng at DOGS soft rock seminar, Austin, Texas, October 3, 2005.

Understanding the origin and sequence stratigraphy of growth-faulted, intraslope subbasins: examples from the South Texas Oligocene Frio Formation: invited talk presented by Bob Loucks at the Texas A&M ConocoPhillips Lecture Series, College Station, Texas, October 6, 2005.

Revisiting the importance of secondary dissolution pores in Tertiary sandstones along the Texas Gulf Coast: invited talk presented by Bob Loucks to Corpus Christi Geological Society & Coastal Bend Geophysical Society, Corpus Christi, Texas, October 19, 2005.

Seismic sedimentology for high-resolution reservoir imaging: presented by Hongliu Zeng to Schlumberger/WesternGeco, Houston, Texas, November 9, 2005.

Sequence stratigraphy of Upper Pennsylvanian and Lower Permian, Eastern Shelf of Midland Basin: presented by L. Frank Brown, Jr., to the West Texas Geological Society, 2006.

Barnett Shale fracture overview: presented by Julia Gale at Permian Basin Geological Synthesis Project Annual Meeting, Austin, Texas, February 27, 2006.

Tools of a petroleum geologist: presented by Ramón H. Treviño to the Austin Area Science Fair Earth Science Experiment students and parents at STARR work area, Austin, Texas, March 6, 2006.

Depositional setting, lithofacies, and pore networks of the Mississippian Deepwater Barnett Shale facies in the Fort Worth Basin: presented at Southwest Section AAPG Annual Meeting, Midland, Texas, May 22, 2006.

Project STARR: presented by Bob Loucks to the Texas Budget Board, Austin, Texas, August 9, 2006.

Natural fractures in the Barnett: presented by Robert G. Loucks at the Rocky Mountain Association of Geologists and Petroleum Technology Transfer Council, 2006 Fall Symposium: Shale Gas: from Grass Roots Exploration to Production, Denver, Colorado, September 25, 2006.

Rocky Mountain Association of Geologists and Petroleum Technology Transfer Council Shale Gas Core Workshop: presented by Robert G. Loucks to the U.S. Geological Survey, Lakewood, Colorado, September 26, 2006.

Rocky Mountain Association of Geologists and Petroleum Technology Transfer Council Shale Gas Core Workshop: presented by Julia F. W. Gale to the U.S. Geological Survey, Lakewood, Colorado, September 26, 2006.

Natural fractures in the Barnett Shale: presented by Julia F. W. Gale at STARR/ Petroleum Technology Transfer Council Seminar, Midland, Texas, November 8, 2006.

Natural fractures in the Barnett Shale: presented by Robert G. Loucks at STARR/Petroleum Technology Transfer Council, Seminar, Midland, Texas, November 8, 2006.

Natural fractures in the Barnett Shale: presented by Julia F. W. Gale at STARR/Petroleum Technology Transfer Council Seminar, Houston, Texas, November 14, 2006.

Clinoforms in the Barnett Shale, Wise County, Ft. Worth Basin, Texas: presented by Hongliu Zeng at Barnett Shale-Gas Play of the Fort Worth Basin Seminar, sponsored by STARR and Petroleum Technology Transfer Council, Texas Region, Houston, Texas, November 14, 2006.

Exploring deep Frio systems tracts in growth-faulted subbasins along the South Texas Gulf Coast: exploration, exploitation, and production challenges: presented by Ursula Hammes to the San Antonio Geological Society, San Antonio, Texas, 2007.

Sequence stratigraphy of Upper Pennsylvanian and Lower Permian, Eastern Shelf of Midland Basin: presented by L. Frank Brown, Jr., to the North Texas Geological Society, 2007.

All fill—no spill: slope-fan sand bodies in growth-faulted subbasins, Frio Formation, South Texas Gulf Coast: presented by Ursula Hammes to the San Antonio Geophysical Society, February 2007.

Seismic imaging? Try stratal slicing: presented by Hongliu Zeng to the South Texas Geological Society, San Antonio, Texas, February 14, 2007.

Natural fractures in the Barnett Shale: presented by Julia F. W. Gale to the Society of Petrophysicists and Well Log Analysts, Austin, Texas, June 3, 2007.

Sequence stratigraphy of the South Texas Oligocene: understanding the relationship between shale tectonism and lowstand deposition: presented by Ramón H. Treviño at the North American Prospect Expo E&P Forum, Houston, Texas, August 22, 2007.

Sequence stratigraphy of the Woodbine Group of the East Texas field: presented by Tucker F. Hentz at the East Texas Engineers Association annual meeting, Kilgore, Texas, October 10, 2007.

Pilot Study of East Texas Field: Geology, Engineering, and Potential Exploitation Workshop: presented by W. A. Ambrose, T. F. Hentz, F. P. Wang, F. Bonnaffé, R. G. Loucks, and E. C. Potter, core workshop prepared for STARR and the Petroleum Technology Transfer Council, Kilgore, Texas, October 30, 2007.

Introduction to sequence stratigraphy, with application to the East Texas field: presented by Tucker F. Hentz to the Petroleum Technology Transfer Council, Texas/Southern New Mexico Region workshop "Pilot Study of the East Texas Field: Geology, Engineering, and Potential Exploitation," Kilgore, Texas, October 30, 2007.

Woodbine stratigraphy and depositional systems: northern pilot area, East Texas field: presented by Tucker F. Hentz to the Petroleum Technology Transfer Council, Texas/Southern New Mexico Region workshop "Pilot Study of the East Texas Field: Geology, Engineering, and Potential Exploitation," Kilgore, Texas, October 30, 2007.

All fill – no spill: slope-fan sand bodies in growth-faulted subbasins, Frio Formation, South Texas Gulf Coast: presented by Ursula Hammes at the Houston Geological Society North Side luncheon talk, November 2007.

New interpretations of reservoir architecture in East Texas field: sequence stratigraphic and depositional perspectives: presented by Tucker F. Hentz at the Bureau of Economic Geology Colloquium, Austin, Texas, November 30, 2007.

All fill – no spill: slope-fan sand bodies in growth-faulted subbasins, Frio Formation, South Texas Gulf Coast: presented by Ursula Hammes to the Louisiana Geological Survey, February 2008.

Results and recommendations of Moncrief Survey study, East Texas field: well deepening for additional recovery: presented by Tucker F. Hentz to Danmark Energy, Austin, Texas, March 5, 2008.

Sequence stratigraphic controls on complex reservoir architecture in fluvial-dominated deltaic and lowstand valley-fill deposits in the Woodbine Group, East Texas field: presented by William A. Ambrose and Tucker F. Hentz to Jones Energy, Inc., Austin, Texas, April 3, 2008.

Overview of Cleveland Formation chronostratigraphy and tight gas sandstone trends: presented by Tucker F. Hentz to Jones Energy, Austin, Texas, April 4, 2008.

Barnett, Woodford, and related mudrock successions in Texas cores and outcrops: presented by S. C. Ruppel, R. G. Loucks, and J. F. W. Gale at a core workshop prepared for the 2008 American Association of Petroleum Geologists/SEPM (Society for Sedimentary Geology) Annual Convention, San Antonio, Texas, April 2008.

Barnett, Woodford, and related mudrock successions in Texas cores and outcrops: core workshop prepared for the American Association of Petroleum Geologists/SEPM (Society for Sedimentary Geology) Annual Convention: presented by Robert G. Loucks at Austin/Hill Country April 19–20, 2008.

Production fairway-speed rails in gas shales: presented by Fred P. Wang at the 7th Annual Gas Shale Summit, Dallas, Texas, May 7, 2008.

How thin is a thin bed? An alternative perspective: presented by Hongliu Zeng to Shell, Houston, Texas, May 19, 2008.

Deltaic cores in the Woodbine Group, East Texas field: presented by William A. Ambrose at the Texas Regional Collaborative Teacher Workshop, Austin, Texas, June 10, 2008.

Integration of core description and sequence-stratigraphic correlations of the Cleveland Formation, northwest Anadarko Basin: presented by William A. Ambrose and Tucker Hentz to Jones Energy, Austin, Texas, July 31, 2008.

Recommendations for waterflood design based on detailed depositional-facies mapping in the South Kilgore Unit, East Texas field: presented by Tucker F. Hentz to Danmark Energy, Austin, Texas, August 8, 2008.

Core descriptions of productive Woodbine Group sandstones in AA Wells field, Polk Co., Texas: implications for regional Woodbine depositional trends in East Texas: presented by William A. Ambrose and Tucker F. Hentz to Vision Resources, Austin, Texas, August 20, 2008.

Sequence stratigraphy and reservoir architecture of the Woodbine Group, East Texas field: presented by William A. Ambrose to Vision Resources, Austin, Texas, August 20, 2008.

APPENDIX E

Table 4. Search Parameters for STARR Matrix Production Figures.

Field/Area	Start Date	End Date	Formation	Search Parameters for STARR Matrix Production
Cleveland/Marmaton/Atoka Regional Study	11/1/2009	7/31/2010	Cleveland/Marmaton/Atoka	Cleveland/Marmaton/Atoka Formations in Counties Listed in Table 2
Haynesville Regional Study	3/1/2009	7/31/2010	Haynesville	Haynesville Formation in Counties Listed in Table 2
Newark East Regional Study-North Barnett	9/1/2008	4/30/2009	Barnett	Newark East Field-Barnett Formation in Counties Listed in Table 2
Newark East Regional Study-South Barnett	5/1/2009	7/31/2010	Barnett	Newark East Field-Barnett Formation in Counties Listed in Table 2
North Texas Eastern Shelf Regional Study	5/1/2009	7/31/2010	Various	All Wells in Counties Listed in Table 2
Woodbine Regional Study	9/1/2008	7/31/2010	Woodbine	Woodbine Formation in Counties Listed in Table 2
Broken Bone Field Study	9/1/2008	7/31/2010	Various	Gunn Oil-Broken Bone Field in County Listed in Table 2
Calhoun Offshore Field Study	9/1/2008	7/31/2010	Miocene	Gulf Energy-Sherman Offshore Field in County Listed in Table 2
Cleveland/Marmaton/Atoka Field Study	9/1/2008	7/31/2010	Cleveland/Marmaton/Atoka	Jones Energy-Cleveland/Marmaton/Atoka Formations in County Listed in Table 2
Copano Bay Field Study	2/1/2009	11/30/2009	Frio	MPG Petroleum-Individual Well in County Listed in Table 2
East Texas Field Study	9/1/2008	7/31/2010	Woodbine	BASA Resources-East Texas Field in County Listed in Table 2
Gold River North Field Study	9/1/2008	3/31/2009	Olmos	SM (St. Mary Land & Exploration Company)-Gold River North Field in County Listed in Table 2
Haynesville Shale Gas Field Study	3/1/2009	7/31/2010	Haynesville	Petrohawk, Common Resources-Haynesville Formation in Counties Listed in Table 2
Spur Lake Field Study	9/1/2008	7/31/2010	Tannehill	Gunn Oil-Various Fields in Counties Listed in Table 2
Yates Formation Field Study	9/1/2008	7/31/2010	Yates	Lynx Energy-Yates Formation in County Listed in Table 2

Table 5. Fields/ Areas and Counties in Texas for STARR Matrix Production Figures.

Field/Area	Counties in Texas
Cleveland/Marmaton/Atoka Regional Study	Lipscomb, Ochiltree
Haynesville Regional Study	Angelina, Harrison, Nacogdoches, Panola, Rusk, San Augustine, Sabine, Shelby
Newark East Regional Study-North Barnett	Denton, Jack, Montague, Palo Pinto, Parker, Tarrant, Wise
Newark East Regional Study-South Barnett	Bosque, Comanche, Coryell, Dallas, Ellis, Erath, Hamilton, Hill, Hood, Johnson, Somervell
North Texas Eastern Shelf Regional Study	Callahan, Eastland, Jones, Shackelford, Stephens, Taylor
Woodbine Regional Study	Anderson, Cherokee, Freestone, Gregg, Henderson, Houston, Leon, Madison, Navarro, Polk, Rusk, San Jacinto, Smith, Trinity, Upshur, Van Zandt, Walker, Wood
Broken Bone Field Study	Cottle
Calhoun Offshore Field Study	Calhoun
Cleveland/Marmaton/Atoka Field Study	Lipscomb
Copano Bay Field Study	San Patricio
East Texas Field Study	Gregg
Gold River North Field Study	Webb
Haynesville Shale Gas Field Study	Harrison, San Augustine
Spur Lake Field Study	Dickens, Kent, King
Yates Formation Field Study	Gaines