

## **Quarterly Technical Progress Report**

**Quarterly Report**  
**October 1 - December 31, 1997**

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## **QUARTERLY TECHNICAL PROGRESS REPORT**

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## ABSTRACT

This document is provided as a Quarterly Technical Progress Report for the program entitled "Identification and Evaluation of Fluvial-Dominated Deltaic (Class I Oil) Reservoirs in Oklahoma", covering the reporting period of October 1 - December 31, 1997.

Work has been completed for the project. The Bartlesville Play workshops were completed as scheduled on October 29, 1997 in Tulsa; on October 30, 1997 in Bartlesville; and on November 12, 1997 in Norman, Oklahoma. The three presentations were attended by 183 people of whom about 80 were operators. In total for the project, there have been 1,211 workshop registrations of which 590 were identified as operator registrations. Clearly, Oklahoma's oil industry has taken advantage of this program. The FDD computer facility continues to be fully operational, and will be continued after the end of this program. During this quarter, there were 21 industry individuals who used the computer facility.

This project is serving an extremely valuable role in the technology transfer activities for the Oklahoma petroleum industry, with very positive industry feedback.

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## EXECUTIVE SUMMARY

This document is provided as a Quarterly Technical Progress Report for the program entitled "Identification and Evaluation of Fluvial-Dominated Deltaic (Class I Oil) Reservoirs in Oklahoma", covering the report period of October 1 - December 31, 1997.

The Bartlesville Play workshops were completed as scheduled on October 29, 1997 in Tulsa; on October 30, 1997 in Bartlesville; and on November 12, 1997 in Norman, Oklahoma. The three presentations were attended by 183 people of whom about 80 were operators. The OGS Special Publication accompanying the workshop (SP 97-6) included 3 field studies, one secondary recovery study, and an introduction to FDD concepts. A special appendix was included that shows scanned images of Bartlesville core with supporting interpretations. A complete lithologic description and log suite of the cores also were provided.

The FDD computer facility is fully operational in Norman, Oklahoma. During the fourth quarter, 21 industry individuals utilized the FDD computer facility. The facility primarily is used for computer mapping, NRIS data retrieval, instructional classes, and plotter applications.

This project has served an extremely valuable role in the technology transfer activities for the Oklahoma petroleum industry, with very positive industry feedback. The popularity of the program within industry has spread with each workshop, and has lead to the decision by the Oklahoma Geological Survey to continue this "play analysis and workshop" format for future Oklahoma technology transfer activities.

## INTRODUCTION

The Oklahoma Geological Survey (OGS), the Geo Information Systems department, and the School of Petroleum and Geological Engineering at the University of Oklahoma have engaged in a five-year program to identify and address Oklahoma's oil recovery opportunities in fluvial-dominated deltaic (FDD) reservoirs. This program included the systematic and comprehensive collection and evaluation of information on all of Oklahoma's FDD reservoirs and the recovery technologies that have been (or could be) applied to those reservoirs with commercial success. This data collection and evaluation effort was the foundation for an aggressive, multifaceted technology transfer program that was designed to support all of Oklahoma's oil industry, with particular emphasis on smaller companies and independent operators in their attempts to maximize the economic producibility of FDD reservoirs.

Specifically, this project has identified all FDD oil reservoirs in the State; grouped those reservoirs into plays that have similar depositional origins; collected, organized and analyzed all available data; conducted characterization and simulation studies on selected reservoirs in each play; and implemented a technology transfer program targeted to the operators of FDD reservoirs. By fulfilling these objectives, the FDD project has had the goal of helping to sustain the life expectancy of existing wells and provide incentive for development and exploratory drilling with the ultimate objective of increasing oil recovery.

Elements of the technology transfer program included developing and publishing play portfolios, holding workshops to release play analyses and identify primary and secondary oil recovery opportunities in each of the plays, and establishing a computer laboratory that is available for industry users. The laboratory contains the play data files, as well as other oil and gas data files, together with the necessary hardware and software to analyze the information. Technical support staff are available to assist interested operators in the evaluation of their producing properties, and professional geological and engineering outreach staff are available to assist operators in determining appropriate recovery technologies for those properties.

## **RESULTS AND DISCUSSION (SUMMARY OF TECHNICAL PROGRESS)**

### **Computer Applications, Database, and User Lab Developments**

During this final quarter, 21 industry individuals utilized the FDD computer facility. Fourteen of the 21 users during this quarter were first-time users. The facility primarily was used for computer mapping, NRIS data retrieval, and plotter applications. About 61 hours of computer time were logged by users. During the months that the lab has been open, usage statistics have been slowly but steadily rising. The lab operation will be continued after the close of the FDD program due to this increasing popularity.

### **Play Analyses, Publications, & Workshops**

Table 1 summarizes the level of activity and industry responsiveness to the FDD workshop and publication series. From this table, it is apparent that about 100-200 participants attend each workshop regardless the number of operators in the respective play. Generally speaking, about 40 to 60% of the total number of attendees are classified as operators. Although we see many "repeat" attendees, many of the participants at each workshop are first-timer's; for the Bartlesville Play, 46 of the 183 registrations were for first-time attendees. This indicates that the positive reputation of the program has continued to grow throughout the entire schedule of workshops. Verbal comments by many attendees indicate they are extremely interested in these types of workshops and have benefited greatly. Following Table 1 is a brief summary of play efforts completed during the quarter.

**Table 1: Summary of Technology Transfer Activities for FDD Plays  
as of December 31, 1997**

<u>Play</u>	Workshop Dates & Locations	# of Registrants	# of play operators	Play Operators		Operators not in play	Total Wrkshp Operators
				@ reduced rate	@ regular rate		
1. Morrow	June 1 & 2, 1995 Norman, OK	215	604	90	5	5	100
2. Booch	September 11, 1995 Muskogee, OK	128	432	31	0	20	51
3. Layton & Osage-Layton	April 17, 1996 OKC, OK	103	466	15	6	25	46
4. Prue & Skinner (2 plays combined)	June 19, 20, & 26, 1996 OKC & Bartlesville, OK	201	1527	36	36	23	129
5. Cleveland & Peru (2 plays combined)	October 17, 1996 Bartlesville, OK	85	516	11	13	14	38
6. Red Fork	March 5 & 12, 1997 OKC & Bartlesville	195	1478	29	40	29	98
7. Tonkawa	July 9, 1997 Norman, OK	101	347	10	13	25	48
8. Bartlesville	October 29, 30, & Nov. 12, 1997	183	1420	26	23	31	80
<b>TOTALS</b>		<b>1,211</b>	<b>6,738</b>	<b>248</b>	<b>136</b>	<b>172</b>	<b>590</b>

All of these statistics are based on registration records and a post-hoc linking to the gross production records. Because of this, it is possible that some company identifications and operator designations have been missed. Therefore, these should be considered "conservative" estimates of the operator contacts through the FDD program.

***The Bartlesville Play:***

*Primary authors:*

*Robert Northcutt, Richard Andrews*

*Contributing authors:*

*Roy Knapp, Zahid Samad, and ChenXia Xie*

*Guest speaker:*

*Greg Riepl*

*Scheduled workshop dates:*

*October 29, 30, and November 12, 1997*

*Scheduled workshop sites:*

*US Army Corps of Engineers Center, Tulsa, OK. Phillips Petroleum Co. Research and Development Center, Bartlesville, OK.; Postal Service Technical Training Center, Norman, OK.;*

*Publication:*

*Oklahoma Geological Survey SP 97-6, Fluvial-Dominated Deltaic (FDD) Oil Reservoirs in Oklahoma: The Bartlesville Play.*

The Bartlesville play was the subject of the last FDD workshop in the DOE sponsored series. It was presented 3 times and places: in Tulsa on October 29, in Bartlesville on October 30, and in Norman on November 12. The workshop had a similar protocol as in preceding workshops: an introduction to FDD concepts followed by a regional overview of stratigraphy and sandstone trend mapping. Accompanying the introduction to depositional environments was a series of 35 mm slides showing reservoir characteristics of the Bartlesville sandstones as seen in outcrops. Three detailed field studies and core displays were provided. Responsibilities were divided between two primary authors; Robert Northcutt completed the regional work and Richard Andrews completed the three field studies and core work. As a special contribution to this last FDD workshop, a guest speaker discussed the applications of seismic stratigraphy in delineating thick Bartlesville channel sandstones. Greg Riepl, who is an active independent geologist, has utilized this technology successfully over the past few years. His talk was of interest to attendees, but was not incorporated into the SP publication because of data confidentiality concerns.

Roy Knapp and graduate student assistants demonstrated waterflood modeling of the Paradise field. This field began secondary recovery in 1996 and has had mixed results to date. The field appears to be relatively simple geologically; however, fracturing in the reservoir and into the underlying limestone appears to control the path of injected water. As a result, water break-through within the Bartlesville reservoir occurred almost immediately. In other places within the field, injected water was lost to the underlying limestone without passing through the Bartlesville sandstone. This situation was an excellent example of a waterflood going terribly wrong due to unexpected reservoir problems. The exercise was extremely valuable to the program in understanding enhanced recovery for this type of reservoir, particularly in regards to fracture awareness and in applying certain remedies in correcting the loss of injected water.

## **CONCLUSION**

This project has served an extremely valuable role in the technology transfer activities for the Oklahoma petroleum industry. Industry feedback to the program has been very positive, with numerous comments stating that this is the most valuable program that has been sponsored by the Oklahoma Geological Survey. The popularity of the program spread with each workshop, leading the Survey to commit to continuing with a similar program for other types of plays and reservoirs after the conclusion of the FDD program.