IDENTIFICATION AND EVALUATION OF FLUVIAL-DOMINATED DELTAIC (CLASS I
OIL) RESERVOIRS IN OKLAHOMA

Quarterly Technical 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 April 1 - June 30, 1997.

Work is progressing as expected for the project. The FDD computer facility is fully operational. During this quarter, there were 27 industry individuals who used the facility. The Tonkawa Play workshop is scheduled for July 9, 1997 in Norman. The Tonkawa publication and presentation graphics are nearly completed. The Bartlesville workshop is scheduled for October and November, 1997, in three different sites. Text and illustrations for that play are in progress.

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

TABLE OF CONTENTS

EXECUTIVE SUMMARY	4
INTRODUCTION	5
RESULTS AND DISCUSSION	6
CONCLUSION.....	9

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 April 1 - June 30, 1997.

The FDD computer facility is fully operational following a recent move from the OU Energy Center to a more accessible location just north of Norman, Oklahoma. During the second quarter, 27 industry individuals utilized the FDD computer facility. The facility primarily was used for computer mapping, NRIS data retrieval, and plotter applications.

The Tonkawa workshop is scheduled for July 9, 1997 in Norman. Efforts are underway to finalize the publication and presentation slides for that workshop. Text and illustrations are in preparation for the Bartlesville Play workshop, to be held later in the year.

This project is serving an extremely valuable role in the technology transfer activities for the Oklahoma petroleum industry, with very positive industry feedback. The popularity of the program is spreading with each workshop. It is fully expected that the remaining play presentations for 1997 - the Tonkawa and the Bartlesville - will see a continued growth in industry responses.

INTRODUCTION

The Oklahoma Geological Survey (OGS), the Geo Information Systems department, and the School of Petroleum and Geological Engineering at the University of Oklahoma are engaged in a five-year program to identify and address Oklahoma's oil recovery opportunities in fluvial-dominated deltaic (FDD) reservoirs. This program includes 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 is the foundation for an aggressive, multifaceted technology transfer program that is 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 is identifying all FDD oil reservoirs in the State; grouping those reservoirs into plays that have similar depositional origins; collecting, organizing and analyzing all available data; conducting characterization and simulation studies on selected reservoirs in each play; and implementing a technology transfer program targeted to the operators of FDD reservoirs. By fulfilling these objectives, the FDD project is expected to help 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 include 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

Many maps, tables, and specialty illustrations that will be used in the Tonkawa publication and in poster displays were made using *NRIS MAPS* - a user-friendly computer program designed to access *NRIS* data. These include maps for detailed field studies such as well base maps and lease production maps. Tables with individual lease production records were generated by *NRIS MAPS* for use in decline curves and in determining cumulative field production. Large display posters have been made showing well production codes, formation show codes, well spud dates, and well status codes. These regional maps will be used to illustrate areas of development and exploration potential, production trends, and drilling periods of well completed in the Tonkawa. Registrations for the Tonkawa workshop were completed utilizing the mail-out program that identifies operators having production from the targeted plays.

During the second quarter, 27 industry individuals utilized the FDD computer facility. Sixteen of the 27 users during this quarter were first-time users. The facility primarily was used for computer mapping, *NRIS* data retrieval, and plotter applications. One training session using *Neuralog* was attended by 7 people (including OGS and GIS staff, plus outside professionals). Additionally, two GeoGraphix classes were given involving 8 participants. About 40 hours of computer time were logged by users.

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. Although we see many "repeat" attendees, many of the participants at each workshop are first-timer's. This may indicate that the program is reaching out to a broad spectrum of operators and geologists in addition to attracting professionals interested in learning more about FDD in Oklahoma. 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 plays completed or in progress during the quarter.

**Table 1: Summary of Technology Transfer Activities for FDD Plays
as of June 30, 1997**

<u>Play</u>	<u>Workshop Dates & Locations</u>	<u># Regis- tered</u>	<u># of play opers.</u>	<u>Play operators</u>		<u>Oper- ators not in play</u>	<u>Total Wrkshp Operator s</u>
				<u>@ reduce d rate</u>	<u>@ regular rate</u>		
1. Morrow	June 1 & 2, 1995 Norman	215	604	90	5	5	100
2. Booch	September 11, 1995 Muskogee	128	432	31	0	20	51
3. Layton & Osage- Layton	April 17, 1996 OKC	103	342	15	6	25	46
4. Prue & Skinner	June 19 & 26, 1996 OKC & Bartlesville	201	1599	36	36	23	129
5. Cleveland & Peru (2 plays combined)	October 17, 1996 Bartlesville	85	516	11	13	14	38
6. Red Fork	March 5 & 12, 1997 Norman & Bartlesville	195	1478	29	40	29	98
7. Tonkawa	July 9, 1997 Norman		347				
8. Bartlesville	October, 1997		1420				
TOTALS:		927	6,738	212	100	116	462

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 Tonkawa Play:

Primary authors: Jock Campbell, Carlyle Hinshaw, Kurt Rottmann
Contributing authors: Roy Knapp, Zahiid Samad, ChenXia Xie
Scheduled workshop date: July 9, 1997
Scheduled workshop site: Postal Service Technical Training Center, Norman, OK.
Publication: Oklahoma Geological Survey SP 97-3, *Fluvial-Dominated Deltaic (FDD) Oil Reservoirs in Oklahoma: The Tonkawa Play.*

A one day workshop for the Tonkawa play is scheduled for July 9, 1997, with a high degree of anticipated industry interest. Many people in the central Mid-Continent Region are somewhat familiar with this reservoir yet in the past have pursued deeper reservoirs. However, recent trends in exploration have focused on Tonkawa gas from marine sands in the more sparsely drilled areas of the deep Anadarko Basin. The Tonkawa is also largely overlooked as an oil reservoir in the shallower portion of the basin. For these reasons, the Tonkawa was identified as a reservoir with significant

potential for additional oil and gas development. To date, this reservoir has produced about 1 TCF gas and 50 MMBO throughout its regional extent in Oklahoma, Texas, and Kansas.

Because of emerging interest in the entire Tonkawa play, the FDD team decided to try something new by combining both FDD (oil) and non-FDD (gas) portions of the play into a single workshop. This effort resulted in regional evaluations of the Tonkawa from shelf to basin specifically dealing with both the oil and gas portions of the play. Funding for the effort is therefore divided between FDD (fluvial oil reservoirs) and Petroleum Technology Transfer Council (marine gas reservoirs) projects. The effort is producing new interpretations of regional depositional environments that will significantly change the way trends within the Tonkawa can be exploited. Detailed field studies include one marine gas reservoir, and one FDD oil reservoir (with accompanied waterflood modeling). This workshop is structured for anyone involved in this play within Oklahoma and surrounding states of Kansas and Texas.

Regional evaluation of the Tonkawa FDD play is the responsibility of Jock Campbell, OGS geologist. This primarily involves the organization of stratigraphic nomenclature, regional sand trend mapping, interpretation of general depositional environments, and regional cross sections. This work is supported by a detailed field study by consulting geologist Kurt Rottmann of an FDD oil reservoir in the Blackwell field. The FDD oil field study will be used for waterflood simulation by Knapp, Samad, and Xie.

Segments of the regional Tonkawa play that extend into the gas-prone portion of the Anadarko Basin and Shelf are being interpreted and mapped by Carlyle Hinshaw, Geo Information Systems staff geologist. This work is of the same nature as that of Campbell's, and extends subsurface mapping and reservoir evaluation of the Tonkawa play into the Texas panhandle and southern Kansas. A detailed field study by Rottmann addresses a marine facies gas reservoir in the Waynoka NE field.

The Oklahoma Geological Survey SP 97-3 will include only information and maps relevant to the Tonkawa FDD (oil) play. Information concerning the Tonkawa gas play in the predominantly marine facies of the Anadarko Basin is printed as an OGS open file report #3-97.

The Bartlesville Play:

<i>Primary authors:</i>	<i>Robert Northcutt, Richard Andrews</i>
<i>Contributing authors:</i>	<i>Roy Knapp, Zahiid Samad, ChenXia Xie</i>
<i>Planned workshop date:</i>	<i>October 29, 30, and November 12, 1997</i>
<i>Planned workshop sites:</i>	<i>Postal Service Technical Training Center, Norman, OK., Phillips Petroleum Co. Research and Development Center, Bartlesville, OK., US Army Corps of Engineers center, Tulsa, OK.</i>

The Bartlesville play will be the subject of the last FDD workshop in the DOE-sponsored series. It is scheduled for 3 days: in Tulsa on October 29, in Bartlesville on October 30, and in Norman on November 12, 1997. The workshop will have a similar protocol as in preceding workshops, with an introduction to FDD concepts followed by a regional overview of stratigraphy and sandstone trend mapping. Three field studies and core displays with accompanied descriptions and interpretations will also be provided. Waterflood modeling using Boast 3 will be completed on one of the three field studies. Responsibilities have been divided between two primary authors, Robert Northcutt who will complete the regional work, and Richard Andrews who will complete the three field studies and core work. Roy Knapp and graduate student assistants will perform the waterflood modeling. Additional workshop input will involve field examination of Bartlesville outcrops and photography for 35mm slide presentations.

CONCLUSION

This project is serving an extremely valuable role in the technology transfer activities for the Oklahoma petroleum industry. Industry feedback to the program is 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 is spreading with each workshop. It is fully expected that the remaining play presentations for 1997 - the Tonkawa and the Bartlesville - will see a continued growth in industry responses.