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Investigation of Relative Permeability Correlations
for Multiphase Fluid Flow in Porous Media

David N. Sawyer

1988

The Mississippi Mineral Resources Institute
University, Mississippi 38677

FINAL RETORT

Investigation of Relative Permeability
Correlations for Multiphase Fluid Flow
in Porous Media

David N. Sawyer

Mississippi State University

30 August, 1988

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ABSTRACT

The major objective of this portion of the study was to survey oil and gas operators who operate reservoirs located within the boundaries of the state of Mississippi to determine how much relative permeability data exists on Mississippi oil and gas reservoirs. During the past year I have contacted nine (9) major oil and gas companies, two (2) independents, one (1) major core analysis laboratory and the Mississippi State Geologist. After months of making telephone calls and a few visits to labs, I have determined that very little relative permeability data has been taken on Mississippi reservoirs. As yet I have not actually seen any of the data as the process for uncovering its existence is long and complex. Once it is determined that data has been taken, the long process of discovering its storage location begins. This has been quite time consuming as no major oil companies have "district" level offices in Mississippi. Almost all work of this type is conducted from New Orleans, Houston or Dallas. In addition, there are no state rules or regulations requiring this type of data to be taken or released to the state if it is taken.

With the renewal of this grant, I am actively pursuing the collection of the existing data. Mr. Thomas Holifield, co-worker of the original work on this project will travel to Mississippi in the second quarter of the year, and at that time we will jointly complete the analysis of this data and prepare the manuscript for submission of this work for presentation at the Annual Meeting of the Society of Petroleum Engineers. Upon completion of the presentation the manuscript will be reviewed for publication in the Society of Petroleum Engineers Journal, Reservoir Engineering. This will complete work on this project.

INTRODUCTION

This work is an extension of work begun July 1, 1985 and reported in references (1) and (2). In those reports, the results of the statistical analysis of already existing relative permeability data which had been collected over a considerable period of time were reported. This data was carefully screened and then curve fit to numerous mathematical models in order to arrive at generalized relative permeability correlations with which to predict two-phase (gas-oil; water-oil) fluid flow in porous media (reservoir rock). As a result of this work it was concluded that there were several variables which have a substantial influence on relative permeability data which had not been accounted for in the existing data and that additional experimental data would be necessary in order to refine the correlations. Visits were made to the research laboratories of four major oil companies and two commercial core analysis firms. As a result of these visits and the work in reference (1), we arrived at a list of laboratory equipment necessary to begin a minimal experimental program. The itemized list of the recommended equipment and its costs are included in reference (2).

RESULTS

Many oil companies who operate in Mississippi have made no relative permeability measurements on the core samples they have taken from reservoirs in Mississippi. Those companies who do have some data do not generally keep it in Mississippi. Usual locations are at laboratories in New Orleans, Houston, or Dallas. The data is very difficult to locate and often as many as seven or eight phone calls spread over a two week period are necessary just to verify that some data exists. Several more telephone calls are usually necessary to

determine the location. Two to three phone calls beyond this are necessary to locate a person with sufficient authority to allow me to look at the data. The state of Mississippi does not require relative permeability to be taken or reported if it is measured.

Thus far my survey has determined

1. Calls to five engineers and managers within the Chevron organization have failed to turn up any indication that they have ever made relative permeability measurements on any oil or gas reservoirs in Mississippi.
2. Calls to two managers and research laboratory engineers at ARCO revealed that they have no relative permeability data from Mississippi reservoirs in their files.
3. after talking with five Shell engineers and managers I have the name of the person who is supposed to know the whereabouts of the Mississippi relative permeability data, but have been unable to contact him.
4. Standard Oil (BP) reports that they do not have any data on reservoirs in Mississippi.
5. Mr. Skip Turner of Pennzoil is reasonably sure they do have some relative permeability data from reservoirs in Mississippi and is trying to locate its whereabouts for me.
6. Four engineers and one manager at Mobil have been unable to determine the existence of any relative permeability data on Mississippi reservoirs in the New Orleans office. Another engineer in the Houston office is currently checking.
7. I have been unable to reach anyone at Exxon.
8. Unocal has not yet responded.

9. Two engineers at OXY-CITIES have located some relative permeability data from two Mississippi reservoirs and are in the process of trying to get it released to me. They are also checking on other reservoirs in their files.
10. I have not yet been able to reach anyone in the Texaco-Getty organization who has knowledge of this type data.
11. One of the partners of Moon-Hines-Tigret, a Mississippi Independent Operator, is checking their files.
12. Commercial core analysis laboratories are prohibited by contract from revealing if they have even done any work of this type for any of their clients.

I am continuing with my survey and will obtain the data from all companies who have any in their files once all the necessary releases have been obtained. Mr. Thomas Holifield, a recent M.S. graduate whose work was supported by the original grant, reference (1) and who is currently employed as a petroleum engineer at the Morgantown (WVA) Energy Center will return to Mississippi during the second quarter. We will analyze the data I have collected from Mississippi reservoirs and will prepare a paper with all of the results of the entire project for presentation at the Annual Fall Meeting of the Society of Petroleum Engineers.

CONCLUSIONS

Very little relative permeability data has ever been measured on reservoirs in Mississippi. There are several possible reasons for this. 1) There are very few enhanced oil recovery projects in Mississippi compared to other major oil producing states. Relative permeability data is most widely used for oil recovery projects which go beyond natural depletion drive. One could conclude from this that

the major oil companies are investing their money for enhanced oil recovery projects in other states and ignoring Mississippi. 2) Very few oil companies have major offices in Mississippi so the importance of data on Mississippi reservoirs is not emphasized. 3) The state of Mississippi may not require as much data to be taken and/or reported as do other states. 4) There are numerous small independent operators in Mississippi who tend to take much less data because of the high cost of obtaining it.

This may be a very good time for the state of Mississippi to review its requirements for the acquisition and release of oil and gas data by operators in the state to the various regulatory agencies (Oil and Gas Board, State Geological Survey, etc). It may also be an opportune time for the state to set a policy regarding the encouragement of enhanced oil recovery activity.

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