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LABORATORY PROGRAM DESIGN FOR UNCONSOLIDATED HEAVY OIL RESERVOIRS: A CASE STUDY

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ABSTRACT

Laboratory programs for unconsolidated heavy oil reservoirs encompass basic core analysis, grain size analysis, geological and petrological studies, and supplementary core analysis tests such as relative permeability, resistivity, fines migration, and clay swelling. The results from a recent program illustrate that effective program design is required in order to obtain the best quality data, and to achieve the maximum economic benefit.

Geological, petrophysical, and reservoir simulation studies on an unconsolidated, conglomeratic sandstone required input of laboratory data including porosity, permeability, fluid saturations, formation factor and resistivity index, and relative permeability. Petrological studies were utilized to supplement geological interpretation. Based upon available information about the reservoir, these tests were sequenced in the order in which the results were required for the subsequent engineering and geological studies. As a result, relative permeability was one of the first tests performed, and anomalous data were obtained. Integration of grain size and petrological data with the relative permeability data, and with the results of a fines mobilization test, resulted in the anomalous data being interpreted and explained. This integrative approach to laboratory data interpretation pointed out the need to modify further experiments in order to achieve meaningful results.

Based on this experience, a sequence of laboratory testing is recommended for suites of samples from unconsolidated heavy oil reservoirs. This sequence allows identification of reservoir problems, such as mobile fines, before they can impact complex laboratory experiments such as relative permeability. Therefore, this test sequence maximizes the potential for obtaining high quality data from all the laboratory tests, particularly the more expensive and time consuming ones.