PETROGRAPHIC IMAGE ANALYSIS AS A TOOL TO IMPROVE RESERVOIR DATA

F.M. Ballentine, D.J. Malek, and C.A. Philipson

ABSTRACT

Petrographic Image Analysis (PIA) can be used to acquire improved core analysis data in percussion sidewalls because the analysis focuses on the unaltered portions of the cores, thereby eliminating the bias which may be created by shattered and disturbed areas. It is also a valuable tool for reservoir characterization of all rock types.

Petrophysical data acquired from laboratory tests on conventional and percussion sidewall cores, wireline logs, and PIA techniques were compared for a cored interval in the Tuscaloosa Formation. Comparison of log and conventional core porosities yielded good agreement. Sidewall core laboratory porosities were 2 to 10 porosity percent too high, due to the shattering effect. However, PIA performed on percussion core samples compared well with both the conventional core laboratory and log porosities.

Permeabilities obtained from conventional core laboratory measurements and PIA analyses compared well. Sidewall permeabilities (derived from particle size analysis) showed similar trends, but tended to be optimistic.

These improved Tuscaloosa porosity and permeability values, as well as other parameters derived from PIA, can be useful in log interpretation and reservoir evaluation. PIA formation factor and porosity were used to define the cementation exponent m. Capillary pressure curves generated by PIA were utilized to correlate irreducible water saturation to PIA porosity and permeability values. PIA porosity and permeability were also used to determine critical water saturations.

PIA is valuable as an aid to reservoir characterization. The Smackover Formation has been separated into several hydraulic units based on pore type and fluid flow properties. PIA was used to help delineate the differences between the pore systems in these reservoir units. Binary images and shape factor distributions were utilized to characterize the distributions and shapes of the pores within each unit. Pore-size distributions were correlated to capillary pressure measurements to delineate the differences among the pore networks.