AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003

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Extracting Hidden Details from Mixed-Vintage Log Data Using Automatic, High-Speed Inversion Modeling of Resistivity and SP Logs: Supplementing Incomplete Log Suites and Editing Poor Quality Log Data Using Neural Networks

High-speed inversion modeling of resistivity and SP logs provides high-resolution, corrected data, even when using very old logs. Neural networks use this new information, along with other readily available log and core data, to generate synthetic curves for data that is missing and to edit poor quality data.

Accurate resistivity information is difficult to obtain because of poor vertical resolution and because of the effects of borehole conductivity, invasion, and dipping beds. High-speed inversion modeling yields a more accurate value for Rt and Rxo at a bed resolution of 1-2 feet, even for the very old logs.

The SP log is available on almost all older wells and has been used qualitatively as a correlation tool and as an indicator of lithology, shaliness, porosity, permeability and bed boundaries. Inversion modeling produces an SP with a 1-2 foot vertical resolution that can be used quantitatively to accurately calculate Rw and predict permeability.

Neural networks provide high-quality synthetic logs and core properties by using available data from wireline logs, cores, or cuttings in nearby wells. They have significant advantages over traditional methods and offer fast and accurate results (ie. synthetic compressional and shear wave sonic logs, porosity logs, NMR data, and core permeability).

Used together, these new methods are extremely powerful exploration and development tools which can solve difficult problems dealing with seismic optimization, completion strategies, reservoir modeling, and the identification and evaluation of bypassed pay zones.