Dielectric Dispersion Field Test Results in Western Canada

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Dielectric measurements were first introduced in the early 1980's. These single-frequency tools offered excellent vertical resolution and the expected sensitivity to water, which enabled better differentiation between hydrocarbon and water when salinity is either unknown or variable. Interpretation of these measurements was often complicated by sensitivity to borehole effects including mud effects, mudcake, and rugosity, which limited their widespread application.

A newly developed tool, used in western Canada, was designed to acquire a continuous measurement of dielectric dispersion, defined as the variation in formation dielectric properties as a function of frequency. The tool operates at multiple frequencies and incorporates multiple spacing antennae arrays that are pad mounted to maintain contact with the formation as the borehole size changes. The acquired data is corrected for the borehole environment before a radial inversion is performed using all of the measurements. The radial model considers the tool in the borehole with a mudcake and an invaded and non-invaded zone. The resultant conductivities and permittivities are then used in a petrophysical model to obtain water filled porosity and fluid salinity.

In addition to pore fluid analysis, dielectric dispersion data provides textural information to estimate the Archie cementation factor in carbonate reservoirs, and has the potential to provide high-resolution clay volume in shaly sand reservoirs.

Field test data is used to demonstrate applications of dielectric dispersion in western Canada.