Joint Interpretation of Formation Permeability from Wireline Acoustic, NMR, and Image Log Data

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Formation permeability is the key to reservoir characterization and management. Wireline acoustic logging and nuclear magnetic resonance (NMR) logging can now provide continuous permeability profiles. This paper compares the permeability profiles obtained from the two fundamentally different measurements. The two profiles exhibit a remarkable correspondence for various data sets around the world. They also show significant differences in some situations. We analyzed the differences based on the measurement principles of the two methods. It was found that the differences are often associated with the presence of gas, fractures, vugs, and hard mudcake. We demonstrate these examples using data from various formations with gas saturation, fractures, vugs, stiff mudcake, and carbonate scenarios, etc. Image data are also used to aid the analyses and interpretation. These examples show that jointly interpreting the acoustic, NMR and image data provides not only valid and reliable formation permeability profiles, but also an effective means for formation characterization.