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Advances in Subsurface Prediction Using Borehole Imaging

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The high vertical and radial resolution of modern borehole imaging provides a detailed, three-dimensional insight into how a reservoir is put together. Since this information is presented in an image or picture format, it is easy to assimilate and utilize on workstations. The excellent repeatability of most images fosters confidence in their usability. Micro-resistivity, resistivity, and acoustical measurements and an expanding array of software to analyze them, are being utilized worldwide.

Borehole imaging can be used to analyze the structural and stratigraphic aspects of a reservoir, as well as to describe it in great detail and in a variety of different scales and formats. Image evaluation, especially when done on a workstation, provides an in-depth understanding of a reservoir, making improved subsurface predictions possible. Two specific applications illustrate the power of these images.

The use of imaging in "low resistivity pay" sands, such as the prolific deep water sands of the Gulf of Mexico, affords the ability to evaluate thin (as small as 1 cm) beds that are well below the resolution of other wireline logs. It also provides a better understanding of the type and distribution of the shales within the sands, which greatly influence the lateral continuity of the reservoir. Net pay is more accurately determined, and this routinely results in additional pay.

Borehole imaging is also changing the way we evaluate carbonates, as in the Lodgepole Formation of North Dakota and the various carbonates of West Texas. Current evaluation techniques seem to often underestimate the ultimate production of these reservoirs. The high vertical resolution and multidirectional (radial) nature of the imaging measurements allow for corrections to other logs, especially pad devices such as the density log. The distribution and interconnectivity of vugs and fractures, which are keys to the performance of these reservoirs, can be "seen" and more fully delineated.

Exciting new types of imaging measurements, including "measurements while drilling," as well as improved ways of presenting and evaluating the data, continue to be developed by a variety of companies, making borehole imaging a truly emerging technology.

Biographical Sketch

Tom Fett graduated from Trinity University in 1966 with a B.S. in Engineering Science. He has worked for Schlumberger in various positions, including Field Engineer and District Manager. For the past twenty years he has been a full time specialist in dipmeters and imaging devices. He has published numerous technical papers on log analysis, dipmeters, fractures, and imaging applications and has given talks and schools to many groups worldwide. He is currently Senior Interpreter - Geology for Schlumberger in Houston, where he continues to specialize in the geological application of wireline logs. His professional affiliations include the AAPG, SPE, SEPM, and SPWLA, as well as the geological societies in Corpus Christi, San Antonio, and Houston. ■