"Another classic triangle: analysis of depositional environment, reservoir characterization and delineation of reservoir continuity using multiple borehole image acquisition techniques."

Abstract:

A classic dilemma in the exploration for sandstone reservoirs has been the analysis of the depositional environment in which the sands have been laid down. Such analysis can provide critical information regarding reservoir parameters such as reservoir quality, continuity, elongation and orientation and size in an early stage of the exploration process. Also, insight into reservoir heterogeneity, vertical and horizontal permeability, may be achieved from a proper judgment of depositional framework.

One of the main obstacles in a study of depositional environments in the subsurface, is the lack of reliable data in between wells. It is often impossible to determine how individual beds are connected to offsetting wells. Frequently it is found (Often only after the field has been producing for some time) that in contrast to our expectations, the real correlations is between beds that do not look similar at all on open hole log data . The reason is that sedimentary units in general and sandstones in particular, do reflect the original depositional environment in which they were laid down, but will commonly not reflect the relative age at which this has happened, resulting in the possibility that similar looking sands were not deposited during the same cycle and indeed may be separated by major discontinuities and or time differences.

From a reservoir management perspective, the question whether or not sands are connected can be crucial during the exploration and development of a hydrocarbon field.

It is therefor that earth scientists are continually searching for new ways to improve the resolution of the interwell space with techniques such as cross well geophysical imaging and 3-D seismic. In this paper, the detailed geological information gained from the study of specific geophysical well logs was used to identify the reservoir properties and to delineate the orientation and depositional style of sub-seismic reservoir sands.

We describe how data from diplogs, acoustic, electrical and combined resistivity and acoustic borehole imagining devices were used to acquire borehole images over prospective reservoir zones. The analysis of these multiple borehole images have helped to resolve the above mentioned reservoir uncertainties in a variety of sedimentary environments. These techniques, when properly applied, can add another arrow in our quiver that can be used in situations where diplog or image data have been included in the open hole logging suites.

Eric F. Paauwe
Western Atlas Logging Services
10205 Westheimer, OB-10
Houston, Texas 77042
Phone: (713) 972-4859
Fax: (713) 972-4401
email: eric.paauwe@waii.com

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