IMAGING POROSITY IN CONSOLIDATED FORMATIONS ESTABLISHING RESERVOIR QUALITY, FLUIDS AND FRACTURE ORIENTATION USING CONVENTIONAL SEISMIC SURVEYS

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ABSTRACT

Consolidated reservoir formations are defined as those having consistently higher acoustic impedance (density-velocity product) than shales of similar age. Also, this requirement must be met over a significant thickness of the section and everywhere below. For such formations porosity-and hydrocarbon effects can be effectively imaged via seismic velocity changes to depths of 16,000 feet or more. The velocity variations have quantitative significance in terms of reservoir quality and production potential. Despite the fact that this technology and capability have existed for more than ten years, few examples have appeared in the literature, and no coherent discussions or comparative treatments have been offered for general distribution.

The goal of this exposition is to fill this void by critically viewing a number of examples. We shall note consolidated sand and carbonate reservoirs from Bolivia, East Texas, Gulf of Mexico, North Sea, Oklahoma, South and West Texas, as well as plays of current high interest including the Austin Chalk, Alaskan formations, Niobrara and Frio-Vicksburg.

The talk will start with a brief summary of requirements for definitive seismic imaging of consolidated reservoirs and move to the technology for interpreting, calibrating, and using such displays. The effectiveness of spatially dense seismic velocity measurements and color inversion sections scaled in velocity is clearly demonstrated by the variety of successful examples reviewed. More sophisticated seismic applications such as amplitude variations with offset and other techniques for confirmation of pore fluid identities are illustrated. Also shown are methods of establishing fracture directions using conventional seismic surveys having different orientations. These approaches, and the positive results obtained, suggest that in the future, seismic techniques will be even more definitive in addressing consolidated reservoirs for both exploration and production applications.

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