Seismic Characterization of Tight Gas Reservoirs; An Integrated Approach

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ABSTRACT

Many hydrocarbon reservoirs such as tight gas sands composed of low porosity (1%-10%) and microdarcy-scale matrix permeability (1-60μD). Such reservoirs unless they are naturally and heavily fractured are hard to develop without proper stimulation. Simulation of the reservoir is directly driven by reservoir geological and geomechanical properties. Hence, it is important to characterize the reservoir not only in terms of reservoir matrix properties but also fracture and mechanical properties.

Detail Seismic characterization of tight reservoirs both in terms of reservoir delineation and quality make development of tight reservoirs more economically viable as better production can be achieved through identifying zones with best reservoir quality and suitable for stimulation (sweet spots).

Depends on the quality and type of the available seismic data, one can use seismic in a qualitative or a quantitative ways for reservoir characterization. In a qualitative way post-stack seismic attributes are correlated to available well data (for example; porosity, rock type, fracture,..). Simple amplitude or frequency attributes or complex ones are used for rock property and quality delineation and mapping using attribute classification techniques. Such analysis could help to map zones with different reservoir quality (high or low porosity or clay content) in 3 dimensional space which could help in not only drilling in the most prolific location but also allow more control on drilling and placement of the horizontal wells. However, if the quality of the seismic data is good and pre-stack or even wide azimuth seismic data are available then a qualitative seismic method (pre-stack inversion or amplitude versus offset an azimuth; AVOZ) can be used for quantifying reservoir quality and discriminating more accurately different rock types, fracture zones and even zones with different fluids.

This presentation after a short introduction will discuss the main elements of an integrated workflow for seismic reservoir characterization and also fracture detection and, modeling. Examples of this workflow will show how advance seismic analysis combined with well, geomechanical and geological data can help mapping sweet spots in tight hydrocarbon reservoirs.