Using Seismic Inversion and Net Pay to Calibrate Eagle Ford Shale Producible Resources

Bo Chen[1], Dhananjay Kumar[1], Anthony Uerling[2], Sheryl Land[2], Omar Aguirre[2], Tao Jiang[1], and Setiawardono Sugianto[1]

[1]BP America, Houston, Texas
[2]BP America, Houston, Texas

ABSTRACT

The production outcome of an Eagle Ford well depends on many factors including reservoir properties. This paper discusses an utilization of seismic attributes to predict them and identify the high production potential areas. Multiple studies have identified the sweet spots in unconventional plays, however not many have been directly correlated with and confirmed by the production data. We studied the production data and analyzed the reservoir characteristics associated with it taking into account the operation procedures. It was found that the producible resources lie in the thicker and more porous intervals. Both thickness and porosity can be determined with seismic data. Seismic inversion is utilized for porosity prediction and seismic net pay for 'net' thicknessprediction with higher porosity. The seismic net pay, confirmed by the blind well log data, has been used to predict the producible resources for future wells in the Eagle Ford shale in South Texas. The study includes the following four steps. First, a correlation between the petrophysical net pay and the estimated production volume is established. Well logs are analyzed to establish a method to predict net pay from seismic data. Second, post migration seismic data conditioning is applied to improve seismic data quality, by attenuating noises, flattening the gathers, and balancing the frequency spectrum and amplitude across offsets. Good quality seismic data are required for seismic net pay estimation. Third, using the conditioned seismic data, colored inversion is applied to invert the reflectivity data to relative acoustic impedance. Acoustic impedance is inversely proportional to porosity and is used to predict porosity in the lower Eagle Ford Shale. Finally, seismic net pay is calculated by detuning the relative acoustic impedanceand integrating over the gross thickness intervals. To quality control (QC) the results, the predicted seismic net pay is compared with well log data and estimated production data. We found that seismic net pay in the lower Eagle Ford as an indicator of its reservoir quality. The reliable estimation of seismic net pay requires an understanding of the rock properties, good quality well data, seismic data conditioning, well calibrated horizons, and accurate seismic inversion for impedance followed by porosity prediction. Even though seismic data is able to map reservoir quality, effective hydraulic fracturingtechnique may still be the dominant factor for good fracture conductivity and well performance.