Detection of Naturally Fractured Tight Gas Reservoirs: Case Histories from the Uinta and Wind River Basins Using 2-D and 3-D Seismic Data

Dave Phillips[1]
Heloise Lynn[2]
Michele Simon[2]
Richard Van Dok[3]

1. Blackhawk Geometrics
2. Lynn Incorporated, 1646 Fall Valley, Houston, TX 77077
3. Western Geophysical

The goal of two U.S. DOE research projects directed by Blackhawk Geometrics, contract no. DE-AC21-92MC28135 and DE-AC21-94MC31224, is the detection of gas-filled fractures using seismic methods. If highly fractured areas can be located using seismic techniques prior to drilling, it can greatly benefit field development. Shear wave seismic detects fractures, but it is expensive to acquire. If P-wave data can also detect fractures, the costs of finding fractured areas will be significantly reduced. In the Uinta Basin, 2 multi-component seismic lines and a multicomponent VSP were used to define fractures in the Upper Green River formation. The azimuthal difference of the P-wave AVO gradients showed open fracture directions consistent with the shear and VSP data. The dominant fracture direction at the Wind River Basin study area is East-West, and this information was used to design a processing sequence which splits the 3-D dataset into two subsets. Compressional waves which travel parallel to the dominant fracture direction will not sense the fractures, while compressional waves which travel perpendicular to the dominant fracture direction will sense the maximum influence of the fractures. The two data subsets were processed independently, and the azimuthally variant seismic attributes were compared to production from wells to calibrate the seismic attributes to production.