Principle Stress Estimation in Shale Plays Using 3D Seismic

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The principle stresses, vertical, maximum horizontal and minimum horizontal, and rock strength parameters can be estimated from wide-angle, wide-azimuth seismic data. This is demonstrated using a small 3D seismic survey over the Colorado Shale Gas play of Alberta, Canada. It is demonstrated that this information can be used to optimize the placement and direction of horizontal wells and hydraulic fracture stimulations.

A simplification of Hooke's Law, using Linear Slip Theory, by Schoenberg and Sayers (1995), allows the estimation of principle stresses from wide-angle, wide-azimuth seismic data. The rock properties required in its implementation are derived from wide-angle seismic data, e.g. Gray (2002). The method is demonstrated by estimating the principle stresses and rock properties for the Second White Speckled Shale (2WS) using seismic data acquired in central Alberta in Canada. The results show that only about ¼ of the 2WS in the survey area will fracture as a network, while most of the rest of it will fracture linearly, which implies that this information should be extremely important in well planning for this shale gas reservoir.