Effect of Anisotropy In Seismic Inversion In Shales

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Anisotropy is the variation of a physical property depending on the direction in which it is measured. On a smaller scale, the anisotropy effect may be caused by organic material and clay platelets in sedimentary rocks such as shales. However in the case of the Barnett this effect might be larger. In the Barnett Shale we observe orthotropic anisotropy, where the azimuthal anisotropy (HTI) is about 5-10% due to horizontal stress, and VTI anisotropy values approach to 40%. This is in a field where the Thomsen's (1986) parameters (ε, δ, and ¥) doesn't hold because this model is valid for values of anisotropy less than <10%. In this project I propose to evaluate the effect of the drilling and hydraulic fracture activity before seismic acquisition. Estimates of brittleness require estimation of both P and S impedance (or equivalent parameterizations of λρ – μρ or E – Z) from pre-stack seismic data.

The accuracy of these estimates improves with the use of longer offset data. The quality of pre-stack impedance inversion and anisotropy measurements is directly related on the quality of the input seismic data. Zhang (2010) found that by correcting for non-hyperbolic moveout it is possible to extend the offset used in imaging beyond 7,000 ft. Preliminary λρ - μρ inversion results from post-stimulation survey show that the optimum gas shale properties have relatively low λ's (incompressibility) and high μ's (rigidity) that give rise to geo-mechanical brittleness capable of supporting extensive induced fractures.