Effect of stress induced anisotropy on dipole sonic logging

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Over the past decades, stress anisotropy has become increasingly important for seismology, geodesy, tectonics, and petrophysics, especially to estimate stress direction. It is based on the assumption crack are open parallel to the maximum stress direction: stress induced anisotropy. Seismogenic zone to active fault interaction during the earthquake cycle produces spatial and temporal variations in stresses and strains within the surrounding material. The objective of this study is to clarify the behavior of deformation, stress, and fluid flow in seismogenic zones. With the development of cross-dipole array sonic logging technology, anisotropy measurement in a borehole environment is made possible, which allows us to determine in situ anisotropy at a vertical resolution that is impossible to achieve with surface seismic measurements. The method is based on the properties of wave propagation in an anisotropic medium. Anisotropy medium may be characterized as either intrinsic or stress-induced. Intrinsic anisotropy is that which exists independent of present-external stresses. Stress-induced anisotropy is anisotropy that results from the application of present-stresses. Then, stress anisotropy measurements have been applied to infer the orientation of the regional stress field, fracture intensity and orientation, and bedding induced anisotropy. We have been studying the stress regime associated with the earthquake sequence; the Nojima fault, western Nagano region, and the Chelungpu fault, and present an analysis of dipole shear sonic data to obtain reliable estimates of stress anisotropy. We also have a plan to extend our work to other seismogenic zones.