Geophysical Research Abstracts,
Vol. 11, EGU2009-4956, 2009
EGU General Assembly 2009

Anisotropy of sandstone reservoir and shale overburden estimated from spherical sample measurements and cross-dipole logging

T. Lokajicek (1), M. Brajanovski (2), B. Gurevich (2), A. Bona (2), D. Nadri (2), M. Urosevic (2), and G. Duncan (3)

(1) Dept of Rock Physical Properties, Institute of Geology AS CR v.v.i., Prague, Czech Republic, (2) Dept of Exploration Geophysics, Curtin University of Technology, Perth, Australia, (3) BHPBilliton, Perth, Australia

The analysis of rock anisotropy in terms of seismic velocities and within the context of rock-physics provides important information for the evaluation of the stress state (tensors) of rocks, the detection of the directions of formation weaknesses, helps in the estimation of overall permeability and failure prediction. Understanding the influence of stress and pore pressure on seismic velocities is important for 4-D reflection seismic interpretation, AVO analysis and reservoir modeling. Overall elastic parameters, seismic velocities and amplitudes (quality factor) are strongly dependent on confining stress and pore pressure. The stress sensitivity approach assumes an estimation of several physical quantities corresponding to rock properties, which in an ideal situation should be measured under special laboratory experiments. The presented data are based on the laboratory approach, as well as theoretical computations. Laboratory measurements were carried out on shale spherical samples from overburden under confining stress up to 400 MPa, by means of ultrasonic soundings in 132 independent directions. Such an approach enables to determine 3D P-wave elastic anisotropy. From the measured velocities, the stiffness tensor was inverted, assuming VTI symmetry approximation (five elastic constants). Since the sandstones were partly unconsolidated, it was not possible to take ultrasonic measurements, so we invented a method for stress induced anisotropy estimation using only cross-dipole logging, which allows us to make HTI approximation in the presence of asymmetric horizontal stress. These two results give the possibility for anisotropic correction in AVO analysis. In this work we have employed a rock physics model based on Biot-Gassmann theory of poroelasticity.