Pore Pressure Prediction Using Borehole Calibrated Seismic Attributes

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An accurate prediction of formation pore pressure is a key requirement for safe and economic drilling. In addition, pore pressure estimates provide important information on seal effectiveness, fault sealing potential and basin hydraulic connectivity. Forming estimates of pore pressure from seismic data requires the establishment of relationships between seismic observables and their associated attributes, with a priori information on formation pore pressure. Further, it is required that the relative contribution of lithostatic, hydrostatic and tectonic components are established.

A number of relationships between seismic velocity and pore pressure have been derived which, with appropriate local calibration to well pressure information and sonic measurements, enables prediction of formation pore pressure. Typical estimates of the required layer velocities from inversion of seismic stacking velocities are prone to a number of errors. It is demonstrated that limitations in stacking velocity inversion may be overcome through tomographic inversion associated with pre-stack depth migration. As seismic velocity variations are non-uniquely related to pore pressure, it is desirable to utilise other seismic attributes, such as impedance inversion and attenuation, to refine the pore pressure predictions. The additional benefits of including estimates of anisotropy and shear information into the pore pressure prediction are discussed.