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N. C. Banik. *Velocity anisotropy of shales and depth estimation in the North Sea basin*

It is known that in the North Sea basin the depths to major reflectors as determined from surface seismic data are often larger than the well-log depths. From a study of data sets which tie 21 wells, I found a strong correlation between the occurrence of the depth error and the presence of shales in the subsurface. Assuming that the error is caused by elliptical velocity anisotropy in shales, I measured the anisotropy from a comparison of the well-log sonic data and the interval velocity profile obtained from the surface seismic data and also from a comparison of the seismic depth and the well-log depth. It was found that the two methods of measurement agree with each other and also agree qualitatively with the previous laboratory measurements of anisotropy in shale samples. The results strongly suggest that the depth anomaly in the North Sea basin is caused by the velocity anisotropy of shales. A simple method to correct the seismic depth is given.

R. A. Ensley. *Comparison of P- and S-wave seismic data: a new method for detecting gas reservoirs*

Compressional waves are sensitive to the type of pore fluid within rocks, but shear waves are only slightly affected by changes in fluid type. This suggests that a comparison of compressional- and shear-wave seismic data recorded over a prospect may allow an interpreter to discriminate between gas-related anomalies and those related to lithology. This case study documents that where a compressional-wave 'bright spot' or other direct hydrocarbon indicator is present, such a comparison can be used to verify the presence of gas. In practice, the technique can only be used for a qualitative evaluation. However, future improvement of shear-wave data quality may enable the use of more quantitative methods as well.

A. Gonzales-Serrano and J. F. Claerbout. *Wave-equation velocity analysis*

Velocity sensitive (wide propagation angle) seismic data do not comply with the r.m.s. small propagation angle approximation. A hyperbolic velocity spectrum and Dix's equation cannot use wide-angle arrivals to estimate interval velocity accurately. The linear moveout method measures interval velocity exactly in stratified media. Snell midpoint coordinates are constructed to image the data before velocity estimation. Energy focuses at the arrival coordinates of a fixed reference Snell wavefront as required by the linear moveout method. The image of a common-midpoint seismic gather in Snell midpoint coordinates, for a nonvertical reference Snell wave, defines the wave-equation velocity spectrum. Two important properties of the velocity spectrum are locality, where energy is a local function of velocity; and linearity, that is invertible using linear transformations. Velocity sensitivity of wave-equation extrapolation operators increases with the angle of propagation. In Snell midpoint coordinates, angles are measured relative to an arbitrary slanted reference Snell wave. At this particular angle wave-equation operators are exact, independent of velocity. Approximations of the wave equation in Snell midpoint coordinates satisfactorily image wide-angle energy. To compute the velocity spectrum, we use the 15-degree finite-difference wave equation in the frequency domain. This equation is insensitive to the downward continuation velocity. This formation resolves multivalued, wide velocity spectrum data using in-homogeneous, offset and depth dependent, downward continuation velocity. Stepout filtering concurrent with downward continuation eliminates wide-angle propagation energy not modeled by the 15-degree wave equation.

M. A. Dablain. *The role and application of entropy terms for acoustic wave modeling by the finite-difference method*

The significance of entropy-like terms is examined within the context of the finite-difference modeling of acoustic wave propagation. The numerical implications of dissipative mechanisms are tested for performance within two very distinct differencing algorithms. The two schemes which are reviewed with and without dissipation are (1) the standard central-difference scheme, and (2) the Lax–Wendroff two-step scheme. Numerical results are presented comparing the short-wavelength response of these schemes. In order to achieve this response, the linearized version of an exploding one-dimensional source is used.