GASSAWAY, G. S., Terra Linda Group

Seismic Amplitude Measurement for Primary Lithology Estimation (SAMPLE): Case Histories From Tertiary Western Basins

Amplitude variations within a common depth point (CDP) gather can be interpreted to yield shear wave velocities or Poisson's ratios. The SAMPLE method does such an interpretation and from crossplot of pressure wave velocities versus Poisson's ratios, lithologies, and pore fluids are estimated.

The SAMPLE method works because reflection and transmission of elastic waves (seismic waves) at the boundary between two media are a function of six elastic parameters. P-wave velocity, Poisson's ratio, and bulk density are the three elastic parameters in each media. Given these six parameters (three in each media) and the angle of incidence, reflection, and transmission amplitudes can be calculated using Zoeppritz's equations (Richter, 1958). SAMPLE is an inversion of this calculation, where;

1. P-wave velocity is determined in a conventional manner, i.e. Dix interval velocity.
2. Bulk density is assumed to be a function of P-wave velocity, (Gardner et al., 1974).
3. Unknown Poisson's ratios can be determined from the reflection amplitude variation versus shot-to-geophone offset within a CDP gather (Gassaway and Richgels, 1983).
4. From a crossplot of Poisson's ratio versus P-wave velocity, lithologies and pore fluids are estimated, (Gassaway and Richgels, 1983).

Live data examples from the Denver-Julesburg Basin in Nebraska and the Sacramento-San Joaquin Basins in California indicate that this technique can identify gross average lithology over zones 50 milliseconds (approx. 250 feet) thick in consolidated rocks. Gaseous hydrocarbons

Earth Science Bulletin, 1984

(approx. 30 feet thick) can be recognized from zones greater than ten milliseconds.