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exploration. The method involves preprocessing and correlating relatively long records of the response of geophone arrays to ambient acoustic energy. The resultant correlograms can then be treated as conventional seismic data, stacked, filtered, and displayed. It has been shown theoretically and demonstrated experimentally with a simple electrical analog, that, for unit surface reflectivity, one side of the autocorrelation of records produced by vertically upward traveling waves is equivalent to the reflection response to a downward traveling plane-wave source at the surface. Field experiments were conducted to assess the quality of these sourceless seismograms (both auto- and cross-correlograms) in an operating environment. During these tests we encountered significant interferences from surface-wave energy and local incoherent noise sources. Some typical sections acquired in these field tests will be presented, and operating experience and possible application of the technique will be discussed.

The Use of Temperature Gradients in Stratigraphic Correlations

A. E. BECK

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In the course of making temperature measurements (for heat flow determination) in cased boreholes using equipment capable of giving accuracies of 0.003°C, it was observed that some relatively thin sections yielded unusually high temperature gradients, some as high as 140°C/km. The character of the temperature gradient-depth logs was found to be characteristic of the formations in which they were measured. Many of the "spikes" correlated well with electrical resistivity and SP logs whereas others did not. In one instance, the character of the temperature gradient-depth log indicated that the location of a particular horizon deduced from the resistivity log had been mispicked by nearly 100 m. Subsequent close examination of the resistivity logs confirmed the mislocation of the horizon.

Limitations of Standard Refraction Interpretation Methods in the Absence of Well-Defined Layers and when Velocities Vary in all Directions

THOM CAVANAUGH AND DAVID M. STEWART

Present methods of seismic refraction interpretation, such as those developed by Slotnick, Tarrant, Hales, Barthelmes, and Wyrobek, are based on a minimum of three assumptions: (1) The two-dimensional expression of Snell's Law is generally useful; (2) all refraction takes place in the vertical plane below the shot line; and (3) the earth consists of layers. These assumptions are adequate in most cases but are not applicable in areas underlain by massive heterogenous units such as solution weathered carbonates, microfractured basalts, alluvium, saprolite, or glacial deposits. Attempts to use any of these graphical or mathematical methods to obtain details of refractions in an inhomogeneous medium can result in fictitious results and the promulgation of misinformation. When velocities vary greatly in all directions, it is necessary to use Snell's law in three dimensions because, in the absence of simple layers, refraction raypaths deviate considerably from the vertical plane. In this study, computer models were used to trace rays through heterogeneous media and generate respective time-distance graphs. Subsequent application of standard techniques to these graphs demonstrates the great difference between the true situation and results calculated when the data from a nonlayered medium are forced into a layered interpretation model.

Amplitudes of Seismic Events and Their Dependence Upon the Absorption-Dispersion Pairs of the Media

C. CROWE AND K. A. ALHILALI

Partitioning of normally incident plane waves at the boundary between lossy media depends on the density and the absorption-dispersion pair on each side of the boundary. For a given model of energy loss, the velocity and absorption coefficient (the absorption-dispersion pair) are specified, and are frequency dependent. A contrast between the absorption dispersion pairs of the media can be attributed either to different parameters in the same model or to two different models. For a given contrast between the pairs, the magnitude and frequency dependence of the reflection coefficient and phase change can be calculated.

Available laboratory and field data were compared with the magnitude and frequency dependence of velocity, absorption coefficient, logarithmic decrement (or Q), reflection coefficient, and phase change, predicted for several models of the media. To test an absorption-dispersion pair, a test of any two of the parameters velocity (v), absorption coefficient (α), and logarithmic decrement (δ) is sufficient, because δ is a function of α and v. Complete experimental data, particularly for lithologies with different pore fillers, are scarce. In spite of this, and some discrepancies, the Averbukh-Futterman model appears to describe best the dynamic behavior of rocks at seismic frequencies.

The Averbukh-Futterman model, for example, predicts that a contrast between the absorption-dispersion pair on each side of a boundary can lead to an appreciable increase in the reflection coefficient over the perfectly elastic case and can introduce significant variations of amplitude with frequency.

New Challenges for Geophysicists

J.-C. DE BREMAECKER AND M. H. HOUSTON, JR.

Geophysicists can now solve many problems of great importance to the oil industry, e.g., diffusion