1983

Seam Wave Characteristics in an Eastern U.S. Coal

Paul J. Wolfe
Wright State University - Main Campus, paul.wolfe@wright.edu

Timothy G. Holdeman

Benjamin H. Richard

have been used for several years in thinner seams in the United Kingdom failed due to noise from multimoded propagation in this seam. An image of the fault was obtained by using an inversion technique referred to as virtual reflector imaging (VRI). The inversion yields a simultaneous solution for group velocity, phase velocity, reflector intercept, and reflector slope. The forward model is based on the complex sum algorithm of Mason et al (1980, p. 1181). Reflector locations computed using VRI in this seam are within 10 ft of the known location of the fault.

Seam Wave Characteristics in an Eastern U.S. Coal — C1.5

Paul J. Wolfe, Timothy G. Holdeman, and Benjamin H. Richard, Wright State Univ.

Seam waves have been used extensively in Europe for coal mine planning, but the techniques have not been applied in the eastern United States. For the purpose of determining the suitability of these methods to determining coal continuity in the eastern U.S., seam wave propagation characteristics were measured in the Lower Freeport coal of eastern Ohio. The tests were conducted between two perpendicular underground entries. The source-geophone distances ranged from 72 to 183 m. Triaxial geophones were set into holes in the coal and seismic waves were generated with a sliding steel bar.

The Love-type fundamental mode was the most prominent seam wave feature observed. The Airy phase had a frequency of 350 Hz and propagated at 510 m/sec.

The data were analyzed by Dziewonski's method. The comparison of this analysis with theoretical dispersion curves gave a wave guide thickness of 1.7 m, which agreed with the actual coal thickness. Rayleigh-type seam waves were also observed but their characteristics were more difficult to determine because the signal-to-noise ratio was poorer.

Some New Aspects of In-Seam Seismics Especially by Improved Determination of Dispersion — C1.6

M. Knecht, Th. Krey, R. Marschall, Prakla-Seismos, West Germany

Parallel to the steadily growing interest in in-seam seismic surveys for coal prospecting, it is necessary to extend and improve existing processing steps continuously. Up to now, in transmission surveys only the observation of the Airy phase as an indication of unfaulted seams was considered. However, attempts are being made to use the whole dispersion curve, i.e., also the low frequency part, for interpretation purposes. From observed seam-wave data, an improved dispersion curve can be obtained by stacking the curves of several single traces.

Exact knowledge of the dispersion curve is also an important prerequisite for successful recompression of dispersive seam waves. In the case of reflection surveys, the aim of recompression is to replace the dispersive wave train with a simple and uniform wavelet which enables the subsequent stacking of single traces without having to form envelopes, or which at least improves the envelope method if still necessary. This is also the aim of another method based on correlation of traces with a signal similar to the Airy phase. In both cases higher resolution and an improved signal-to-noise ratio are achieved. The methods mentioned are discussed on the basis of several data examples.

High-Resolution Seismic: A Practical Approach to Coal Exploration — C1.7

R. C. Fry, Utah Power & Light Co.; E. Berkman and A. Orange, Emerald Exploration Consultants

The use of high-resolution seismic surveys has been extremely effective in defining the geologic structure and stratigraphy of a developed coal property located within the Wasatch Plateau coal field, Emery County, Utah. The coal property, which is the East Mountain property owned by Utah Power & Light Co., contains 5 underground coal mines that collectively produce about 4 million tons of coal annually.

High-resolution seismic surveys were conducted in 1980 and 1981 to define the geologic structure in areas where data collected by geologic mapping and drilling resulted in questionable interpretations regarding the geologic structure. These surveys produced data which allowed detailed identification of the geologic structure, continuity and thickness trends of the coal seams present, and location of fluvial channel sandstones superimposed on these coal seams.

Generalized Ray Analysis: A Tool in Coal Seismology — C1.8

S. S. Lee, J. Regueiro, and J. Reeves, Colorado School of Mines

Synthetic seismograms have been computed, using selected subspecies of a generalized ray classification, to simulate two instances for which there is field data available: (1) hole-to-hole seam wave survey, and (2) underground seam wave survey. The kinematic discontinuity method is used to calculate amplitudes and arrival times for far-field, high-frequency components with long supercritical offset. The asymptotic ray method is applied to the critical region. Azimuthally symmetric P and SH point sources are employed. Automatic ray generation is applied to generate a set of multiple-reflected rays. The deep coal model consists of a sequence of horizontal, isotropic, homogeneous, elastic layers overlying a half-space.

The Love and pseudo-Rayleigh waves, as well as leaky modes, compare favorably to the seismogram obtained from the field experiments. For the Love wave, the $(S_2)^2$, $(S_2)^3$, $(S_2)^4$, $(S_2)^5$, and $(S_2)^6$ species were the greatest contributers to the synthetic record. Pseudo-Rayleigh waves are the result of superposition of reflected P and SV-waves, primarily by the species $(P_2)^2, (P_2)^3, \ldots, (P_2)^{10}$ and $P_2S_2, P_2(S_2)^2, \ldots$, etc. The PL phases result from superposition of many head subspecies: $P_2H_1P_2, P_2H_1(P_2)^2, \ldots$, etc. These results show that generalized ray analysis can be used as an aid in the interpretation of seam waves.