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Reflection seismic-exploration method

A. Antsiferov, M. Tirkel, L. Kamburova, O. Glukhov, V. Antsiferov

Ukrainian State Research and Design Institute of Mining Geology, Rock Mechanics and Mine Surveying (UkrNIMI), National Academy of Sciences of Ukraine, Donetsk, Ukraine (ukrnimi@ukrnimi.donetsk.ua/Fax: +38 062 3481648)

When using land seismics in conditions of the Donets Coal Basin, waves reflected from typical sandstone thick strata occurring at the depths down to 1,500 m embedded in a set of rocks enclosing coal beds being mined at present are constantly observed. This fact has served as the basis to devise a promising method for detection and description of coal bed dislocations and areas of probable methane accumulation confined to them. The exploration is carried out by common-depth-point (CDP) reflection method, and data interpretation is made by the seismic transmission method interpretation system.

From the original wave records by rearranging seismic channels, CDP seismograms are formed that are considered as common excitation point seismograms and are interpreted by seismic transmission method; i.e. each reflecting point lying in the selected reflecting boundary is considered as imaginary oscillation source. Preparation of reflection data to be interpreted by seismic reflection method consists of the following steps:

1) Reflecting boundary is selected above which an interesting to researcher object to be transmitted is located; the boundary should be traced with confidence in sections of preliminary interpretation by reflection method.

2) From the original wave records CDP seismograms are formed by rearranging seismic channels.

3) CDP seismograms are implicitly considered as common excitation point seismograms (as common exciting points of implicit common source seismograms, common

reflecting points of real CDP seismograms are taken).

4) Each of the CDP seismograms is duplicated. The first copy implicitly represents the wave that passes between the real source and the reflecting point; the second copy implicitly represents the wave that passes between the reflecting point and the real receiving point.

5) The array of implicit sources and implicit receivers is depicted in the plane that cuts vertically the strata and traverses profile of seismic observations.

6) Implicit common excitation point seismograms are converted into the format of seismic transmission method interpretation system and are interpreted by seismic transmission method.

As a result of investigations conducted in UkrNIMI Institute of the National Academy of Sciences of Ukraine it is determined that the attribute describing the ability to apply the given method for anomaly detection is the following relationship: $\frac{\Delta M \times l}{L\chi} > 5$, where ΔM deviation of elastic responses of the medium within the zone of anomaly, l – its size, L – depth of occurrence of the reflecting boundary, χ – its acoustic stiffness. By theoretical computations it is determined that the sharpness value of the reflecting boundary $\frac{V_?}{V_?}$ (where $V_?$ and $V_?$ propagation velocities of seismic compression and shear waves) has to be less than 0.9.

Using technique developed, we carried out prediction of diversity of fault-, overthrust-type dislocations with the amplitudes of 5 to 100 m and areas of small-amplitude dislocations, zones of changes in lithology of the cap, flexure folds with the amplitudes of 10 and more meters at the depths down to 1,000 m in typical for the Donets Coal Basin mining-geological conditions and in a number of special cases.