P-wave Attenuation Attribute Forecast Water-rich Region of Deep Limestone

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Abstract It`s an advantageous way that using seismic inversion to research limestone water-rich area and obtain a large area of deep limestone water-rich area information, based on three-dimensional seismic data. Considering the status of coalfield logging data: most cut-off depth of logging data is under the main coal seam floor 20 ~ 30 m, did not reach the deep limestone. So it is difficult to identify water-rich limestone by using conventional seismic inversion. From this perspective, we attempts to take the advantage of the attenuation characteristics to predict water-rich limestone in coal seismic survey, can be an effective way to identify solves practical problems. P-wave attenuation and the physical parameter was analysis based on the Biot theory, the limestone with water-rich was seen as porous media, but the limestone without water seen as a single-phase media. The physical parameter conversion between them was established. P-wave datum was simulated with the staggered-grid finite difference method, and the P-wave spectral characteristics were analyzed according to it, then the evaluation method was proposed and validated with the real seismic data, the method shows robust effect. The result shows that attenuation in water-rich media is more than non-aqueous media. It makes the seismic spectrum show a trend moving towards low-frequency. The main spectral differences between the two media are composed of the spectrum mobile features and the "Low-frequency high-value, high-frequency low-value". The former can be very well measured by the dominant frequency attribute, the latter by spectral decomposition attribute. The integrated above results show that the limestone water-rich region is in line with the feature, which is "dominant frequency low-value, low-frequency high-value, high-frequency low-value”.

Keywords fracture water inrush, numerical simulation, pressure, water inrush mechanism