Application of Dominant Frequency Band Reconstruction Inversion Technology in the Prediction of Oil-Bearing Reservoirs under Coal-Bearing Strata

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9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

The study area is located in Malang Sag of the Santanghu Basin in northwest of china, where a favorable exploration target is Xishanyao formation reservoirs in Jurassic. It is a lithologic hydrocarbon reservoir with the tectonic setting, about 1800m in burial depth, and the hydrocarbon beds are mainly packsands with rapid change laterally under the coal seam; the pay-zone is about 15m in average thickness. The seismic features of sand layer were blurry because of the interface of strange seismic reflection caused by the coal measure strata at the bottom of Xishanyao formation. The conventional acoustic impedance inversion based on original seismic data is difficult to predict the distribution range of the favorable reservoirs under the coal seam. In this paper, we used wavelet decomposition and reconstruction technology to remove the shielding effect of the overlying coal-bearing strata. Firstly, we determine the sensitive frequency band of the sand reservoirs under coal-bearing strata in the study area by spectrum analysis and then use wavelet decomposition and reconstruction technology to reconstruct sensitive frequency seismic data volume of sand reservoirs. It is revealed that the vertical and horizontal resolution had been improved and the sand layer under coal seam presents obvious reflection of seismic waveform on the reconstructed seismic profile of dominant frequency band. In order to further predict the distribution of oil-bearing reservoirs, we use waveform phase-controlled statistical inversion based on dominant frequency band reconstructed data volume in the study

area. According to this method, we can establish a reasonable relationship between well and seismic data by comparing the optimized well samples with the reconstructed seismic waveforms, so that the inversion results can effectively depict the distribution characteristics of reservoirs under coal seams. And through our research, the fourteen reservoirs with an area of 41 square kilometers were predicted in the study area; the coincidence rate with drilled wells is more than 92%. Therefore, the inversion technique based on dominant frequency band reconstructed seismic data can predict the distribution ranges of the oil-bearing reservoirs under coal-bearing strata effectively. It is a good guidance to the layout of the evaluation wells and has made an important contribution to the implementation of economic and effective exploration in the study area.