Innovation and Application of Reservoir Geophysics Technology for Mature Oil Fields in the Mangeshlak Basin, Central Asia

Chen Xin[1], Feng Xukui[1], Yuguang Zhao[2], Xiaodong Wei[1], Sun Tiejun[1], Sun Haishan[1], Wang Wei[1], Yang Ke[1], Li Qiang[1], Cai Junxian[1]
[1]BGP; [2]BGP International, CNPC

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Abstract

Thin bed reservoir characterization plays an important role in residual oil development in mature oil fields in Mangeshlak Basin, since most of the thick reservoir was water flooded. However, due to heterogeneity of thin bed reservoir and limited resolution of seismic data, accurate imaging of thin bed reservoir for residual oil development in Mangeshlak Basin has been challenging for many years. After decades of research and fieldwork, we developed an effective reservoir geophysics workflow that uses the latest technologies from seismic acquisition, imaging, interpretation, geological modeling and production history matching. They include 3D high-density and wide-azimuth(WAZ) acquisition, target high-resolution processing, semi-automatic interpretation, seismic wavelet indicated inversion, geological modeling and production history matching. To further reduce uncertainty in reservoir characterization and improve the accuracy of geological model, our geologists, geophysicists, petrophysicists and reservoir engineers worked closely through the reservoir geophysics study cycle (from seismic acquisition, processing, interpretation, reservoir characterization, geologic modeling, to production history matching). This reservoir geophysics workflow has been used successfully in residual oil development in the Mangeshlak Basin. 3D WAZ high-density seismic surveys have been conducted over 10,000 square kilometers, greatly improving the field seismic data quality. After application of target high-resolution processing, new seismic data with high quality image of thin bed reservoir significantly enhancing reservoir characterization. And an accuracy geological model

have generated directly based on the seismic wavelet indicated inversion volume. To further reduce uncertainty in reservoir connectivity and improve the accuracy of geological model, combined analysis based on reservoir dynamic data, seismic attribute and seismic inversion date was carried out in our multidisciplinary team. Hundreds of commercial wells drilled with abundant remaining oil, and many other potential residual oil areas have been identified based on the new reservoir model. The application of new technologies not only increased drilling success but also reduce depth well-tie errors between seismic data and wells. The main advantage of this reservoir geophysics workflow lie in, through the integration of seismic acquisition, processing, interpretation, geological modeling and production history matching, we were able to acquire high-quality seismic data with improved SNR and high-resolution seismic wavelet indicated inversion volume, build reliable geological model, and generate an efficient development adjustment plan for mature oil fields.