Application of Seismic Characterization for Geological and Engineering Sweet Spots of Shale Oil: A Case Study in the Erdos Basin, China

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Abstract

Shale oil exploration is a hotspot and big challenge in petroleum exploration nowadays. Shale oil resource is rich in Erdos Basin, mainly distributed in the Loess Plateau Area in the south of the basin. Chang 7 shale oil resource amounts to 20 billion tons, accounting for half of the shale oil resources in China. Due to the great thickness and lateral variation of the Loess Hilly Region, the 2D seismic data is very poor. And shale oil sweet spot characterization differs greatly from conventional oil and gas, geological & engineering sweet spot seismic prediction is a great challenge. Aiming at the complex surface seismic and underground geology in this area, 3D seismic data acquisition of 'Wide-azimuth, Broadband, and High-density (WBH) seismic acquisition' have been applied for the first time in the Loess Mountains area. In this paper, key geological sweet spot parameters such as TOC, porosity, fault, structure, shale thickness and key engineering sweet spot parameters such as brittleness, fracture and stress have been obtained by pre-stack simultaneous inversion and integrated interpretation with the WBH 3D seismic. Based on detailed analysis of rock physics, the technique of sweet spot characterization for shale oil is studied. In the target area, the success rate of horizontal well is over 85% with the technique.

Key words: Shale Oil, 'Wide-azimuth, Broadband, and High-density (WBH) seismic', Geological & Engineering Sweet Spot, Prestack simultaneous inversion