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Please fill in your abstract title.	Probing Hybrid Tight Oil with a Rock Physics Template Technique

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Abstract

There are two hybrid tight oil reservoir segments developed in the Permian Lucaogou Formation of Jimusar Sag. The complicated lithologies and pore structures make it difficult to quantitatively predict the sweet spots by using the traditional seismic inversion methods. This paper proposes a new set of rock physics template (RPT) technique to predict the lithologies, porosity and total organic carbon of tight oil sweet spots, the effectiveness of which is verified by seismic data inversion results. The new RPT technique process includes the following steps: first, the trends of P-wave impedance and Vp/Vs changing with the lithologies, porosity and total organic carbon (TOC) content are obtained from the ultrasonic data of core samples in Lucaogou formation; second, a bimaterial matrix-double inclusion concentrations model is introduced into analyzing the parametric sensitivity to porosity and TOC content; third, a modified RPT of P-wave impedance versus Vp/Vs with three end members (sandstone, dolostone and mudstone) is proposed to predict porosity and lithology of reservoirs. Also, a new RPT of density versus poisson ratio is presented to predict TOC content and lithology of source rocks. For high quality tight oil reservoirs, Ip and Vp/Vs will increase with the increasing of dolomite content, while Ip will decrease and Vp/Vs will rise with higher porosity. Considering that the lithologies of reservoirs are dolarenite, feldspathic litharenite, dolomitic siltstone, most of which consist of clay statistically lower than 10%; the porosity is generally larger than 5%; and with Ip>8(Km/s*g/cm^3), Vp/Vs<1.85, all these above lines are drawn in RPT of Ip versus Vp/Vs as the limit lines to predict the high quality reservoirs. For source rocks, the poisson ratio and density will increase with the increasing of dolomite, while the density will decrease linearly and poisson ratio will change little with higher TOC. The lithologies of source rocks are dolomitic mudstone and carbonaceous mudstone, most of which have TOC overweighed by 4%, so we can predict TOC and lithology of source rocks in RPT of density versus poisson ratio. These two rock physics templates are applied to predict the porosity, TOC content and the thickness of upper sweet spots in J17 work area of Jimusar Sag. Favorable reservoirs are mainly distributed on the eastern side of J17 work area and the reservoir distribution has obvious zonal features. The inversion results are in accordance with oil testing results, verifying the viability and effectiveness of the technology of rock physics template. Based on analyzing the ultrasonic lab data and rock physics modeling, a new set of rock physics template technique is proposed to quantitatively predict porosity, TOC content and lithology of hybrid tight oil sweet spots for the first time. We hope the readers can gain some knowledge and understanding about geological features and seismic exploration methods of continental tight oil in China from this study.