A New Thin Bedded Reservoir Prediction Method Based on Geological Seismic Conditioning and Waveform Indicated Inversion and Its Application in the Yingmaili Gas Field, Tarim Basin

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Abstract

Reservoir prediction is the key to lithological exploration. Conventional wave impedance inversion and geostatistical inversion have their respective defect to predict reservoirs that characterized by deep buried, thin thickness and strong heterogeneity, like in the western Tabei uplift of Tarim basin. In recent years, with the improving of seismic data acquisition method, the SNR and resolution of deep seismic data are greatly enhanced, which make it possible to predict deep thin bedded reservoirs. Based on new 3D seismic data, integrated with regional geologic background, drilling data and well logging data, a new thin bedded reservoir prediction method was proposed on the basis of geological seismic conditioning and waveform indicated inversion. This method mainly includes following three steps. 1) Geological seismic conditioning. Original seismic data was undergoing wavelet decomposition and reconstruction, waveform decomposition to make the seismic response of thin sandstone prominent and improve identification ability of seismic data for thin layer. 2) Studying of sedimentary facies. The sedimentary facies of target layer are investigated by applying techniques of seismic facies analysis, and then the macro distribution regularity of reservoir can be recognized. 3) Well logging data conditioning and wavelet indicated inversion. The well logging data is calibrated by core data, and then extract well logging parameters that

can identify reservoirs under instruction of sedimentary regularity. This preprocess can highlight the identification ability of well logging data for reservoir recognition. And then wavelet indicated inversion is conducted to finely depict the spatial distribution of sand body in target layer. Application in Yingmaili gas field, Tarim Basin indicates that deep thin bedded reservoir with thickness of 3~7 meters can be depicted successfully. The reservoir of the studied lithologic gas deposit was a set of sandstone that formed in a fluvial-dominated delta front. The pinch-out boundary of sandstone was depicted and result shows that another 100km^2 favorable gas-bearing area was discovered in the southern and eastern of the gas deposit. A new well in this area shows that the consistency between real drilling results and prediction results is up to 93% and this well has achieved great success with daily gas production of 11×104 m^3. The advantages of this new method lie in it can enhance the matching degree of well data and seismic data, and can really integrate the high lateral resolution of seismic data and high vertical resolution of log data to improve the accuracy of reservoir prediction. This method may have a great instructive significance to the exploration and exploitation of similar oil-gas field.