Fine Geological Modeling of the Tight Oil Reservoir

LIANG Hongru\textsuperscript{1,2}, LU Shuangfang \textsuperscript{1,*}, TANG Mingming\textsuperscript{1}, YAN Bihui\textsuperscript{1,2} and SHEN Shan\textsuperscript{1,2}

\textbf{1 Introduction}

The study area of Northern Honggang is located in the Daan-Honggang terrace in the central depression of the southern Songliao basin, covering an area of 110km\textsuperscript{2}. The oil field is categorized as an ultra-low permeability reservoir and the target horizon is the Fuyu oil layer. The reservoir is characterized as poor physical property, strong heterogeneity and difficulty exploitation. Through the establishment of dense reservoir horizontal well representative area, certain effect has been obtained. But how to fine describe the spatial distribution of effective reservoir and to further determine reasonable development scheme still need to study.

\textbf{2 Fine Description of Sand Body}

Fuyu oil reservoir is mainly channel sand body. The channel swang strongly and is multi-superimposed. Only by subdividing the lithofacies unit into a single sand body can the complex fluvial sand bodies be described more finely and lay the geological foundation for the reservoir fine modeling of next step. The research on sand body of the small layer has been difficult to meet the need of oil field production. More accurate description of single sand body reservoir is required to guide the development and adjustment work of oil field. Anatomy of sand body through dense well pattern can be used to further understand the vertical overlap of sand body and the lateral contact relationship and provide the basis for fine description of sand body’s distribution. Based on two encryption wellblocks, this study mainly describes how to improve the accuracy of sand body characterization and analysis the intersection and overlay law of sand bodies through the anatomy of sand bodies.

\textsuperscript{*} Corresponding author. E-mail: lushuangfang@qq.com

The sandstone thickness of Fuyu oil reservoir decreases from northwest to southeast and it has been improved that the source is from the Northwest. The whole channel sand body is widely distributed in the whole region and has many branches, showing extremely unstable banded lentoid sand body. The width and thickness of the channel varies greatly, of which the widest part is near 2000m and the narrowest part is about 400m. The overall distribution looks like the human "blood vessel".

The relationship and distribution of sand body can be clearly defined through dense well pattern dissection. The thickness of channel sand body and sand bodies between rivers are different and the contact relationship can be divided into four types: isolated type, docking type, stacking type, pod cycle. The distribution of sand body is fine depicted by the combination of plane and profile.

Northern Honggang area is abundant in horizontal wells log data. It can be used to predict the boundary of sand body, improve the accuracy of sand body prediction and checkout the result. The sand body can be described and divided into single sand body by using the horizontal wells log data. We can draw the physical property distribution picture of single sand body and analysis the spatial distribution of reservoir property such as thickness, physical property, oiliness of single sand body by using the reservoir geological model data. It has been proved that the channel sand body is changed quickly in the horizontal. Dividing single sand body and recognizing the lateral distribution characteristics are essential for guaranteeing the lateral precision of modeling.

Fig.1 is the distribution map of sand bodies of F9.4, F10.1, F10.2, F10.3, F10.4, which has been adjusted by using interpretation results of horizontal well logging. The horizontal wells have good effect on adjusting thickness and zero line boundary of sand bodies. Meanwhile, to some extent, the plane distribution map of sand body is also able to verify the accuracy of the established sand body model.
3 The Reservoir Sand Modelling

On the basis of lithofacies and reservoir physical property studies, with comprehensive application of geological and logging data, structural model and sand body model of Northern Honggang area have been built by geological modeling software. For the sake of precision needed in the studies, three-dimensional structural model and facies models have been built combined with the specific circumstances of study area. Based on the results of the division of single-sand body, using phased sand body modeling method, a sand body model has been built in the study area. One-step modeling approach is unsuitable for the modeling of fluvial reservoir, so we adopt a two-step modeling approach to establish a phase model and property model (Fig. 2).

4 The Reservoir Property Modelling

Properties model includes three-dimensional model of porosity, permeability and oil saturation attribute parameters. The first step is to count spatial distribution features of sand bodies and to describe the spatial distribution of reservoir porosity and permeability and other parameters by using spatial variation function of regional variable. Phased application modeling technology has been used to build fine geologic models of main small layers; the porosity, permeability and oil saturation facies-controlled models of the small layers have been built through phased simulation method by setting the appropriate variogram .

References


