The Anatomy of Shallow Water Sandy Braided River Reservoir Architecture

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1 Introduction

Reservoir architecture refers to pattern, scale, direction and overlapping relationship of different levels of architecture units. The research of architecture in fluvial phase began in the 1980s (Miall, 1985). The braided river reservoir makes important role in fluvial, which has been one of the hotspots in the sedimentology at home and abroad.

Previous opinions about the braided river are that it mainly composes of sand bars and the bars can be formed by vertical accretion because of the transverse circulation (Smith, 1980). And the foreign scholars proposed eight architecture elements, and summarize twelve deposition models (Miall, 1988). Of course, many domestic scholars make studies on the braided river reservoir architecture and put forward some relevant deposition models on the basic of outcrops and modern sedimentary survey (Cao yaohua et al, 1994; Liao baohua et al, 1998). However as the development of geological study, it is necessary to pay more attention to the subsurface reservoirs. The original method to analyze the sedimentary facies is on the basic of the single profile, which can not clearly make characterization of complex braided river reservoirs.

The reservoir analytic hierarchy process (AHP) breaks the former ideal. It is used to describe each level by hierarchical division, to explain the results of the description, to find the regular conclusions, to establish models for different levels, so that different levels of The characteristics are hierarchically normalized in a system to achieve the purpose of prediction. The reservoir hierarchy analysis method is used to analyze the structure of the braided river and the stratigraphic structure of the braided river, which is based on the microfacies and reservoir architecture analysis (Zhang Changmin, 1992). *

2 General conditions of region

In this study, the main layer L50 in P oil field was selected. The P field is located at the northeastern end of the middle of the Bonan low relief of the eastern part of the Bohai Bay basin and develops on the Tanlu fault zone. The oilfield is a faulted anticline controlled by two groups of strike - slip faults. The tectonic direction is about north to south, with complicated faults and developed fault system. The source direction is roughly northeast. The major reservoir situates at the part of Minghuazhen formation and the Guantao Formation in Neogene. The layer L50 is located in the upper part of the Guantao Formation with typical braided river characteristics.

3 Research methods

With reservoir hierarchy analysis method from four levels including the braided channel belt, complex braided sand bars, the single sand bar and internal layers of single sand bar, the qualitative and qualitative distribution models of sand bars and internal elements can be established, and the sand bars and braided channels of the target layer can be predicted. Firstly, the geological background of the P oil field was investigated, and the sedimentary settings of the sandy braided river was determined. The development of sand body is flaky with large distribution. The study area has several depocenters, and the average thickness of sandstone is 4.53 meters. Secondly, based on the survey of braided river sedimentary models, the modern sedimentary investigation was carried out. The study used the Google satellite platform and selected the modern river . The river is called shengli river and is located in Luotian county, Huanggang City, Hubei Province. Then typical braided section was selected to measure and make statistics of the scale of channels and bars inside. There is a positive correlation between the length and width of the sand bar and the braided channel. Then, a large number of complex

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sand bars were found in the section, and a typical one was selected to measure the scale and the inclination angle of the bar, the water depth and velocity. And it is found that the complex one can be divided into four types including sand bar, chute, channel and abandoned pool. Analyzing the previous models, such as "braided channels-sand bars-internal layers", "complex channel belt –single channel-elements-internal elements", they are based on that the sand bars are formed by transverse circulation. However, due to the modern sedimentary survey it was found that the formation of sand bars may not related to the transverse circulation. This at least shows that the formation of braided sand bars needs further exploration. Thus, it is difficult to apply the traditional model to anatomy and analysis. Based on the single sand bar as the basic unit, the complex sand bar is used as the constraint, and the braided channel is identified to construct the internal elements of the sandy braided river. In the study, a thick section of wellbore network in the area is taken as an example to establish the skeleton profile. Based on the mudstone at the top of the thick reservoir, a single sand bar is used as the basic unit, the contrast profile is constructed by the bottom drawing technique, and the logging curve is identified The sand bar is identified by the curve return and the change of the curve. The three-dimensional distribution of the sand bar is determined by tracking and comparing the sand bar in the three-dimensional space. On the basis of single profile contrast and three - dimensional closure, the evolution of single sand dam is analyzed according to the overlapping relation of sand bar, and the formation process of sand dam is reproduced.

4.Results

In view of the modern sedimentary investigation and the anatomy of the layer L50 in the P oil field, the author obtains the following understanding: 1) The formation of the braided sand bar is not due to the transverse circulation of the flow; 2) The architecture of braided river can be divided into four parts: bars, chutes, channels, and abandoned pools 3) Using the reservoir hierarchy analysis method, with the reservoir model, according to the "braided river belt - complex sand bars - single sand bars – internal layers of a single bar" for progressive anatomy. Based on the sandy braided river model, the authors consider the formation of the braided sand bars, which is completely different from the traditional cause. May be it is related to the depth of the river, but this model will provide a new idea for anatomy of reservoir.

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