

# Research and Application on Sedimentary Characteristics of Reservoir

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**Abstract.** The oil field enters the extremely high water cut period, the fine reservoir description work is aimed to deepen the reservoir understanding and clear the potential distribution. In this paper, the favorable conditions of dense well net north region west, combining with coring data, using the combination of well and seismic fine reservoir description method, in-depth and detailed study of the reservoir in the study area, the deepening of the I, 2, 3 class reservoir sedimentary characteristics of the understanding, established 9 kinds of sedimentary reservoir the corresponding relation model, depositional model and sedimentary environment, analyzes the different deposition patterns and the distribution of remaining oil, the development of effective guidance adjustment and tapping the potential of remaining oil.

## 1. research background

The block is located in the northern part of the Saertu structure, SI, SII, SIII, PI, PII, GI, GII reservoir is the largest depositional system - depression stage of Song Liao basin to the North River delta sedimentary system, characteristics of the distant source, pohuan, long, strong energy, in shallow water and as with the main river, estuary dam development.

The sedimentary system of the north can be divided into two stages during the main sedimentary period of Qingshankou formation, Yao Jia group and Nanjing formation:

- 1) Lacustrine retrograde Delta in the sedimentary period from the first member of the first member to the first member of the Yao formation;
- 2) Lacustrine delta of the first and the last one or two stages of the deposition of the Yao River.

## 2. Study on fine anatomy of reservoir

### 2.1. Research Ideas

Under the condition that the well spacing density is up to 110 /km<sup>2</sup>, under the guidance of high-resolution sequence stratigraphy theory, the sequence of subdivision of the 92 sedimentary units in the study area is vertical to the main single sand layer, and the adjustment of the correlation layer is carried out. With the advantage of seismic information in plane identification, fine description of local sedimentary characteristics of sand bodies, correction of sand boundary between wells, accurate and accurate description of reservoir in the western part of the Three Gorges area is achieved.



## 2.2. Methods for fine dissection of reservoirs

**2.2.1. Fine Micro Phase Study.** Fine core observation and description of two coring wells in this block are carried out, the lithology, fossils with single sand body morphology and logging curves of four kinds of indicators, including color, texture and structure, lithology, cyclist, antigenic mineral composition, and contains a special substance, fossils, single sand body morphology and logging a total of 10 kinds of index curve, single well facies analysis, the sedimentary environment of the reservoir are as follows:

S0: Front delta subfacies; SI: Delta front subfacies; SI ~ SII intercalation: Delta subfacies.

SII 1+2a ~ SII 2+3b: delta plain subfacies; SII 4 ~ SII 5+6b: delta front subfacies.

SII 7+8a ~ SIII 2, 8, 10: delta plain subfacies; SIII 3+4a ~ 7, SIII 9a, SIII 9b: delta front subfacies.

PI 1, PI 5 ~ PI 7: delta plain subfacies; PI 2 ~ PI 3: fluvial facies.

PI 4: delta front subfacies; PII ~ GII: delta front subfacies.

Divided into 6 subfacies and 20 microfacies types of river embankments, river bed, don't know, 4 River oxbow lake subfacies; microfacies are point bar, the heart beach, river, natural levee, crevasse channel, crevasse splay, overbank thin sand, interdistributary delta mud, abandoned channel; delta facies to identify delta distributary plain and delta front subfacies 2. Among them, the delta plain subfacies identify the distributary channel, abandoned channel, natural levee, crevasse channel, overbank splay, thin sand and interdistributary mud microfacies; delta front subfacies subaqueous distributary channel and overbank thin sand, subaqueous distributary Bay, estuary dam microfacies, and the establishment of 20 corresponding logging facies models.

**2.2.2. Study on splitting method of composite sand body.** Composite sand bodies are formed by vertical and lateral stacking of single sand bodies in different stages of the channel, and are the complex of multiple genetic sand bodies. The division of the time unit is the causes of the single sand body identification of large composite sand body, the single well by the time the unit can be divided to be the first to determine the boundaries, contrast, according to single well cut laminated surface characteristics, vertical cut overlapping degree and vertical mode to determine the causes of genetic unit boundaries. Finally, determine the "large side cut overlapping river sand body interface.

The division of genetic single sand bodies (single distributary channel sand bodies) on the plane can be made according to the following points:

1) Different single channels usually have separated parts in the larger area, which can be appropriately extended according to the width of the single channel, the scale of development and the change of the physical properties.

2) The sediments of abandoned river channel are important marks of the boundary of a single channel sand body

3) The occurrence of discontinuous Heian sand bodies may represent the boundaries of two different rivers.

4) The identification of the river edge can be used to distinguish the two river boundaries. Generally the channel edge sand body thickness, poor physical property, partial horizon, in meandering river refers to the convex side of the channel edge.

5) There is a single channel boundary when the horizon thickness difference of adjacent wells is greater than that of sand body thickness 1/3.

**2.2.3. Study on Fine Reservoir Description Method of Well Seismic Combination.** Due to the requirements of seismic data plane to identify the advantages and the interpretation accuracy of the thickness of sand body, combined with seismic reservoir description, two reservoir as a breakthrough, the specific approach is: first, through well seismic contrast matching relationship established with different thickness of sand body and energy intensity level, and then based on the results of fine logging curve, eliminate overlay effect, determining the ownership of layers of channel sand bodies, and finally to the earthquake trend control, reference curve characteristics and morphological changes

of different elevation of fine horizon interpretation, identification of sand body to interwell sand body boundary and single channel boundary, thus realizing the accurate description of the reservoir.

### **3. achievements and new understanding**

#### *3.1. Change Law of Sand Body before and After Infilling Well Pattern*

By contrast before and after the infilling of sand body characteristics, summed up the microfacies types of sand body changes, in particular: flood plain facies sand body changes little, channel and interchannel sand body in the basic control range has been described in the plane of I is not understanding the change of reservoir, the remaining oil mainly by intraformational control, more concentrated at the top of the thick oil layer near the interlayer and inner layer; distributary plain facies area distribution in channel sand body of single sand body reparability better, interchannel sand body drilling ratio increases, the plane heterogeneity of II reservoir increased, remaining oil is mainly affected by the microfacies control and more concentrated in the transition part; delta front channel sand body distribution is more continuous, width, curvature increases, straight stream reduce, increase River branch and confluence, namely III reservoir channel sand body vertical The remaining oil is mainly affected by the degree of well pattern control and injection production relationship, and the potential is mainly within the narrow channel that is not recognized before the encryption.

#### *3.2. Nine Typical Depositional Models of Reservoir are established*

According to the parfacies, considering the channel sand body development scale, and whether the plane distribution of abandoned channel development, at the same time, the reference distribution area and form channel sediments, determine the reference factors to establish the typical sedimentary model (Table 1), according to the environment during the deposition of sand bodies can be divided into 9 depositional modes of reservoir layer, namely the braided river facies sedimentary model, meandering river facies sedimentary model, sedimentary model of delta plain, shore shore sediment model, coastal sedimentary model, sedimentary model of delta front shore, shore sediment model, infralittoral deposit model, delta front sedimentary model. According to the 9 depositional models of reservoir, the sedimentary model and sedimentary environment of each time unit in the western part of the three North districts are re classified

### **4. Achievement application**

#### *4.1. Guiding the Adjustment of Water Flooding and Polymer Flooding Measures*

According to the results of fine reservoir description, combined with the dynamic change characteristics of the block, the water injection wells are subdivided into 257 wells, such as water injection, fracturing, patching and water plugging, so as to effectively improve the development effect of the block.

The block SA III10+11a sedimentary unit, there are two wells from the same river, combined with seismic reservoir anatomy results showed the presence of single channel boundary of these 2 wells, belong to different river branch. The pulse well test method is used to verify the connectivity between wells. Well test results show that the pressure and flow rate of the exciting well vary with the pulse period, while the flow rate curve of the reaction well does not vary with the pulse period. Therefore, the two wells are not connected, and the precise anatomical results are correct. It is suggested to control water flooding in the next step.

#### *4.2. Reservoir Fine Anatomy Results Guide Horizontal Well Design*

Fine reservoir anatomy. The results showed that in the test block, SIII1+2b sedimentary unit from 4 wells in enclosed area developed into the typical abandoned channel and point bar sand deposition was Oxbow, and northeast faults formed near the closed injection interval, the injection production relation, on the development of vibration interlayer is deposited between units and the distribution of remaining

oil research, that the point in dam of residual oil, by drilling 1 wells of remaining oil in point bar, the horizontal section drilled sandstone 391.4m, all for the low water, the oil saturation is 58.5%, the remaining oil enrichment.

## 5. Conclusion

1) The basic well pattern condition can only describe the sand body contour, application of well network density increases and various materials for the fine anatomical reservoir provides the conditions, correct understanding of various changes before and after sand infilling, has important significance to the oilfield development and potential tapping of remaining oil.

2) Establish 9 reservoir models, define the corresponding relationship between sedimentary model and sedimentary environment, deepen the understanding of sedimentary characteristics and remaining oil distribution law of I, II and III reservoirs, and guide fine dissection of various reservoirs in block of North Development zone.

## References

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