

## **Fine Study of Sedimentary Microfacies in Delta Front- In Heidimiao Key Sand Group as An Example**

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**Abstract:** Integrated black emperor temple reservoir depositional time unit 310 wells logging curve shape, sand body geometry and porosity and permeability data, combined with regional geological background, the Puxi oilfield ancient block 1 black oil reservoir group each sand group sedimentary characteristics and depositional model of research. Research results show that will Heidimiao original six layer segment to 10 depositional time unit, through comparison of the fine, the establishment of logging facies models, 14 sedimentary microfacies plane distribution characteristics and evolution rules are obtained, provides an important geological basis for the exploration and development of reservoir.

**Key words:** Western oil field, stratigraphic correlation, sedimentary time units, sedimentary microfacies, delta front sub facies

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Oil field to enter the stage of mining in the future, the various causes of the remaining oil distribution becomes more and more complicated, interlayer and plane and layer and pore <sup>[1-2]</sup> according to the West Putaohua oilfield ancient block 1 Black Emperor Temple Reservoir Group of six layers 310 development wells logging data analysis, the subdivision of the well sedimentary time units to the single sand body and fine strata contrast, based on establishing logging microfacies model, established the six layers of plane sedimentary microfacies and single sand body space distribution, for the research of the reservoir characteristics play geological basis.

### **I. Regional geological survey**

Puxi oilfield ancient block 1 Black Emperor Temple Reservoir is to rely on fluvial camp force and is accompanied by a wave geologic forces, to delta front sub facies of strata formation, which is located in the central depression of Songliao basin depression area, Qijia Gulong sag of Southern Puxi nose like structure of the front shaft, the central fault Zone cutting <sup>[3]</sup>. Black two reservoir is mainly delta front sub facies, and the main source is from the north.

### **II. Sedimentary facies**

#### **1. Division and comparison of sedimentary time units**

Depositional time unit is in sedimentary unit time segments and the whole system contrast, plane sedimentary microfacies of the most basic and important task, and a direct impact on the reservoir study and understanding of the fine degree and degree of accuracy, the author to 310 wells in the region of the region's fine contrast and the X1B3-A0 stratification standard well, and the original six layer segment to 14 depositional time unit.

#### **1.1 Fine division of sedimentary time units**

The author through to the standard hierarchical well section of each depositional time unit with the separability research, concrete is divided into: obviously, basic points, barely points, can be divided into four categories, the region's four stage can be well accounted for 88.7%. As a result, H22 small layer can be subdivided into four depositional time unit; the region II can be well accounted for 99.68%. According to this, H24 small layer is subdivided into two depositional time unit; the region three period can be well accounted for 75.49%. Therefore, the H25 subdivided into three depositional time unit. Finally, the original 6 small layer of the black two oil layer is subdivided into 14 sedimentary time units, and the basic one is the single phase sedimentary.

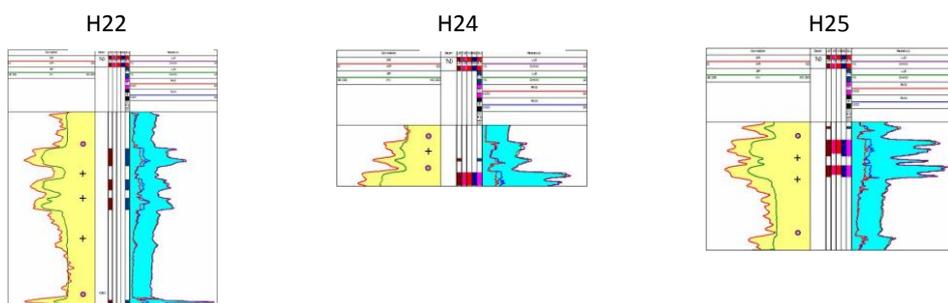


Fig. 1 The sedimentary time units of the H2 reservoir formation in the ancient 1 block of Daqing,

Preferred system core, sandstone, multiple layers, channel sand body development, cycle is obvious, with vertical to the separability and drilled Heidimiao oil layer thickness is moderate "well X1B3-A0 stratification standard wells (Figure 1).

### 1.2 Fine contrast of sedimentary time units

The study area is wide and well spacing, have a certain impact on the realization of accurate time unit fine contrast. The the theory of high resolution sequence stratigraphy <sup>[4]</sup> ", " fluvial sedimentology <sup>[5]</sup> ", well correlation method is proposed in this paper, planar pattern comparison method, about 7000 well level fine layer contrast analysis, basically solved the problem of correlation of formations in the region.

The standard location starting point as a reference, comparison study area skeleton profile. First of all, from the time of deposition, the standard well X1B3-A0 is set out along the closed framework, and the contrast and the level of the black emperor temple in the research area are compared. If the well is not closed, then check the contrast process before all the wells are closed. Then, the sandstone group is compared, until the closure, the following sequence of small layer, the deposition time unit closed. And this is accomplished by the comparison of the sedimentary time units of all the well layers in the closed framework section. After comparing and closing the well controlled skeleton profile with a closed framework section, the well is closed, and all the development wells are closed.

### 1.3 Research area comparison method and results

#### 1.3.1 Standard layer control under the approximation

By comparing the marks to control the region's formation in the study area, control layer 2 standard approximation comparison (Figure 2) three level 1 signs were identified. Two level 2 mark, top and bottom of each find a sign, in the logo layer control approximation comparison HII reservoir group of top surface marker, HII2 top, large sets of sandstone, grade II development marks a > development stable mudstone, class I markers b > development set of sandstone, grade II markers b > development large set of sandstone, grade I mark C, large sets of sandstone, stable mudstone, bottom.

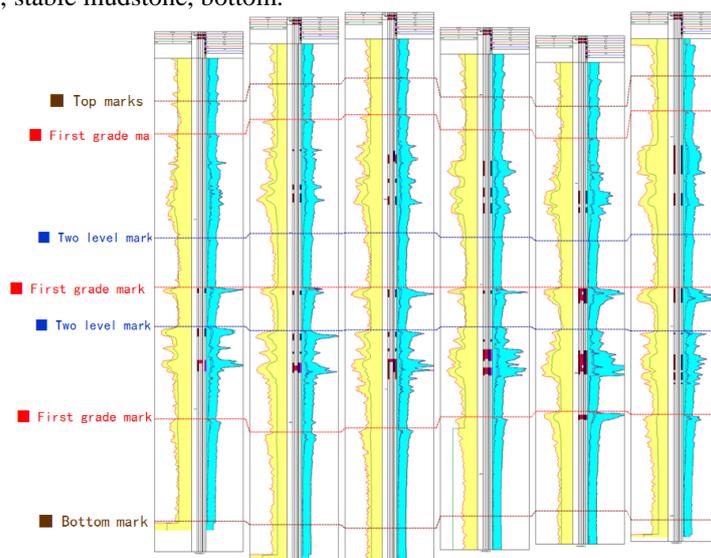


Fig. 2 Standard layer contrast control chart

### 1.3.2 Regional well seismic contrast control of long-term base level cycle sequence stratigraphic correlation

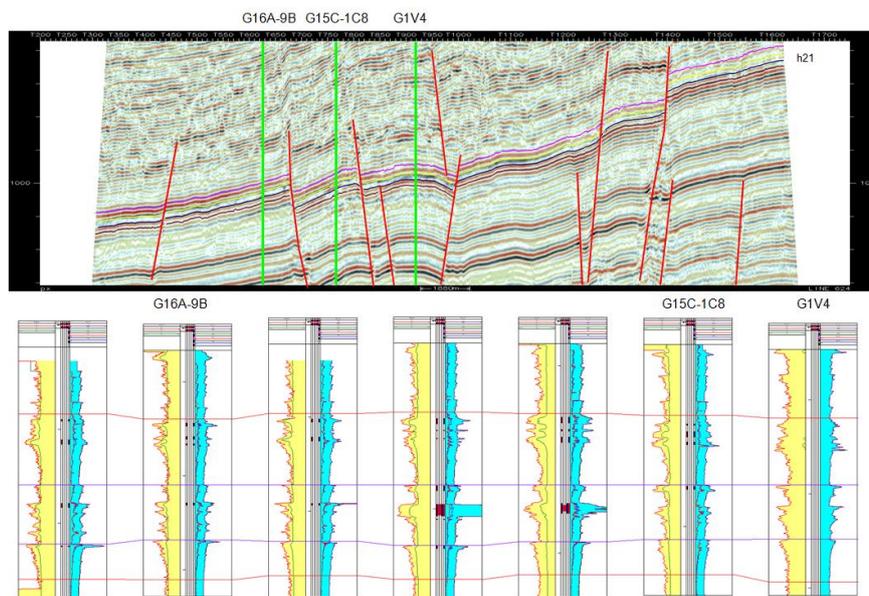


Fig. 3 Comparison of the "well seismic combination" of the black emperor temple in the study area

Although the seismic data on the thickness of the thin sand shale layer compared with great difficulty, but the seismic data (Figure 3) can judge the formation macroscopic thickness variation trend and for subsequent comparison has a certain reference value.

### 1.3.3 With the guidance of the same fault mode

Through the establishment of syngenetic fault pattern, has a guiding role for the same fault or fault in different two sets of comparison, as drop plate is thickened, what small layer thickening, growth index size, vertical and parallel sections in the direction of the thickening of formation of (Figure 4).

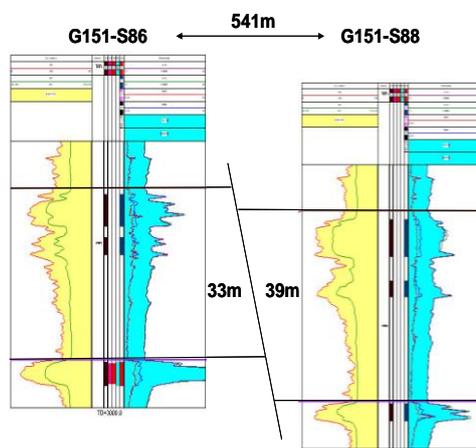


Fig. 4 Comparison of the model of the same students in the section

## 2. Log micro facies model

Through the scanning data of cores and core data analysis, with well layer corresponding to the selected well logging curve, analysis the microfacies log phase factor characteristic and through the multi well with a micro phase logging features, summarize the microfacies were some logging phase factor characteristic, thereby establishing a the microfacies of the logging mode. In the study area, the 2 phases of the 10 phases of the 1 phases are identified.

### 2.1 Underwater diversion channel

Underwater distributary channel microfacies is water distributary channel under the water to the water extends with typical erosion on the bottom of discontinuous surface, positive rhythm and River vertical features, and land on the river have obvious difference, such as underwater distributary associated; energy reducing, at

the bottom of retention was not obvious; in thick sandstone thickness and the grain size is fine; within the Tao and the interlayer with underwater bedding <sup>[6]</sup>. Log curve is a typical bell type, the bottom of the mutation, the top gradient.

## 2.2 Mouth bar micro facies

Mouth bar microfacies <sup>[7-10]</sup> prosodic features have typical anti prosodic features, thickness larger and at the top has obvious horizontal or wavy surface characteristics of mutation; lithology is primarily siltstone develops massive bedding. The log curves are thick box type and thick funnel shape, showing a high amplitude difference, local high value, showing the top of the mutation characteristics.

Because the study area the most important micro facies and sand body types is mouth bar, so the estuary dam further subdivision of estuarine dam body, a mouth bar, mouth bar, mouth bar edge, mouth bar, the outer edge of the five sub facies.

## 2.3 Far sand dam

Far sand dam crest to the surrounding energy gradually low, particles tapering, bedding size gradually smaller, mud matter content increasing, the thickness is thin gradually, of getting poor; and retain the typical reverse rhythm, mutation at the top, at the bottom of the gradient, wave bedding, dome shaped etc. far sand dam common <sup>[3]</sup>.

## 2.4 The micro facies of the mouth bar

Mouth bar micro facies sedimentary thickness is relatively large, the lithological composition is mainly composed of grayish black mudstone and silty mudstone and the characteristics of logging curves for low amplitude and amplitude difference; linear or linear clip tooth.

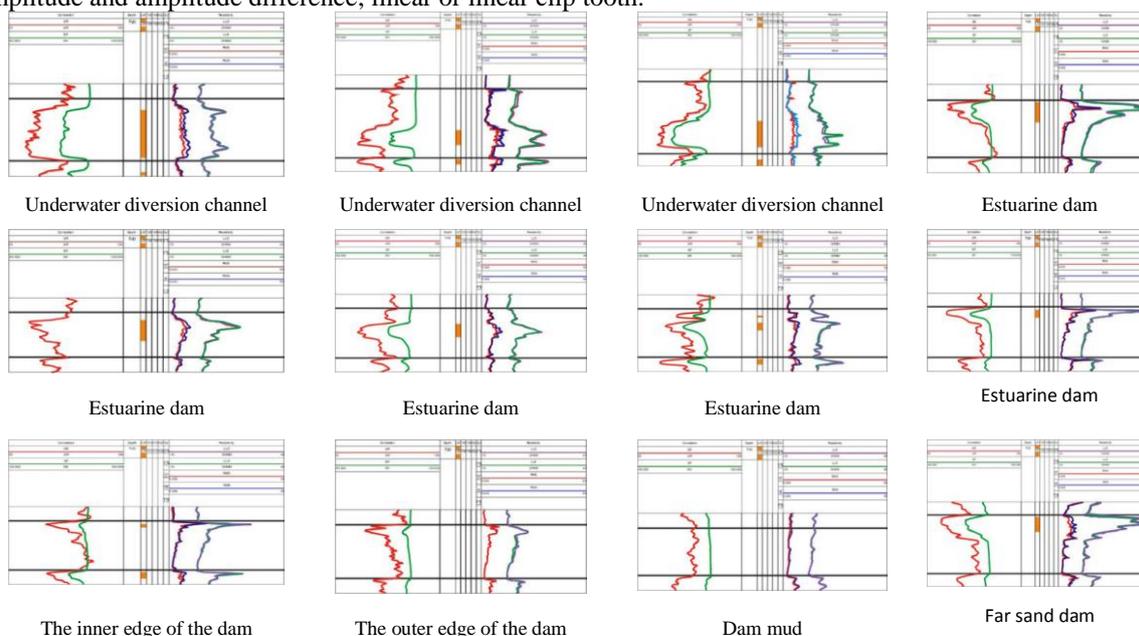


Fig. 5 log facies model of the ancient 1 block of the western oil field

## 2.5 Sedimentary microfacies and spatial distribution of single sand body

The study area in Heidimiao oil layer in the sandstone, contour map and sandstone thickness isoline figure shows, the black Emperor Temple Reservoir during the deposition of the sand percent content mainly along the north to the south to reduce thin, black oil layer 3 sand group H25, H26 two layer has 4 branch only determined from the North South direction distribution distribution channel sand body, through the research of heavy minerals data and found basically the same as the direction, not only the existence of the northern provenance. Based on comprehensive indexes and phase space matching relation of genetic single sand body of fine description, so as to establish the two black oil reservoir group six layer 14 depositional time unit of plane sedimentary microfacies distribution of single sand body figure. In addition to H22-4 and H25-3, the study area is the delta front sub facies, and the characteristics of some key sedimentary time units are described.

**(1) The H22-1 time unit plane sedimentary microfacies**

The h22-1 time unit is a delta front sub facies, which is dominated by the water diversion channel and the mouth bar. River from north to south is a branching distribution, which identified seven river body, 13 a kind of underwater distributary channel, 11 second class of underwater distributary channel; channel width is 150 ~ 550m, belonging to medium-sized distributary channel. Also identified, 3 a mouth bar, 21 second mouth bar. At the same time, the development of cut into block dam edge by mouth bar, large area development at the outer edge of the dam. Sedimentary microfacies in the plane was the overall distribution of north south direction, main river development in a class of distributary channel, second class distributary channel in a class of distributary channel front-end, or independently forms a river, river around by inward on both sides were developed a kind of mouth bar, two categories of estuarine dam, the inner edge of the dam, dam edge.

**(2) The H25-1 time unit plane sedimentary microfacies**

H25-1 time unit is located in the delta front sub facies, which is mainly based on the water diversion channel and the mouth bar micro facies. Which developed North to south is dendritic and banded distribution channel, identified water distributary channel subject. 7 a water distributary channel, channel width for 180 ~ 260m, belongs to the small underwater distributary channel. Also identified three estuarine dam body, 3 a mouth bar, 6 second mouth bar, one far sand dam body, one far sand dam, large area development on the inner edge of the dam, dam edge, between the dam and the mud. Sedimentary microfacies in the plane was the overall distribution of north south direction, the main channel distribution in a class of distributary channel internal, on both sides of the river from the inside outward are respectively developed estuarine dam body, a mouth bar, mouth bar, the periphery area development is the outer edges of the patchy distribution of the inner edge of the dam, the dam. Far away from the main channel, the main body of the far sand dam is located in the front of the diversion channel, which is in the shape of the distribution, and the outer development is far from the sand dam.

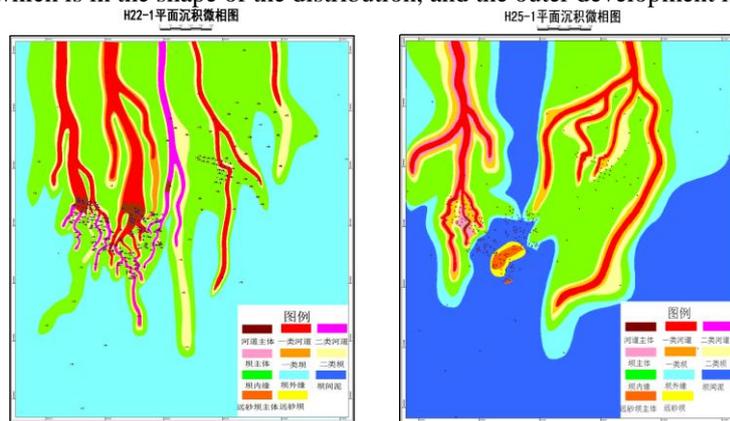


Fig. 6 Micro phase diagram of the fine plane of the deposition time unit

Through research, there are two modes of the combination of the sedimentary facies in the black emperor temple oil layer (Figure 7). One is the combination of the middle and small narrow branch water diversion channel and the sand layer. Channel is narrow dendritic distribution, width is 170 ~ 680 m plane changes fast, spread from north to south, in the mid to small water distributary channel is the main, channel sand body, well controlled rate is about 71%. This type of combination, mainly developed in H22, H26 layer. The other one is the combination of the channel and the far sand dam (Figure 8). This kind of mode to ~ Mini underwater distributary channel based, on both sides of the river fragmented mouth bar is developed and the direction perpendicular to the channel is in sheet and strip development far sand dam features into the thick sandstone, reservoir is better, this type of combination, mainly developed in H23, H24, H25 layer.

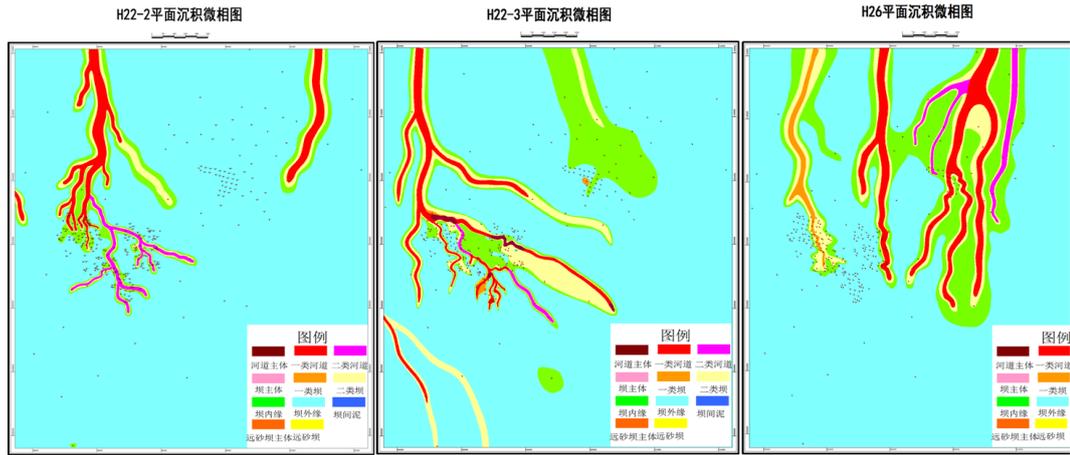


Figure 7. A combination of thin and thin, narrow, narrow, narrow, branching, and sand.  
H24平面沉积微相图 H23平面沉积微相图 H25平面沉积微相图

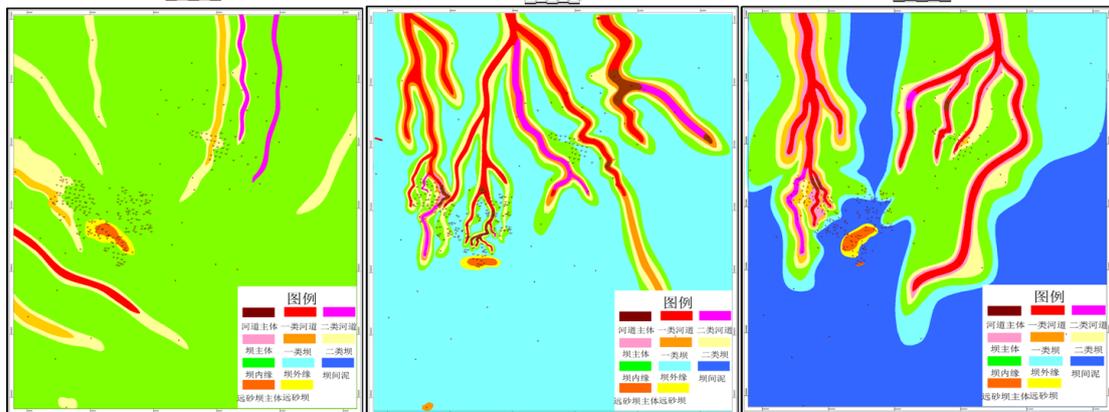


Figure 8. A combination of small, narrow, nar channel row, branching, and far - sand - and - bar - eshapd

### III. Standard well analysis reveals the vertical sequence of sedimentary time units of the black emperor temple

Through the vertical log curve of the black emperor temple oil layer, the vertical sequence of the black Emperor (as shown in Figure 9) is revealed:

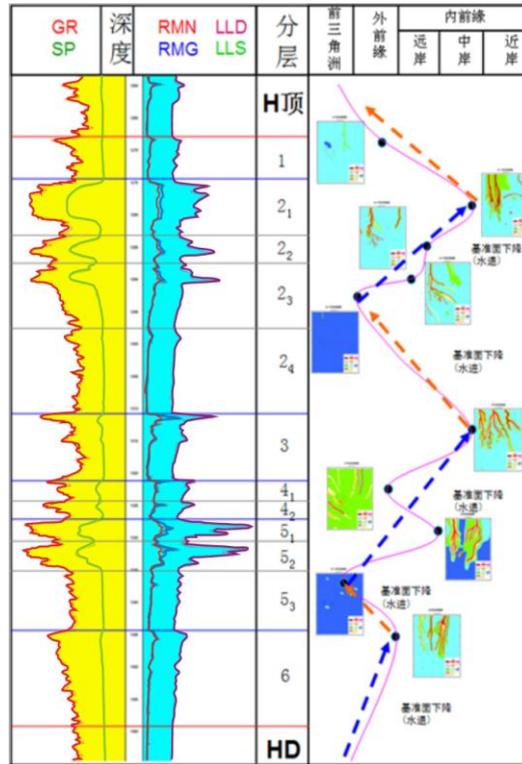


Fig. 9 vertical sequence evolution of the black emperor temple

The retreat point maximum withdrawal; to H22-3 prior to genus; H22-4, belonging to the H25-2 prior to genus; from the vertical sequence can be clearly seen, and H26 belongs to delta front, the development of small underwater distributary channel H25-3 River Delta Delta sub facies, from H23-1 triangle delta front the development of small underwater distributary channel, typical estuarine dam the River Delta sub facies, from H22-1 River delta delta front, and developing small underwater distributary channel and mouth bar H21 belongs to delta front, the development of a small area of the mouth bar, so the black Emperor Temple Reservoir as a whole was "slow water quickly withdrawing water into the base surface precipitation environment, which H22-1 water.

#### IV. Vertical and planar characteristics of sedimentary microfacies

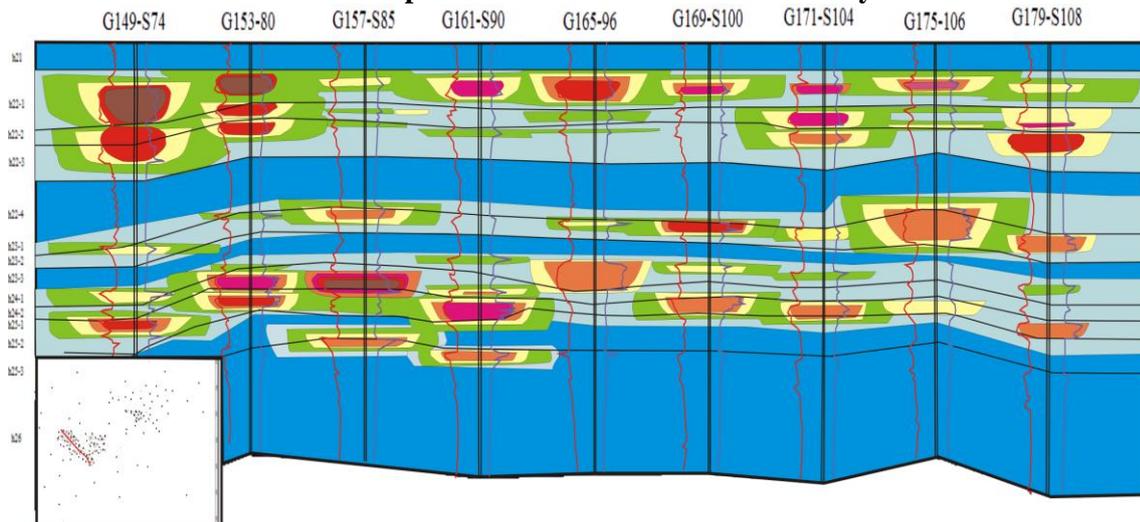


Fig. 10. G149-S74 ~ G179-S108, the sedimentary facies and microfacies of the reservoir in the black emperor temple.

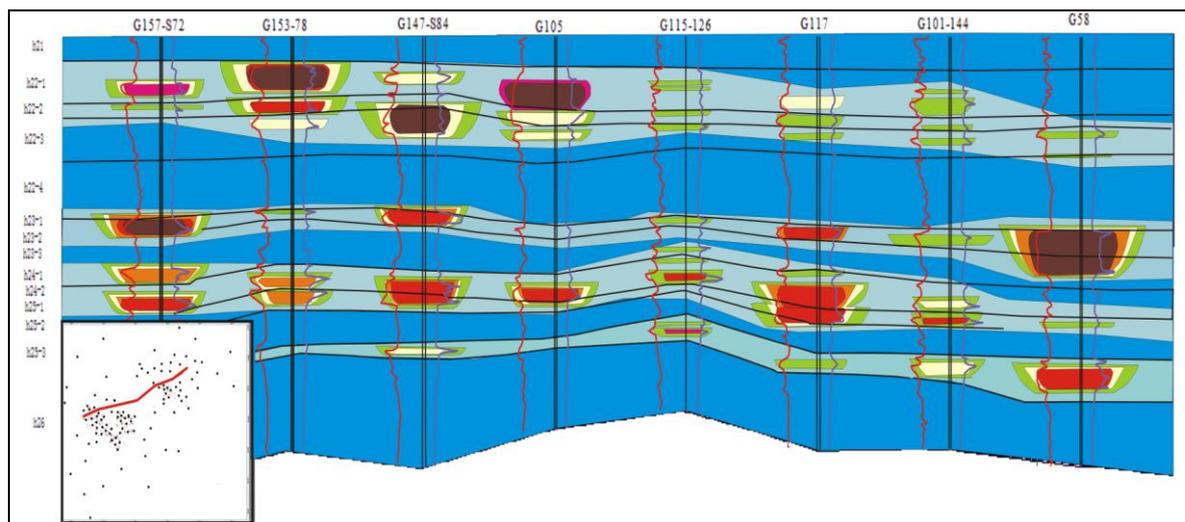


Fig. 11. G149-S74 ~ G179-S108, the sedimentary facies and microfacies of the reservoir in the black emperor temple.

In order to analyze the continuity of sand bodies in the vertical, the distribution of 2 sand bodies is established. Near the northwest to, the Near East and north to 2 sandbodies correlation profile (Figure 10 and 11), from the figure can be seen, sand body and development of sand body scale, sand body of lateral continuity and sand body profile geometry has the following characteristics:

(1) sandstone concentrated development in small h22-1, h22-2, h22-3, h23-1, h23-2, h24-1, h24-2, h25-1, h25-2 etc. layer, multi water diversion channel sand, mouth bar sand) [4-6], four sets of sand vertical is blocked by the five sets of mudstone.

(2) on the scale of the development of sandstone, the sand bodies of the whole upper to the north are relatively well developed, and the development of the sand bodies in the south is relatively poor;

(3) in the form of sand body, there is a view of the sandstone and the sandstone lens, which indicates that there may be some potential for the reservoir in the black emperor temple.

## V. Conclusion and cognition

(1) By comparing the fine contrast of the 310 wells in the ancient 1 block of the western oil field, the original 6 small layer of the black emperor temple oil layer is subdivided into 14 sedimentary time units of the single sand body level.

(2) To establish the study area delta sedimentary system of 12 kinds of sedimentary micro facies and logging facies model and identified every sand group 14 depositional time unit plane sedimentary micro facies and single sand body space distribution characteristics.

The outer edge of the inner edge of the three main river is divided into two, in addition to the group 1 (3) Puxi oilfield ancient block 1 black oil reservoir, 3 sand group H22-4 H25-3 layer triangle delta sub phase and the rest are for the underwater distributary channel and mouth bar of delta front deposition, the development of underwater distributary channel, mouth bar, distributary mouth bar, far sand dam 4 types of sedimentary microfacies, and underwater distributary channel, a class of distributary channel and the second class of distributary channel energy unit, and the river mouth bar microfacies and subdivided for estuarine dam body, a mouth bar, mouth bar, mouth bar, mouth bar 5 energy unit, far sand dam further subdivided as far sand dam body, far sand dam 2 energy unit.

(4) Two black oil group 1 sand group in the depositional time unit to water diversion channel, mouth bar, two micro facies and sand 2 group in each time unit to water diversion channel, mouth bar, bar dominated, followed by the far sand dam.

(5) H23, H25-1 and H22-1 are the main reservoir in the black two reservoir, which is the main reservoir, which is the basis for the development of the oil field and the search for the remaining oil.

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