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Analysis of Log Facies of the Test Area in Nanqi Area of Saertu Oilfiled, Daqing

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Abstract: This essay use the contact relation between the amplitude, shape, or, smooth degree of conventional log natural gamma ray, natural potential, deep lateral resistivity curve to analysis The sedimentary facies in the study area . According to the characteristics of different logging facies, 3 sedimentary facies and 26 sedimentary microfacies are identified. Including the micro facies of the heart, braided channel, the micro channel of the channel, the sand of the overflow, the microfacies of the sand table. On the basis of the identification of well logging facies, the micro phase diagram of the representative layer is precisely plotted.

Keywords: sedimentary facies ,logging facies, 26 sedimentary microfacies, micro phase diagram.

INTRODUCTION

The songliao basin across Heilongjiang, jilin, liaoning province and Inner Mongolia , Most in heilongjiang and jilin province, Surrounded by mountains and hills around [1]. The basin is divided into seven first-order tectonic units : Southwest uplift area, northwest slope area, central depression area, northern dumping area, southeast uplift area, northeast uplift area, Kailu depression Uplift area. Changyuan Daqing is the second stage structural unit which located in the central depression area and formed by 7 Anticlines: Lamadian, Saertu, Xingshugang Taipingtun, Putaohua, Gaotaizi, aobaota[2]. The songliao basin deposites Mesozoic Cenozoic strata. Mesozoic Cretaceous develops Huoshiling Formation , Shahezi Formation, Yingcheng Formation, Denglouku formation, Quantou Formation, Qingshankou formation, Yao Jiazu formation, Nenjiang formation, Sifangtai formation, Mingshui formation from bottom to top. Cenozoic Era Paleogene Oligocene develops yian formation. Cenozoic Era Neogene develops daan formation and taikang formation.

This essay' s research area is located in the East of South seven area, Sanan Oilfield (Development Zone), Daqing Placanticline. This essay ' s research area contains 390 wells,390 wells contain Basic wells, First Infill Wells, second infilling wells, third infilling wells, Polymer flooding wells. Research area ' s purpose horizon is PI1-4. Buried depth is about 1100-1200M. The research area is located in the east of 1700 fault, east of South seven area, The mining area is about 1.92km^2

The main oil-bearing formation contain a great deal of Sandstone, muddy sandstone and it have a certain amount of calcareous sandstone , Most of rock particles are a bit thick, have high roundness. Most of Grain' s shape are between 0.1mm and 0.2mm , middle sorting. Most of grains are contact cement type , have a large amount of politic cementation, have a small amount of iron cementation and calcium cementation. bedding structure involve parallel bedding , Wavy bedding and oblique bedding[3].

MATERIAL AND METHODS

Electrofacies analysis

Different combination features of Sandstone, mudstone and calcareous sandstone In horizontal and vertical form p11-4' s sedimentary facies, Different rock characteristics and different electrical characteristics determine different Log response on sedimentary facies and it leads different logging typical.

Delta plain facies

PI2a, PI2b and PI2c three time units belong to delta plain facies , PI2c,s characteristic of deposition is different from PI2a and PI2b. PI2c,s characteristic of deposition is braided channel . we can draw the conclusion from analyzing well log that the Deposition morphology of braided channel evolved from meandering river . Here, the "kind heart beach micro phase" is a succession of micro phase, evolved from Meandering river beach. So there is not so much well show obvious characteristics of the core of the heart, but has a very good point of the characteristics of the dam. Overall, PI2c depositional time unit develops kind heart beach microfacies, sedimentary microfacies of braided channel , sedimentary microfacies of thin layer

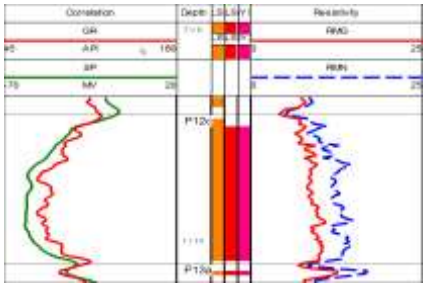
sand. PI2a and PI2b is normal distributary plain subfacies , mainly include: distributary channel microfacies, thin sand overbank microfacies, crevasse channel microfacies and distributary mud microfacies[4] .

1. Kind heart beach microfacies

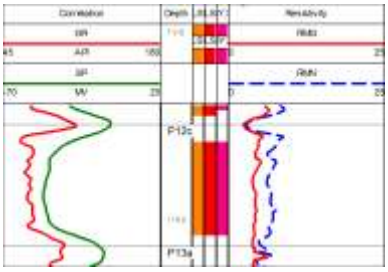
Kind heart beach microfacies : The formation of this form is due to the frequent meandering river diversion, changes in climate and environment. It inherits the sedimentary characteristics of the meander point bar and then the characteristics of the transformation of their own. Rhythm features are complex, in which the normal rhythm, the counter rhythm, the rhythm and the rhythm of the complex are all complex.

The first kind heart beach microfacies: Micro electric potential and gradient curve are high - and especially high amplitude, high amplitude.In the case of the natural gamma ray and natural electric potential curve, clock type and box type is the main type, but the box is the main type and the micro tooth is changed. Effective sandstone thickness is greater than 5m. the total thickness of the two types of sandstone is generally greater than 6m. The physical property is excellent, and the mutation of the bottom is obvious.

The second kind heart beach microfacies: The characteristic of log curve is basically a kind of narrow version of the first heart microfacies. Resistivity curve is middle and high amplitude and Curve shape is also the clock, box type . Effective sandstone thickness between 4m to 5m, the total thickness of the second types of sandstone is generally greater than 5m. Good physical properties. Curve has multiple returns and develops thin layer .



First kind heart beach



Second kind heart beach

2. Micro phase of the diversion channel

Micro phase of the diversion channel and swamp deposit formed the main body of the sub facies of the diversion plain. It, s sedimentary characteristics are similar with fluvial deposit. It has typical dual structure. Prosodic feature is that coarse particles exist In the lower part and fine particulate exist in the In the upper part. It develops plate and trough cross bedding. Medium sand and fine sand is Major particle types. Grain size is thicker than the thin sand of outside. Log curves, s type are mainly bell type and box type. The thickness of sandstone is more than 2m. Permeability is medium and high[5].

First class river: resistivity microelectrode curves are high - and especially high amplitude . Resistivity values are generally not less than 18Ω·m. it, s type is mostly box type and gear box type whose Bottom suddenly change, top suddenly change or gradually change. The total sandstone thickness is more than 5m, and the effective sand thickness is more than 4m, and the physical property is good. Top resistivity curves have cone peak.

Second class river: Micro gradient and micro potential curves are high amplitude. it, s values are generally not less than 16Ω·m. Curve, s type is mostly bell type or box type , which have obvious suddenly change at the bottom. The total sandstone thickness is more than 4m, the effective sand thickness is more than 3m, and the physical property is good.

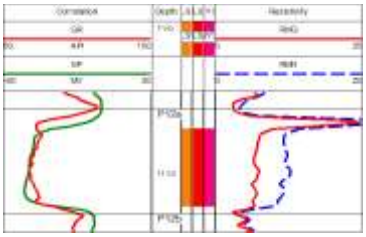
Third class river: Micro electric potential and gradient curves are medium - high amplitude. he value of resistivity is generally not less than 14Ω·m[6]. The main curve type is the type of bell. Log facies have obvious positive rhythm and suddenly change at the bottom. The total sandstone thickness is more than 3m, and the effective sand thickness is more than 2m, and the material property is moderate.

Fourth class river: Micro electric potential and gradient curves are medium amplitude. The resistivity value is generally about 12Ω·m. The main curve type is the type of bell. The total sandstone thickness is generally less than 3m, the effective sand thickness is generally less than 2m, the physical property is poor.

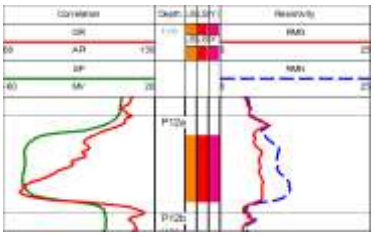
River side: The whole channel is located at the top of the depositional time unit. The resistivity curve is generally high and high amplitude . At the bottom of the river, there are obvious abrupt change, and the lower part of the channel is mudstone or mudstone.

Abandoned river: The abandoned channel is generally opposite to the river side . The abandoned

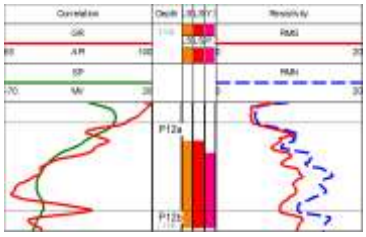
channel sandstone is located at the bottom of the sedimentary time unit. Micro electric potential and gradient curves are Middle - high amplitude. The effective sandstone thickness is about 2m, and the physical property is good. The upper curve is flat or slightly dentate.



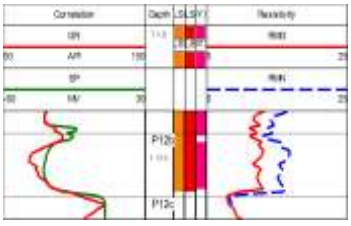
First class river



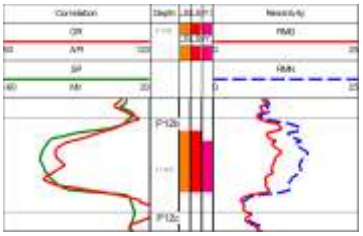
Second class river



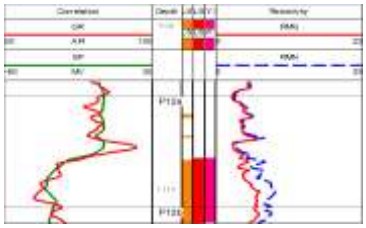
Third class river



Fourth class river



River side



Abandoned river

3. Overflow sand microfacies

According to the characteristics of the log curve of non channel sand body, the development of sandstone and effective sandstone, and the distance between the river and the river, And weaken their specific cause, the non channel sand body is divided into five types.

Main overflow sand : Generally , effective sandstone thickness greater than 1m. Log curves show multi - finger and multi - tooth type, Permeability is low to medium.

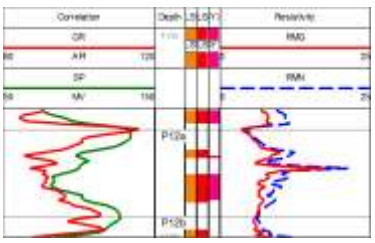
First overflow sand: Generally , effective sandstone thickness greater than 0.5 m. The type of well logging curves is multiple fingers and teeth.

Thin sand and mud superimposed on each other. Permeability and porosity is low.

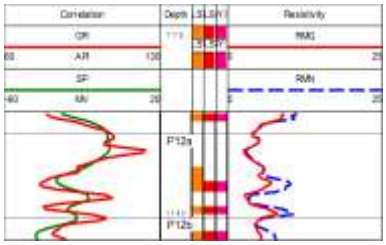
Second overflow sand: Effective sandstone thickness is generally between 0m~0.5m. Log curves are characterized by the dentate and low amplitude. Permeability and porosity is low.

Third overflow sand : no effective sandstone thickness, generally, sandstone thickness is greater than 0.2m. Characteristic of well logging curves is low amplitude and multi tooth shape. Permeability and porosity is very low.

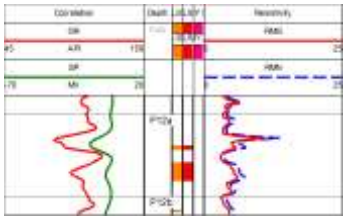
Fourth overflow sand: No effective sandstone thickness, generally, The thickness of the sheet is more than 0.2m. well logging curves are Low amplitude and multi tooth. Permeability and porosity is lower than any of others overflow sand.



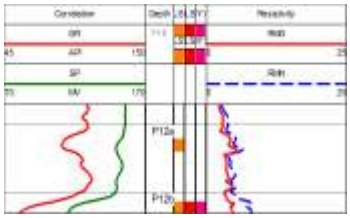
First overflow sand



Second overflow sand



Third overflow sand



Fourth overflow sand

4. Interdistributary bay

No sandstone interpretation thickness. Log curve is basically flat, no ups and downs .

Delta front sub facies

Delta front facies is dominated by water environment, controlled by Rivers and lakes. It belongs to the weak reduction environment. The quality of fossil increases . The main types of the particles are fine sandstone. Channel energy becomes weak The delta front sub facies is divided into inside delta-front facies and outside delta-front facies. inside delta-front facies develops end of the channel terminal and outside delta-front facies develops no channel. PI1a and PI1b is inside delta-front facies . PI3a,PI3b,PI4a and PI4b is outside delta-front facies.

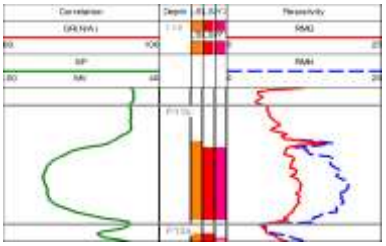
1. Underwater distributary channel

The extension section of the water diversion channel of the diversion plain, and river energy becomes weak[7].

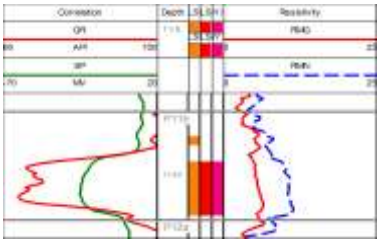
Grain size becomes thin. The thickness becomes thin. The channel size becomes small. Shape is the shape of the tree, the shape of the rod. Log curves are high amplitude. The main type is bell type and box type . Curve thickness is smaller than that of the water diversion channel.

First class river: Log curves have suddenly change at the bottom. Rhythm type is positive rhythm. Log Shape has obvious bell and box type. The effective thickness of sandstone is generally greater than 3m, and the thickness of the total sandstone is more than 4m, and the physical property is better.

Second class river: Micro electric potential and micro gradient curves are middle and high amplitude. The shape of the whole curve is mainly in the shape of the bell. Effective sandstone thickness is generally greater than 2m, there are also a few wells effective sandstone thickness less than 2m. Good physical properties.



First clas river



Second class river

2. Sheet sand microfacies

Sheet sand microfacies controlled by rivers and lakes, with different size and form. According to the difference of thickness and physical properties ,mat sand have a distinction. The thickness of good sheet sand microfacies is generally larger than 0.5m, and they develop in the side of the river. The physical properties are relatively good. Log curves are middle and low amplitude . Not good sheet sand is the extension of main sheet sand. Physical properties are relatively poor. The thickness of sandstone is generally less than 0.5m. Some only have a surface sandstone, no effective sandstone reservoir.

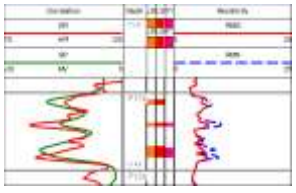
First sheet sand microfacies: effective thickness greater than or equal to 0.5m. The shape of the log curve is mainly in short form. Porosity and permeability is good.

Second sheet sand microfacies: The effective thickness is more than 0m, and the physical property is generally. The shape of well logging curve is mainly in the shape of the tooth.

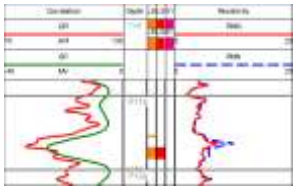
Third sheet sand microfacies : there is no effective sandstone, the overall sandstone is also thin, about 0.5m

Fourth sheet sand microfacies: There is no effective sandstone, the surface of the sandstone is generally about 0.2m.

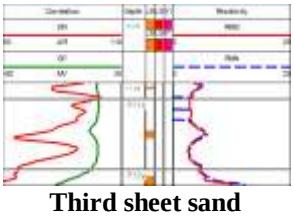
Mud: the mud is deposited, and the log curves are nearly flat.



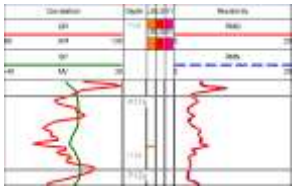
First sheet sand microfacies



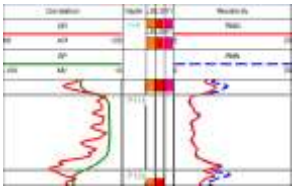
Second sheet sand microfacies



Third sheet sand microfacies



Fourth sheet sand microfacies



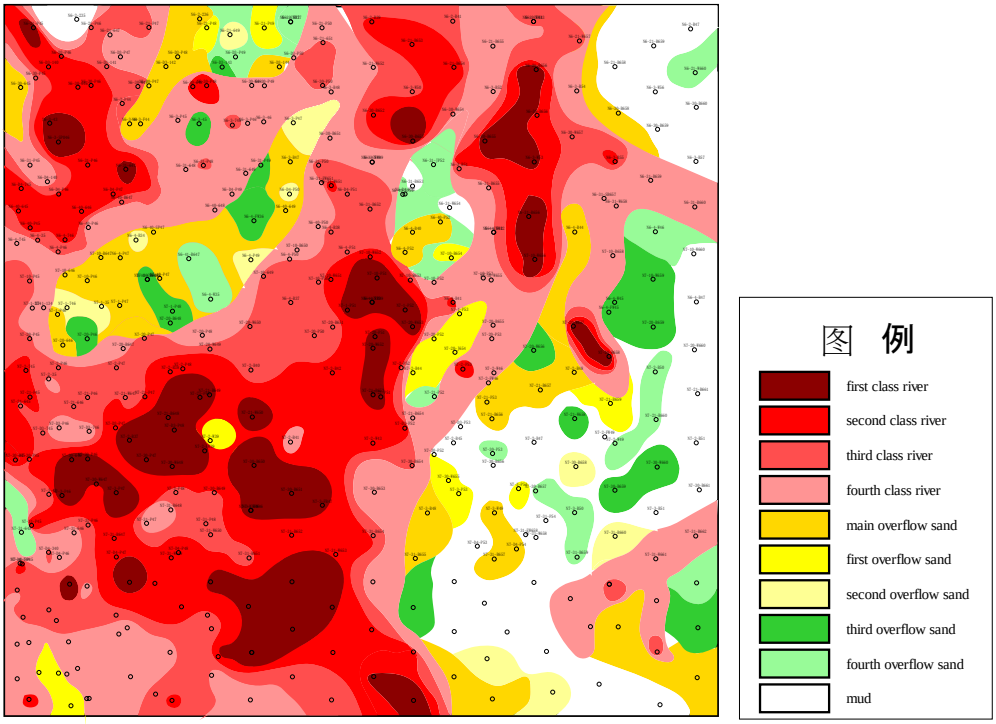
Mud

The plane distribution of sedimentary microfacies

Delta plain facies microfacies type

The micro facies analysis of the PI2b deposition time unitp12b is typical of the delta plain facies microfacies type: small to medium-sized diversion channel, bursted channel, branch channel, overflow sand, mud. Specific micro phase type: first class river, second class river, third class river, fourth class river. Main overflow sand, first overflow sand, second overflow sand, third overflow sand, fourth overflow sand.

Micro facies plane distribution: The main river is near North South, and we identified 5 rivers.（2small 3 middle）, five rivers flow together on the left area. The region contains a total of 390 wells and About 252 wells drilled in the channel. Drilling case coverage rate reached 64.6%. The non channel sand body is small, and they develop on both sides of the river.

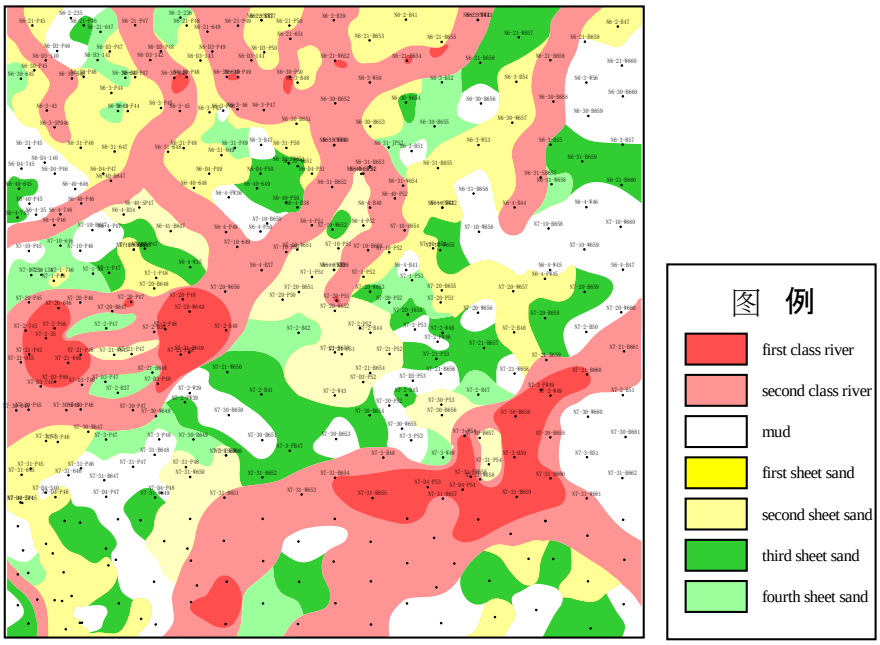


The micro facies analysis of the PI2b deposition time unit

Inside delta front facies micro phase type

The micro facies analysis of the PI1b deposition time unit: PI1b is typical of the inside delta front facies micro phase type: small to very small diversion channel, branching channel, Sheet sand, mud[8].

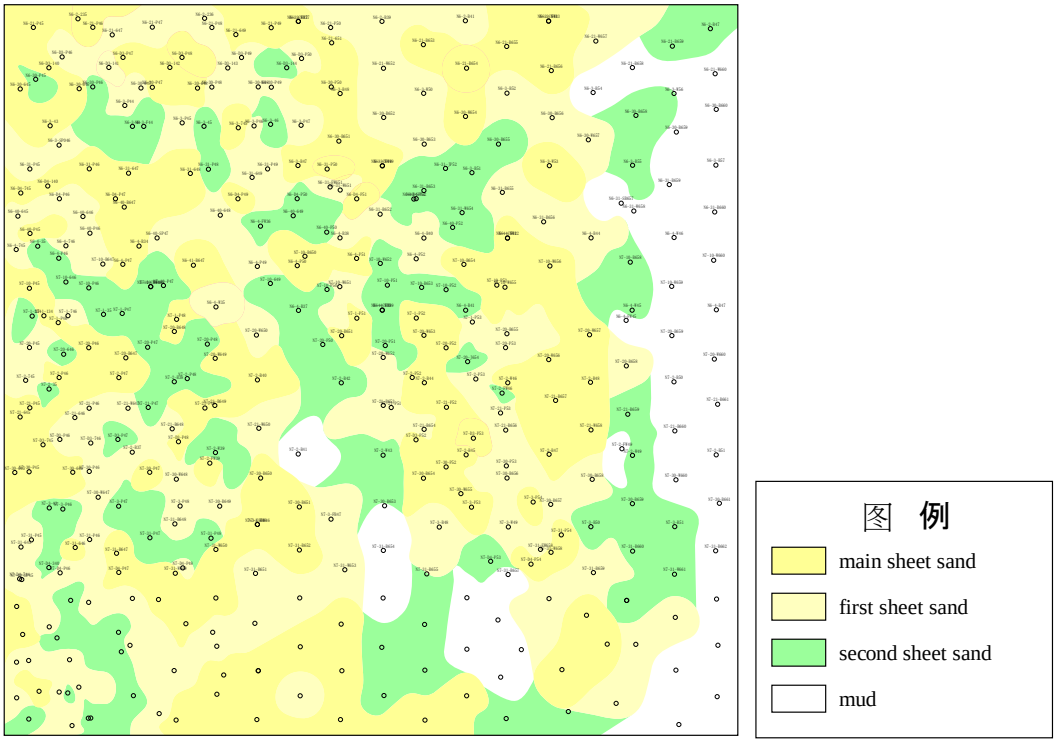
Micro facies plane distribution: The main river is near the north south. A total of 7 small rivers are identified and 6 rivers developed on the upper left side of the study area. The other river developed on the lower right side of the study area. The region contains a total of 390 wells and 132 wells drilled into the river. Drilling case coverage rate reached 33.9%.



The micro facies of the PI1b deposition time unit

Outside delta front facies micro phase type

The micro facies analysis of the PI3a deposition time unit: PI3a is typical of the outside delta front facies micro phase type , and develops no diversion channel. Sheet sand and mud is the main sedimentary micro facies. Sand bodies are not very well developed, and the physical properties are poor. Main sheet sand and first sheet sand ratio is great, accounting for 75.9% of the total in which main sheet sand accounting for 34.4% of the total and first sheet sand accounting for 34.4% of the total.



The micro facies of the PI3a deposition time unit

RESULTS AND DISCUSSION

We analyze the following contents: The shape of log curve, the amplitude of log curve, The degree of tooth of log curve, the thickness of the sandstone, the thickness of the outer sandstone, the thickness of the effective sandstone. At the same time, i make a representative layer of the sedimentary phase diagram and get the following conclusions:

1. At P1 1-4 deposition, The research area develops diversion channel, overflow sand, underwater diversion channel, sheet sand, mud and so on . Main sand body type is diversion channel and underwater diversion channel In the study area.
2. In the log phase analysis, the form log curves, the shape of Log curves, and thickness of effective sandstone. Meanwhile , I refered previous literature and the ancient geographical features .
3. Delta plain facies mainly include the diversion channel in research area .Inside delta front Mainly include underwater diversion channel in research area. Outside delta front develops no channel in research area.

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