Research and Understanding of Reservoir Sedimentary Facies Characteristics in New Drilling Area

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Abstract. After more than 50 years of development, Daqing Oilfield has gained a lot of knowledge in basic geological research. But because of the new drilling area increased in recent years, with the increasing density of the well pattern, there are certain problems in the study of sedimentary facies characteristics and the recognition of sedimentary patterns in the new drilling area. Therefore, the new drilling area needs to be improved and re-recognized on the basis of the study of the whole secondary stratum and the sedimentary facies of the whole area, so as to further drive the overall re-recognition of the geological characteristics of the entire development area and the geological characteristics of sedimentary unit-level structure modeling and numerical simulation, so as to further consolidate the geological foundation of oilfield development.

Keywords: New drilling area, reservoir deposition, geology.

1. Problems in the understanding of sedimentary facies in the new drilling area

1.1. The inner stratum of the new drilling small block, the layered boundaries of each block are inconsistent
The new drilling block has an independent stratum, which is not completed on the basis of the second overall stratum, resulting in inconsistent layering boundaries between the blocks.

1.2. The prediction accuracy of the sand body at the edge of the new drilling block is low, and the overall understanding of the whole area is lacking
The new drilling block is encrypted to re-recognize the sedimentary facies belt map. In the past, it was not based on the sedimentary facies belt map of the whole area, but only sketched inside all wells in the drilling area, so the wells in the side of the block have low prediction drawing accuracy, concrete manifestation in: the combination of the channel sand on the side, the continuity is unreasonable, or the direction of the channel distribution is not clear.
2. Research on the sedimentary facies of dense well pattern in the study area

2.1. Research on the secondary stratum of the whole region
All wells in the study area have established a perfect isochronous grid, and on this basis, and then each single well is restratified according to the guidance of the vertical composite thick sand system layer comparison technology combining "point, line and surface", so as to realize the unification of stratification boundary of all wells.

2.2. Research on sedimentary facies of different sedimentary strata systems in the whole area
The whole area is divided into different types of sedimentary subfacies, establish sedimentary models and description specifications of sedimentary microfacies for meandering river distributary plains, inner and outer delta fronts, and the fine sedimentary models of "channel sands, interfluvial sands and sand dams" were established and completed to guide the genetic characterization of various sand bodies.; clarifies the changes in the distribution of sand bodies in each unit of the "lake line, inner and outer front boundary" to further deepen the understanding of the sedimentary environment in the whole region. Under the guidance of the sedimentary model and sedimentary environment, the rerecognition of the whole sedimentary facies in the whole area was effectively completed, and the drawing of the sedimentary facies' belts of all units in the whole area was completed.

After redrawing the sedimentary facies in the whole region, the overall characteristics change:
First, the geometry of the sand body has changed to varying degrees, the continuity and direction have changed, and the sand body distribution is complicated (Figure 1-1);

![Basic well pattern (16.3 ports/km²)](image1)
![Current well pattern (283 ports/km²)](image2)

**Figure 1.** Unit sedimentary facies belt diagram.

The second is that the probability of penetration of channel sand bodies is reduced, and there are certain on-surface and off-surface sand bodies between the channel sands or the edge zone, which makes the development scale of the channel sand bodies smaller on the plane (Figure 1-2).

![Basic well pattern (16.3 ports/km²)](image3)
![Current well pattern (283 ports/km²)](image4)

**Figure 2.** Unit sedimentary facies belt diagram.
Third, there are few continuous and large-area distributions of in-surface sand bodies, out-of-surface sand bodies and pinch-out areas. In most cases, the distribution of all kinds of sand bodies is small and scattered, with rapid planar phase transition, and the geometric morphology of sand bodies is interphase and staggered distribution of all kinds of sand bodies (Figure 1-3).

![Basic well pattern (16.3 ports/km²) Current well pattern (283 ports/km²)](image)

**Figure 3.** Unit sedimentary facies belt diagram.

### 3. New understanding of the change of sand bodies with different well pattern densities in the new drilling area

At present, the drawing of sedimentary facies in the new drilling area is carried out on the overall research results of the secondary stratum and sedimentary facies in the entire base area. The results are inherited, which can clearly show the difference in sand body distribution before and after the new drilling, with strong comparative, change be clear at a glance. At the same time, the macroscopic distribution characteristics of sand bodies in the whole area can be combined at the boundary of the block to rationally combine the distribution of channel sand, and the prediction accuracy of sand body distribution can be further improved.

The distribution characteristics of sand bodies in the new drilling area are mainly changed in the following aspects:

1. **Identify the new narrow channel**
   In the area that was originally predicted to be mat-shaped sand, the new drilling encountered a narrow subsea distributary channel sand body.

2. **The river channel expands outwards and swings sideways**
   In the originally predicted mat-shaped sand on both sides of the narrow and small underwater distributary channel sand body, the new well was drilled into the channel sand, and the width of the narrow and small channel sand increased, or oscillated to both sides. If a new channel sand body is encountered, the channel is originally predicted to expand outward and increase in width.

3. **River inward contraction**
   At the edge of the originally predicted narrow and small channel sand bodies, the new drilling encounters non-channel sand bodies, the channel sand width narrows and shrinks inward, and the original predicted channel sand width narrows.

4. **Change of direction of river course distribution**
   In the narrow and small channel sand bodies predicted between wells, the new drilling did not encounter channel sand, but in the adjacent well area drilled meets the channel sand. Therefore, the prediction of channel sand between wells was improved, and the channel spread and oscillated.

### 4. Continuity changes of channel sand

On the originally predicted continuous narrow and small channel sand bodies, the new drilling encounters non-channel sand, and now it is predicted to be a discontinuous channel body. For example, if the original predicted channel sand body is drilled into the sheet sand body in the surface, the continuity of channel sand will become worse, with intermittent narrow strips.
Through the fine dissection of the dense well pattern in the new drilling area, five new understandings of the channel sand bodies in the dense well pattern area were proposed to further improve the research on the sedimentary facies of the entire development zone. At the same time, it guides the fine geological research work such as water in different reservoirs, polymer flooding development, precise perforation and sedimentary unit level structural modeling, numerical simulation, etc., which lays a solid geological foundation for the efficient development of oil fields.

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