Study on the Sedimentary Microfacies Subdivision Standard of Type ii B Reservoir in Sanan Development Zone

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Abstract: At present, the object of tertiary oil recovery and development in Sanan development zone has been transferred to type ii B reservoir, aiming at the current situation that the development effect is not ideal at the stage and the characteristics of more heterogeneity of type ii B reservoir. The sedimentary microfacies subdivision of type ii B reservoir was carried out, and the sedimentary microfacies subdivision standard was established by combining qualitative and quantitative methods, which provided a strong support for further improving the quality and increasing the efficiency.

1. Preface

The southern development zone of Saertu oilfield has entered the period of extremely high water cut, and the difficulty of oilfield exploitation is becoming more and more serious. As to the development of the oil transfer to Saertu oilfield in the south four- eight area, mining object for Sa II 1-4 and II 7-14 reservoir, reservoir channel sand smaller, drill encounter rate was only 13%. This block was put into polymer flooding development in 2015. After polymer injection, the injection-production well spacing was further reduced. However, compared with the second class A oil layer with the same injected pore volume, the oil layer was in poor operating condition, with great difference in effectiveness, and the stage development effect was not ideal. The reason is mainly caused by the variety of sand body types, the fast phase change and the strong heterogeneity in the plane of B oil layer. In order to improve the reservoir utilization and improve the reservoir development efficiency, the middle block of the south fifth district was selected as the anatomical object to carry out the research on the subdivision standard of sedimentary microfacies of the second class B reservoir, and the reservoir was finely characterized.

2. Sa II 7-12 high precision fine stratigraphic contrast of sedimentary units

Accurate stratigraphic division and correlation is the basis for further study of reservoir internal properties. The sand body of the target layer in the research area is developed with serious vertical tangential overlap and poor separability, which is a difficult point for stratigraphic classification and comparison. However, there are still Wells with obvious vertical separability, sandstone development, moderate thickness, relative concentration, obvious cycle and large channel sand body, which can be divided into other wells according to these wells.

Through the well layer's comparative analysis, the goal layer, Sa II 7-12 small layers in the original plan in the studied area has reached the degree of single phase of the river (single sand body level). It is divided into six small layers, because Sa II 7-12 in the study area reservoir affected by the channel sand body each cutting, stacking, Wells of the division of sedimentary unit boundaries exist multiple solutions, for accurate division of sedimentary unit boundaries, the correct understanding of reservoir sedimentation, of the target layer has carried on the system.
3. The sedimentary microfacies subdivision criteria for type II B reservoirs were established

On the basis of fine stratigraphic correlation, the classification and study of sedimentary microfacies are carried out. In the study area, a comprehensive phase-determination model combining effective sandstone thickness, formation coefficient and logging was established, and the types of microfacies were refined from 5 to 8.

3.1. Sedimentary types, characteristics and logging microfacies patterns

Objective layer, Sa II within 7-12 belongs to delta front facies, rivers, because of fluvial and lacustrine wave transformation function changes frequently, causing a variety of sand body morphology and combination features.

3.1.1. Analysis of well logging facies

The study of planar sedimentary microfacies in the study area mainly uses well logging data and needs to establish well logging microfacies model. The types and characteristics of sedimentary microfacies are reflected by logging facies elements. In the analysis of logging facies, the following five elements are the most important:

1) Curve amplitude and amplitude difference: mainly used to reflect the lithological characteristics.

2) Morphology: mainly used to reflect the characteristics of vertical lithologic assemblage, that is, the cyclicity. Can be divided into: bell shape (flat bell shape, bell shape, long bell shape, toothed bell shape);Box (flat box, box, long box, tooth box);Funnel shape (flat funnel shape, funnel shape, long funnel shape);Finger shape (single finger shape, multiple finger shape);Tooth shape (forward tooth shape, symmetrical tooth shape, reverse tooth shape);Linear and composite.

3) Cycle amplitude (or thickness): reflects the vertical scale of a single curve shape.

4) Top bottom contact relation: mainly reflects hydrodynamic change speed and degree.

5) Degree of smoothness: mainly reflects the strength and weakness of hydrodynamic changes: smooth, micro teeth, tooth.

3.1.2. Selection of phase determination curve

According to the logging curve can well reflect the "three characteristics" (lithology, physical property, oil-bearing) relationship, shale content, lithological interface and top-bottom contact relationship, cycle property and the requirements of universality and high precision of each well, the microelectrode and spontaneous potential are optimized as the main phase determination curve of logging.

3.2. Quantification of sedimentary microfacies types

In order to quantify the influence of the smoothness of the curve on the phase determination of the classified river channel, the dentalization degree was introduced to quantify the smoothness of the phase curve of the river channel. The dentalization degree was set as k=n/h, where n was the number of interlayers within the effective thickness of the unit and h was the effective thickness within the unit.

When k is greater than or equal to 1, the sedimentary microfacies are judged to be one grade lower. Statistics show that 8.9% of the first class channel and 9.8% of the second class channel are reduced to the second class channel when the effective thickness and formation coefficient are both consistent.

The sedimentary microfacies can be identified and distinguished better by quantitative constraint and well logging.
Table 1 classification table of sedimentary microfacies

| No. | sedimentary microfacies   | Sandstone reference standard | Formation coefficient | Log characteristic                                                                 |
|-----|---------------------------|------------------------------|-----------------------|-------------------------------------------------------------------------------------|
| 1   | I class channel sand      | Continuous effective thickness ≥ 2 meters | ≥1000µm²              | High resistivity, high amplitude difference, smooth curve, mainly box-shaped, bottom mutation, top mutation or gradient |
|     |                            | Effective thickness ≥2.2m     |                       |                                                                                     |
| 2   | II class channel sand     | Effective thickness ≥1.8m     | ≥500µm²               | High resistivity, high amplitude difference, tooth box or bell curve, the bottom mutation is obvious |
| 3   | III channel sand          | Effective thickness≥1.5m      | <500µm²               | High resistivity, high amplitude difference, mainly bell shape                        |
| 4   | 1 class main sand sheet   | Effective thickness≥1.0m      | Medium high resistivity medium high range difference, mostly thick fingers          |
| 5   | II class main sand sheet  | Effective thickness 0.5~1.0m  | Medium high resistivity medium high amplitude difference, mostly finger teeth      |
| 6   | Non-main body of sand     | Effective thickness 0.2~0.4m  | In the resistivity of the difference in amplitude, a fine finger shape               |
| 7   | Outer sheet sand          | The off-table thickness > 0 and there is no effective thickness | The minimum range of middle and low resistivity is jagged                             |
| 8   | mud                       | Zero sand thickness          | Low resistivity without amplitude or difference, the curve is flat                   |

4. Conclusions

4.1. unsatisfactory development effect of type ii B reservoir is mainly related to the development characteristics of thinner thickness, poorer physical properties, more scattered distribution and larger phase change on the plane, which also determines the necessity of subdivision of sedimentary microfacies;

4.2. Fine stratigraphic correlation of sedimentary units is the prerequisite for accurate reservoir characterization.

4.3. A comprehensive phase-determination model combining effective sandstone thickness, formation coefficient and logging can be established to better identify micro-facies. Meanwhile, the degree of dentalization can quantify the smoothness of channel facies curve and assist in judging the type of channel facies.

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