

Fine Division and Consistency of High Resolution Sequence of the Fuyu Oil Layer in Toutai

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Abstract: According to the layered existing in Toutai oilfield, Fuyu oil reservoir is divided into 18 layers, and the "area, many faults, well spacing density differences compared with" problem "of high resolution sequence stratigraphy" and "fine sedimentology" theory, put forward the "regional skeleton closed profile based standard layer under the control of thick sand combination marks, sedimentary model of contemporaneous fault mode - guidance, step by step first approximation comprehensive comparison, and gradually progressive partition closed open, method of reservoir comparison finally causes shift sector', Toutai oilfield, Mao 10、 Mao 11 layered unification, based on respect for the original hierarchical division, single sand body levels on the formation of the Fuyu region, the original 18 layer segment to 34 sedimentary units, and of all the 566 wells were all well integrated and unified contrast, establish the research area Uniform and fine small level stratigraphic framework, for the plane microfacies and single sand body identification, reservoir connectivity, similar layer sand body distinction, stacked sand distinguish and plane heterogeneity, fault identification laid a solid foundation for the geological.

Keywords: Toutai oilfield, comparison, reservoir connectivity.

INTRODUCTION

In Toutai oilfield is located in, Daqing City, Heilongjiang Province Zhaoyuan County, on regional structural location in central depression of Songliao basin depression area of Chaoyanggou terraces at the western end, a North West dip nose like structure. The upper part of the three member of the Fuyu formation, the upper part of the four member of the lower Cretaceous of the formation, is a set of red dominated sand and mudstone interaction deposits [1, 2]. From a historical point of view the evolution of sedimentary,

Songliao Basin experienced spring head group - Qingshankou group, Yaojia formation - Nenjiang group two lake water expansion - shrinking process, two of the largest lake expansion respectively in the first and second section of green section and Nenjiang Formation [3-5]. The main purpose of this area (Fuyu) for the lower Cretaceous Quantou Formation of head group four Izumi head group three upper strata layer and its thickness from south to north gradually thickening [1].(Fig.1)

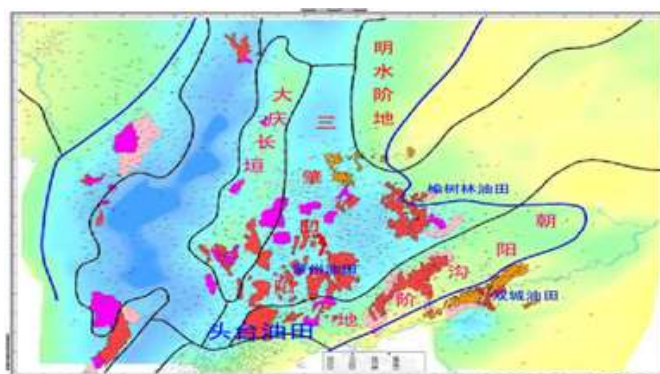


Fig.1: Regional geological map of the Toutai

SELECTION OF STANDARD WELLS

In the choice of the standard well basis is preferred with representative fields of hierarchical key wells, these wells with sandstone, multiple layers,

channel sand body, the relative concentration, thickness representative and vertical to separability, choose has the representative wells M62-88 hierarchical key wells, and another M64-91、 M57-83 as layered auxiliary

shaft, the auxiliary shaft of hierarchical boundaries. In contrast to the key wells, But due to the layer thickness, sand body development high degree of well is not the purpose layer of sand body development are good, a standard well eventually selected M62-88 F I 1a-F II 2a, M64-91 F II 2b-F II 5a, M57-83 F II 5b-F 5a III combination.

Small layer fine contrast

Comparative difficulties: study area (35km²), exploration wells from, many faults, inclined, deposited labile (mainly in the delta front sedimentation), subdivision.

Identification and characteristics of standard layer and mark layer

According to the characteristics of well logging curve, the 3 zones are identified with 2 layers of standard layer, the 2 layer is in the top and bottom of Fuyu oil layer, respectively. According to the curve of high gamma and high resistivity in the top of Fuyu oil layer, three sets of peak oil shale can be identified. The peak is from the top 14-20m, the middle peak is 9-14m, and the bottom peak is 2-5M. At the bottom of the standard layer of stable development of the mudstone, high gamma, acoustic logging curve was significantly higher. The depth of lateral logging curve in this section is the lowest value, the curve is relatively flat, and the micro potential curve also appears low value.(Fig.2)

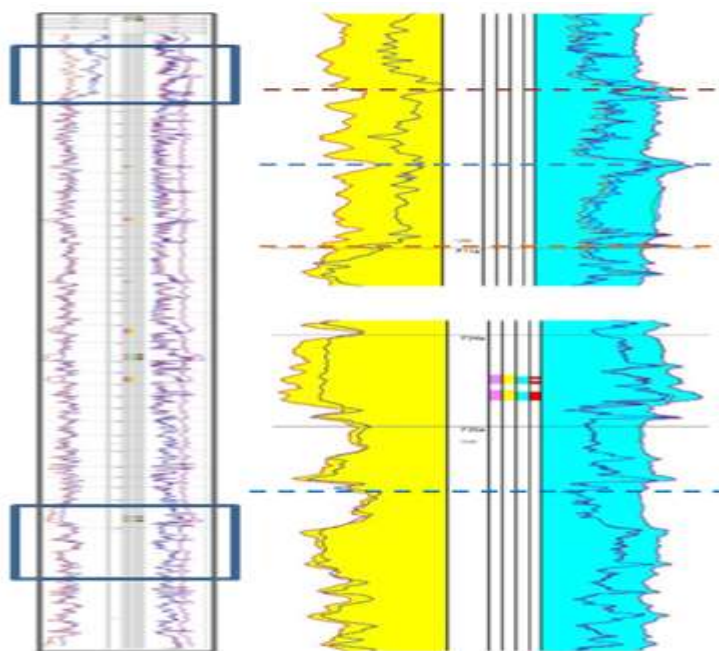


Fig.2: Mark layer recognition curve

According to the resistance of two high value anomalies, the high value of GR, high AC values can be in Fuyu oil layer at the top of the recognition of a mark layer, the characteristic of oil shale. Fuyu reservoir bottom lacustrine, low resistance, high AC, high GR. F35a in most cases channel sandstone is not developed, the bottom begins with black mudstone and to change to a mutual layered anti cyclic sedimentation, F34 usually river development, through combination of rhythm and river to recognition of Fuyu oil layer in the bottom. The thick layer channel becomes the sign layer, the boundary F I 5b, F I 8b, F II 2a for the region's large scale distribution of the marker layer.

Cross closed skeleton profile optimization

How to push the 34 deposition time units in the whole area is the most important foundation, the key and the difficulty! Therefore, the stratification standard well M62-88 well area standard well by the middle of

the block to the hierarchical key wells M57-83, M64-91 well area cited thing mainstay profile, and well region of Northeast China standard well strict well comparison, and the comparison of well network methods: the region enclosed skeleton profile multi step by step closed verification, contrast control technology, namely according to the vertical direction of source and nearly parallel on the principle of provenance, preferably through dense well area of closed skeleton profile, by dense well area outside the optimization framework section, control the region comparison. According to the "stratigraphic section, sandstone formation, small layer deposition time unit" step by step fine contrast, step by step closure verification. There are 3 advantages: 1, greatly reducing the weight of the heavy workload; 2, the region's unified, accurate comparison; 3, master the law of change of the plane, it is very important. (Fig.3)

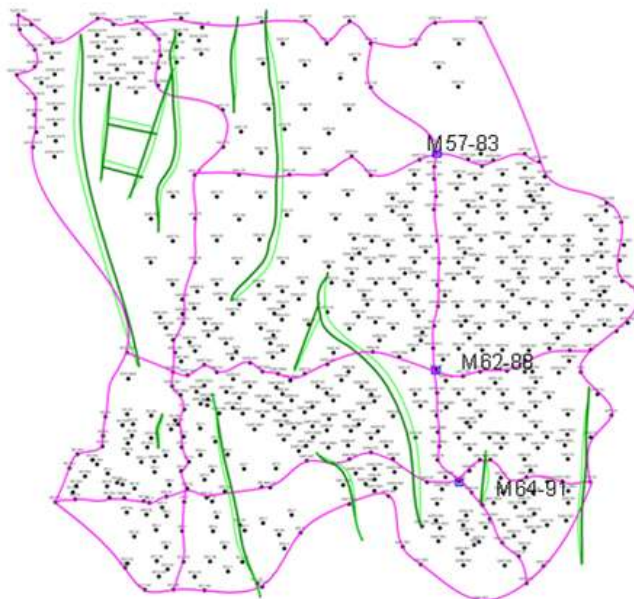


Fig.3: Closed skeleton section control chart

Well and well contrast method

1. Approach contrast under standard layer control: first through the standard layer strict control layer, the flag (F I 5b 、 F I 8b 、 F II 2a) layer at the bottom of the local control, and then through the logging curve shape one by one small layer contrast. Do the whole consistent, local fine.
2. Compared with the guidance of the fault mode of the same life, the thickness of the well layer is thinner and the thickness of the well is increased, which is located in the fault zone, because the fault in the study area is the same as that of the same fault. In fault rise disc near the well thickness to than the thickness of the hole is normal to thin, is located in the fault decreased the thickness of the plate wells to thicker than the thickness of the hole is normal, for example M185-173 wells and M184-S168 well in two sets of the same fault, which M185-173 wells located on the fault decreased disc, help the top to the bottom of the support thickness is 276.0m, located in the fault and M184-S168 rise disc and help the top to the bottom of the support thickness is 251.5m and fault growth index of 1.10, and the average thickness of the formation in Fuyu oil layer is 260m.
3. Off the well contrast method: broken wells in the vicinity of the fault, for the fault wells to start from the standard layer, combined with the auxiliary marker layer, according to the adjacent wells curve shape, and gradually approaching the comparison. There are 7 wells in the study area, which are M59-77, M60-78,

M64-84, M68-S84, H4-3, M70-87 and MJ65-S91.

HIGH RESOLUTION SEQUENCE FRAMEWORK

The high resolution stratigraphic framework, sedimentary time units' subdivision and the whole system compared is plane sedimentary microfacies of the most basic and important work, and directly affect the reservoir study and understanding of fine the extent and degree of accuracy. In the well pattern density difference is great, and the lack of internal standard layer, large area, to try to keep original layered follows the basic, calls for the establishment of the study area was small layered standard, compared to the fine and for the main sand body identification and lithologic subtle oil and gas reservoirs prediction lays the solid foundation.

With the above method, the 566 wells completed 34 sedimentary units of more than 19244 wells fine contrast, established the framework of high resolution sequences of single cycle river.

CONCLUSION

1. Fault migration: (1) through the fine contrast of Inoue, M59-77 and M60-78 broken up the roof, the fault should be left. (2) Compared with the adjacent wells, the M66-S91 has no fault, so the fault is left.
2. The new discovery fault: the vertical fault distance is 16.1m, through the adjacent wells contrast, found MJ65-S91 fault layer F12a、F12b.

REFERENCES

1. Ying, Z. (2010). High resolution sequence

- stratigraphy of Fuyu oil layer in the Mao 11 block of the first oil field. *Inner Mongolia petrochemical industry*, (23):113-116.
2. Yachun, W., Xiaoling, Z., Guangbo, Z., Ridge, Z. (2013). Study on oil water discrimination method of Fuyu oil layer in the first oil field. *Science and technology and engineering*, (17): 4912-4917.
 3. Mingxue, Z., Lijing, W., Jiangping, L. (2007). Sedimentary characteristics of Fuyu oil layer in the head of Songliao Basin. *Daqing petroleum geology and development*, (06):43-46.
 4. Ruiqi, G., Xiyuan, C. (1997). The formation and distribution of oil and gas field in Songliao Basin. *Beijing: Petroleum Industry Press*, 103-106.
 5. Mingxue, Z., Yanjie, L., Hewen, Z. (2000). Songliao Basin in Haituozi area Putaohua reservoir sedimentary microfacies. *Journal of Daqing Petroleum Institute*, 24 (2): 8-11.