

Putao Hua Oil Layer Lithology Plate Establish

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Abstract: -This paper based on crossplot and core data,analysis the Pu Xi oilfield ,Putao Hua oil layer 's conventional logging response characteristic.Based on the describe of the three cored wells, Putao Hua oil layer is mainly made up with siltstone, muddy siltstone, silty mudstone,. First normalized the well logging curves, elimination the influence of the nongeological factors to the well logging curves.After that, establish the logging data intersection,and identify the lithology.The lithology crossplot are mainly depend on $\Delta SP,GR,AC,ILM,ILD$.At last ensure the lithological standard.

Keywords: - Pu Xi oilfield; Putao Hua oil layer; crossplot; lithological discrimination.

I. INTRODUCTION

With the rapid development of economy in our country, The demand of resources is growing,the exploration and development also have higher requirements. The lithology identification is one of the most important steps in the process of oilfield exploration,accurately identify lithology, is very impotant to find main oil-producing formation,and found the residual oil. Pu Xi oilfield is located in Zhao Yuan and Durbat monggol nationality autonomous county in Heilongjiang province.This area's ground conditions is complex,most place are low-lying land,altitude 132~151m.Mainly with mouth bar、distal bar、sand sheet、distributary channel sand body. In this paper we establish multi- lithologic identification cross plots ,and one by one to distinguish the lithology.

II. HEADINGS

1. Putao Hua oil layer physical property parameter analyzing

By studing the 47 cored wells,2325 porosity and permeability cored samples. Putao Hua oil layer's porosity distributed in a wide range, extremely low porosity(5~10%) is 23.53% of the sample;Low porosity(10~15%) is 40.3% of the sample; low porosity(5~10%) is 23.53% of the sample;Medium porosity(15~20%) is 33.94% of the sample.Permeability is mainly distributed in densify to extremely low tight reservoir accounts for 22.55% of the sample, ultra-low permeability accounts for 40.28% of the sample, extra-low permeability accounts for 27.28% of the sample, the average of core permeability is $4.70 \times 10^{-3} \text{um}^2$.From the above statistics, putaohua reservoir belongs to low porosity and low permeability reservoir.

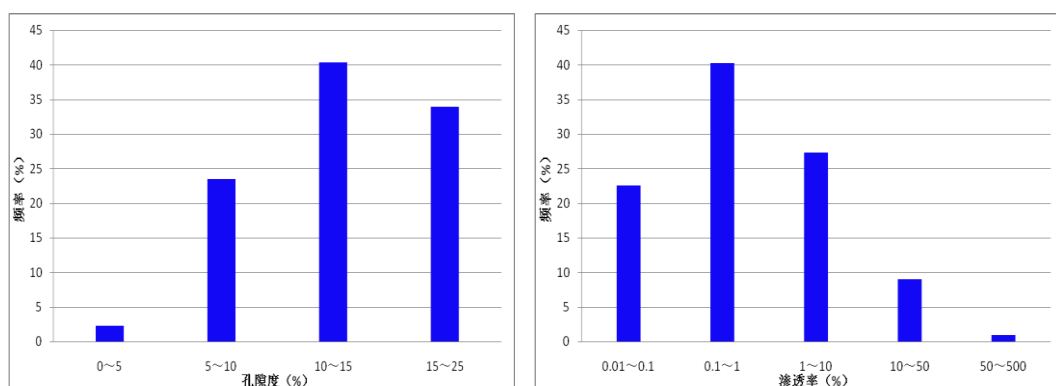


Fig.1 Putao Hua oil layer porosity histogram Fig.2 Putao Hua oil layer permeability histogram

III. NORMALIZATION OF GEOPHYSICAL LOGGING

The Normalization of geophysical logging is most important step to complete before the well logging interpretation. Due to the different years of logging,the difference of logging instrumentation,and some of the artificial impact. These will have a certain influence on logging curves,and affect the accuracy of the interpretation result.Standardization of well logging curve can eliminate the influence of the area of geological factors on the well logging curve.

Before to standardize, we select the P111-2 to be the standard layer, this layer is widely distributed in the scope, stability sedimentation,With the same logging response to the stability of the mudstone laye.First of all to drift the baseline of the SP curve.Set natural potential value of the mudstone to zero,Calculate the average of index bed interval transit time ,Using the trend surface method of acoustic moveout correction,Fig3 and Fig4 are before and after the correction of acoustic travel time distribution trend diagram.

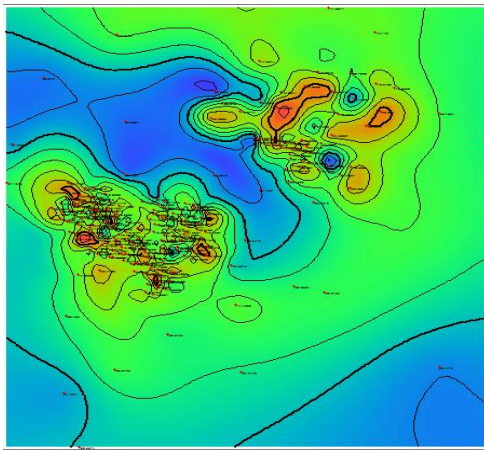


Fig.3 before correction

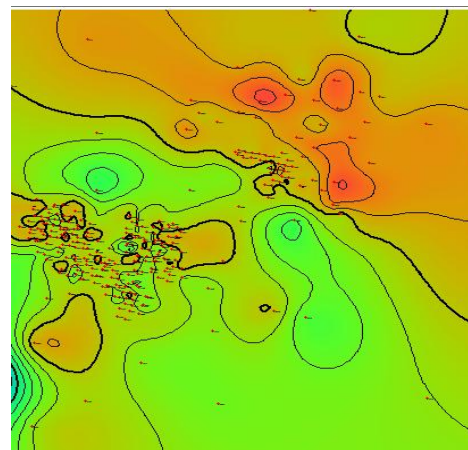


Fig.4 after correction

IV. PUTAO HUA OIL LAYER LITHOLOGIC DISCRIMINATION PLATE ESTABLISHION

Putao Hua reservoir belongs to the subaqueous deposit,Contains a lot of calcitic cementatio、nablock and oiliness difference,These factors will have larger influence on logging response. In this paper preferred the AC, GR, ΔSP , and ILM、ILD curve to set up lithologic identification plate. First , according to the data, readout the typical data of Cored Wells , readout the thickness of relatively large silt rock and argillaceous siltstone, silty mudstone, mudstone values.Should pay attention to when reading a value, to read each paragraph lithology relatively well site average,This method of reading values can reflect the each of the lithologic features, eliminate the error caused by the limit of the logging instrument measuring resolution,And it can eliminate the influence of strata to read values on both ends.

3.1 Siltstone, muddy siltstone and silty mudstone, mudstone identification plate

The putao Hua reservoir oil-water are distributed complex,There are a lot of nablock, calcitic cementation and mud interlayer,These factors have a great influence on electric resistance,In order to eliminate the influence of electric resistance to lithologic interpretation,This paper uses SP and AC curve to set up the cross plot ,This method can eliminate the influence of factors such as fluid,calcium can also be identified(Fig.5).

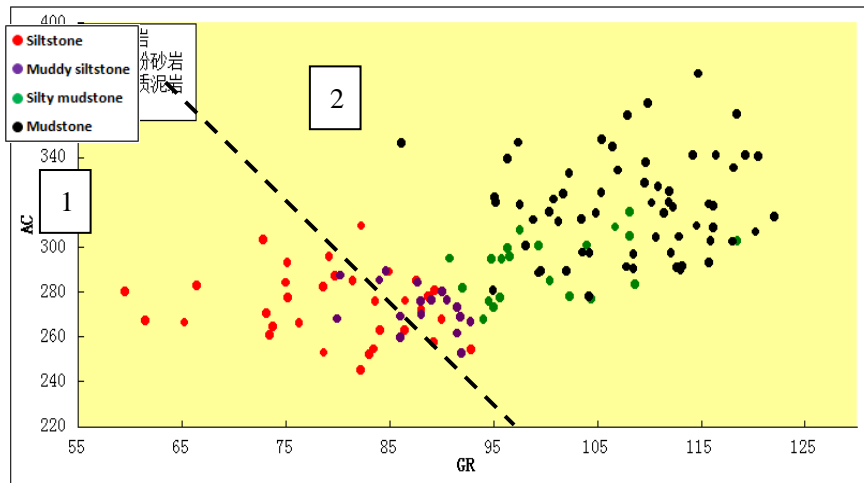


Fig.5 Identify the sandstone and mudstone cross plot

$(SDT+1.76*GR) < 454.4$ for siltstone and muddy siltstone, $(SDT+ 1.76 * GR) > 454.4$ formudstone and silty mudstone. For more than 95% accuracy,To achieve the requirements of oilfield production,Next to distinguish number 1 area of siltstone and argillaceous siltstoue, number 2area of silty mudstone and mudstone.

3.2 Identification of siltstone and muddy siltstone plate

Through the analysis of the physical nature of siltstone and muddy siltstone characteristics and logging response characteristics,we will found that because of the muddy siltstone contained in mud, this lead to the muddy siltstone's GR value is higher than that of the siltstone's GR value,and because of the effect of mud, the permeability of argillaceous siltstone worse than siltstone.By comparing several reaction permeability curve, the magnitude difference of induction resistivity is obvious, using natural gamma and (ILM-ILD) build the siltstone and muddy siltstone lithologic identification plate(Fig.6).

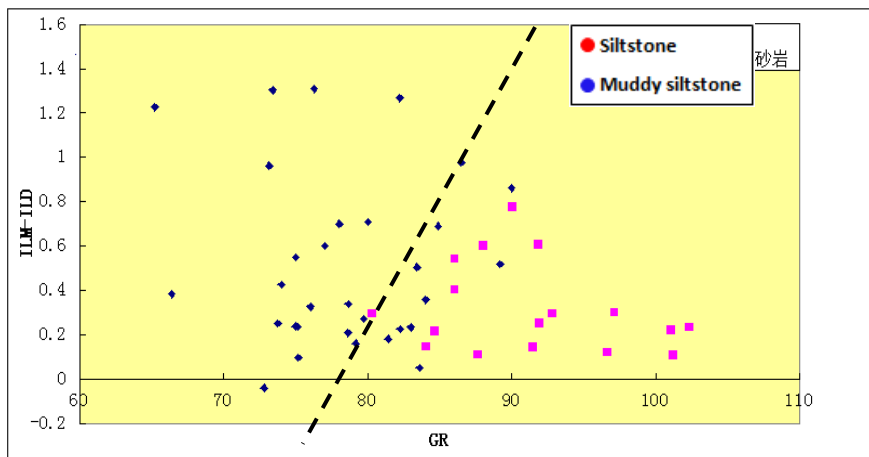


Fig.6 Identification of siltstone and argillaceous siltstone chart

The chart can distinguish the siltstone and argillaceous siltstone, $(ILM - ILD) > 0.32 * GR - 26.7$ for siltstone; $(ILM - ILD) < 0.32 * GR - 26.7$, which is muddy siltstone. Misinterpret as sample points of argillaceous siltstone 3 accounted for 6.4% of the total sample, coincidence rate reaches 94%.

3.3 Silty mudstone and Mudstone Identification plate

Before identificate silty mudstone and mudstone,we should analyze the difference between them. Through analyzing , because of the silty mudstone have less radioactive substances and mudstone,lead to the silty mudstone's permeability is higher to the mudstone.Use the ΔSP and induction resistivity to identify the silty mudstone and mudstone(Fig.7).

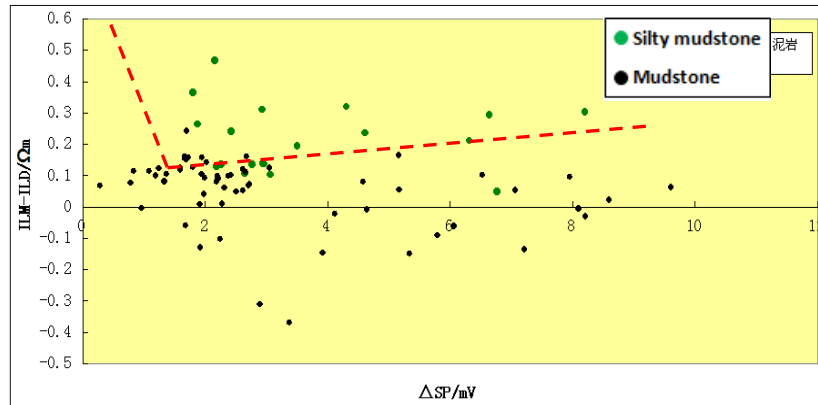


Fig.7 Silty mudstone and Mudstone Identification plate

When $2.2-(ILM-ILD)<\Delta SP$ and $\Delta SP<((ILM-ILD)-0.05)/0.025$ for silty mudstone.

V. CONCLUSION

This paper based on 3 pressure coring wells,15 zones and 133 data points.Made the GR-AC、GR-(ILM-ILD)、 ΔSP -(ILM-ILD) cross plots,and to test them.We have these following conclusions.

- 1) Use the GR-AC cross plot to identificate the siltstone、muddy siltstone、silty mudstone、mudstone. When $(AC+1.76*GR) < 454.4$ are siltstone and muddy siltstone and $(AC+1.76*GR) > 454.4$ are silty mudstone and mudstone.
- 2) After identificate the siltstone、muddy siltstone and the silty mudstone、mudstone.Use the GR-(ILM-ILD) cross plot to identificate the siltstone and muddy siltstone. When $(ILM-ILD)>0.32*GR-26.7$ is siltstone.When $(ILM-ILD)<0.32*GR-26.7$ is muddy siltstone.
- 3) Use the ΔSP -(ILM-ILD) cross plot to identificate the silty mudstone and mudstone.When $(ILM-ILD)<0.014*GR-1.23$ is silty mudstone;When $(ILM-ILD)>0.014*GR-1.23$ is mudstone.

REFERENCES

- [1] Chang D,Liu J L,et al.Technique and development of lithology identification.Inner Mongolia Petrochemical Industry (in Chinese),2009,(6):69-70.
- [2] Ye H M,Fu W S,Wu J.Reservoir parameter interpretation model study of mature oilfield with multi-target stratum.Science and Technology Review(in Chinese),2010,28(9):52-58.
- [3] Ma Z.Petroleum Logging Geology (in Chinese).Wuhan:China University of Geosciences Press,1994:37-38.
- [4] Song Y J,Hu Y S .Geophysical Data Comprehensive and Interpretation (in Chinese).Daqing: Daqing Petroleum Institute,2005:124-135.
- [5] Wang X M.The Principle of Applied Geophysics(in Chinese).Beijing:Petroleum Industry Press,2000.
- [6] Yan L,Pan B Z,Chen Y K,et al,Log recognition and integrated evaluation of volcanic gas bearing reservoirs in Dongling Area,Songliao Basin.Geophysical & Geochemical Exploration(in Chinese),2008,132(6):656-660.