IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 06, Issue 01 (January. 2016), ||V1|| PP 31-36

Research on Interlayer's Identification and Distribution in Xinli Oilfield Ⅵ Block

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Abstract: - Distribution characteristics of interlayer are main controlling factors of heterogeneity in thick oil layers. According to the channel sand body in Xinli oilfield Ⅵ Block, taking the core analysis and logging data, the internal interlayer can be divided into three categories: Argillaceous interlayer, Calcium interlayer and Physical interlayer. The standards of quantitative of all kinds of interlayers are established as Well. It provides a favorable effect for recognition of single Well vertical interlayers and a train of thought for identification of interlayers, at the same time lays the foundation for research on remaining oil distribution and development plan in the later period of oilfield.

Keywords: - *Xinli Oilfield, Interlayer, Logging*

I. INTRODUCTION

Barrier layer refers to impervious bed which is able to prevent or control fluid on the vertical and lateral migration over a wide range(in terms of sand body). Barrier layer's thickness is relatively large and stable on transverse distribution, and barrier layer is between two sand bodies in general. Interbed refers to low permeability or impervious bed inside of the sand with less thickness and poor stability. Interbed can only play a partial role in permeability of fluid, and form a remaining oil enriched area. Because barrier layer is very similar to interbed in formation and lithology, People usually collectively refer to as interlayer. Interlayer is one of main reasons that affects continental reservoir fluid flow heterogeneity and controls the oil and water movement. In the later period of oilfield development, oilfield has entered into the phase of high water-cut stage of production. Percolation barriers and differences caused by interlayer make it difficult to extract residual oil. Therefore understanding the formation, characteristics, distribution and identification methods of interlayer is of great significance for detailed characterization of reservoir geological features, research on remaining oil distribution, and then taking effective engineering measures.

II. THE GENERAL SITUATION OF THE RESEARCH REGION

Xinli oil extraction factory is located in Qin Guo county Songyuan city of Jilin province, in which includes Xinli oilfield, northern Xinbei oilfield and Nanshanwan oilfield. It is located in the west end of Fuxin uplift belt of the central depression area in southern Songyuan basin, the east is wood nose-like structure and the north, west and south plunges in cologne and changling sag tectonically. The research region—Xinli oilfield Ⅵ block is located in the west of the field with development area of 8.49 square kilometers, geological reserves of 5.8241 million tons, recoverable reserves of 1.68995 million tons, and calibration recovery of 29%. Reservoir belongs to low permeability structure—lithologic reservoir in which the average permeability is 11.05×10-3μm2 , and the average porosity is14.4%. The original formation pressure is 12.2MPa, and saturation pressure is 9.6MPa. The developmental target zones are Fuyu and Yang Dacheng Zi oil reservoirs, the reservoir is mainly fine sandstone which belongs to river—delta sedimentary system. Longitudinal Fuyang oil reservoir is divided into nine sandstone groups, twenty six small layers among with eight, fourteen and sixteen small layers as the main reservoirs and the average depth of reservoirs is 1277.2 meters.

III. THE INTERLAYER'S TYPES AND ITS LOGGING RESPONSE CHARACTERISTICS

Due to geological processes such as sedimentation and diagenesis are different, different interlayers form accordingly. The formation, characteristics and distribution of different interlayers have great differences and they also have differences for controlling oil and water movement. Interlayer can be divided into two kinds that one is sand body internal interlayer, the other is interlayer between the sand bodies within the same small

layers, through the analysis and study of coring Well data, on the basis of interlayer's effects on mining. According to the types of the interlayer , they can be divided into three categories:Argillaceous interlayer, Calcium interlayer and Physical interlayer. Because the calcareous interlayer widespread distributes in sandstone at the bottom, it has little impact on permeability function, and it doesn't need to carry on the recognition analysis. The research method of this article is the application of lithology coring Well data and logging data, setting up different types of interlayer's logging identification marks especially natural gamma (GR) and deep dual lateral (RLLD) logging response characteristics In combination with acoustic time (AC) and other micro electrode resistivity logging response characteristics for identification.

(1)Argillaceous interlayer

Lithology is mainly mudstone, shale, silty mudstone, argillaceous siltstone. Basically this kind of interlayer is formed under the condition of weaker hydrodynamic and fine suspended solids deposition. On the vertical frequency is higher, and the log response of argillaceous interlayer characteristics is shown in figure 1.

Interlayer is with great thickness, pure texture and stable distribution. Its logging response characteristics are typical and easy to identify. It is manifested in detail as: Sp curve returns to baseline, microelectrode curve low-rising overlaps, natural gamma value is high, acoustic time value is high, and resistance curve value is low(FIG. 1) .

Argillaceous interlayer is with thin thickness, so its log response characteristics are not as good as interlayer obvious. The area's logging curve sampling rate is 0.125 m. The interlayer with more than 20cm can be recognized Well by microelectrode curves. Given the deep and shallow lateral resistivity, the resolution of Gamma logging curve and the actual needs of oilfield exploitation, put the identified interlayer's thickness lower limit as 0.4m. Main features of the argillaceous interlayer on the Well logging curve are that the natural gamma ray is in the moderate amplitude of ligule protuberance or in the high amplitude of finger raised, natural potential curve has the phenomenon of returning or a bit returning, the difference of deep and shallow resistivity decreases and the resistivity reduces, acoustic time increases, microelectrode returns and amplitude difference decreases.

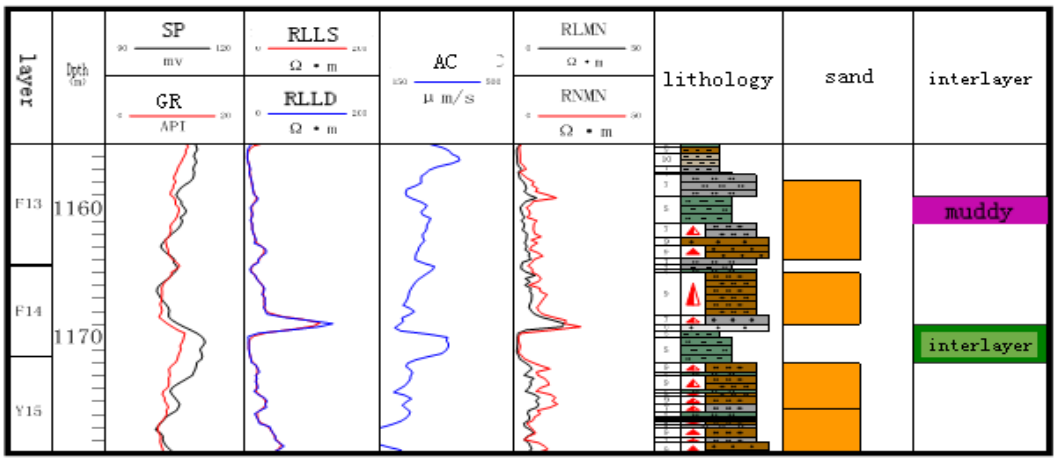


FIG. 1 The Picture of Argillaceous Interlayer of JI10-17 Well(1155～1179m)

(2) Physical interlayer

Physical interlayer is the small layer between the powder sandstone and argillaceous siltstone, silty mudstone and silty mudstone interbedding. If these types of powder sandstone layer are as a barrier, its permeability is generally small. On the Well logging curve, the type of interlayer's natural gamma ray value is higher, microelectrode curve sWells jaggedly obviously, the curve is with no separation or smaller amplitude difference. Property of physical interlayer is mainly argillaceous siltstone, silty mudstone, and is the most common type of interlayer in the continental sedimentation. Logging curve characteristics as follows: hold diameter exits with unconspicuous hole enlargement, natural gamma curve is in the moderate amplitude of dentate bulge, natural potential curve shows the phenomenon of a little returning, deep and shallow lateral resistivity decreases, acoustic time reduces. (FIG. 2-1, FIG. 2-2)

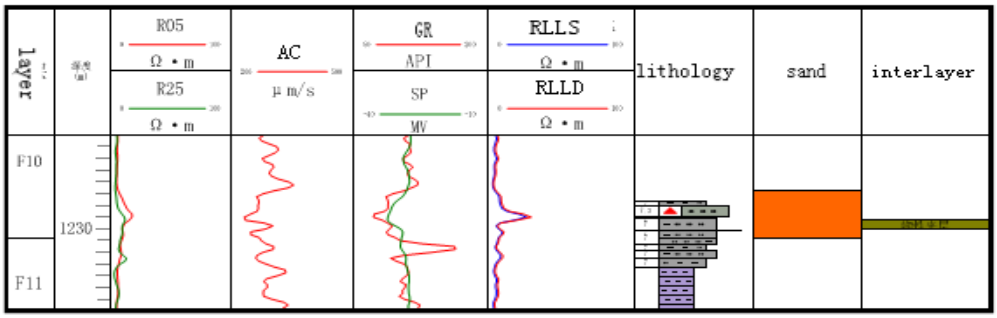


FIG. 2-1 The Picture of Physical Interlayer of JI+28-015.1 Well

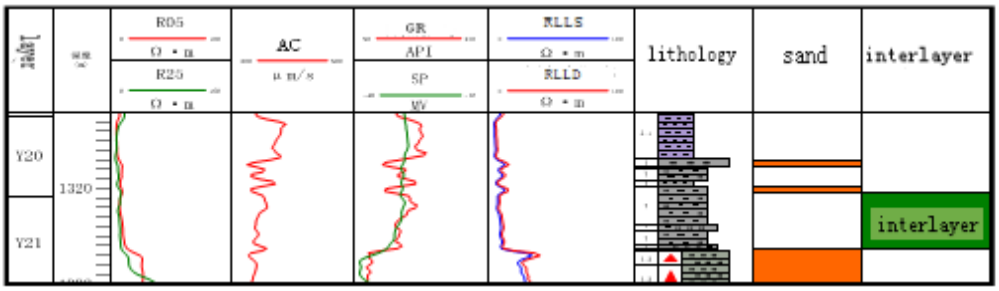


FIG. 2-2 The Picture of Physical Interlayer of JI+28-015.1 Well

IV. THE INTERLAYER'S CRITERION OF IDENTIFICATION

The core is the most direct and detailed first-hand information in the oil field geological research. JI10-17 Well and JI+28-015.1 Well of research area are coring Wells. The analysis data of the Well core is very rich which provides favorable conditions for the research of thin layers.

The main purpose of this study is interlayer in the sand body. First, identify the interlayer on the core. Its characteristics are that interlayer's color is different from the adjacent sand body, however, interlayer shows in gray, celadon or light brown with poor oil content. Particle size is fine and they are mudstone and silty mudstone, argillaceous siltstone and silty sandstone. Second, on the basis of the single layer classification and correlation, using the data of core, mudlogging and logging, combined with dynamic data, using the relationship between barrier layer and interbed, thickness of the electrical, and physical property, setting up the chart division and regression relation, and determining the interlayer's criterion of identification.

(1) Curve selection

Select the deep lateral resistivity, natural gamma curve and microelectrode curve which are more sensitive to interlayer's reaction.

(2) Setting interpretation standard

In the study, at first according to Xinli oilfield reservoir, make the simple chart of interlayer identification such as FIG. 3-1. Because the number of Wells with natural gamma ray below 50 API and Wells with microelectrode logging in the work area is small, FIG.3-1a and FIG. 3-2c are not used. Set the rate of deduction of interlayer by analyzing.

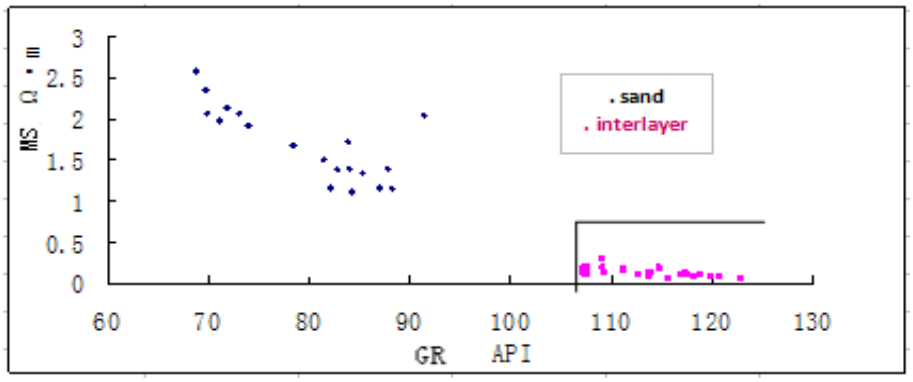


FIG.3-1a The Chart of the Relationship Between Natural Gamma Ray and Microelectrode Separation

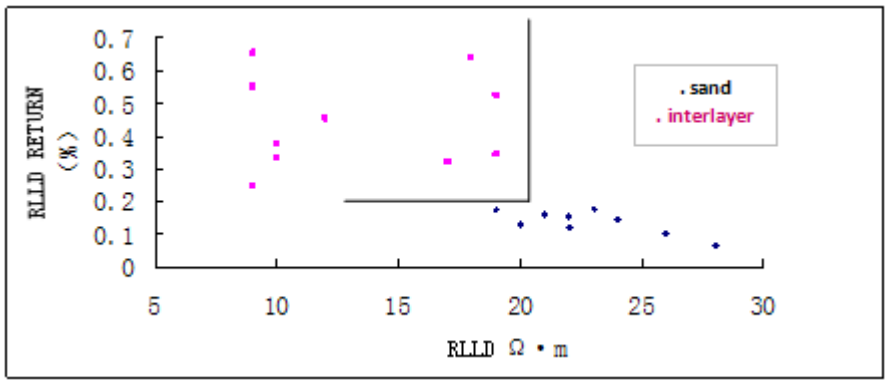


FIG.3-1b The Chart of the Degree of Relationship Between Deep Lateral Resistivity and Its Return

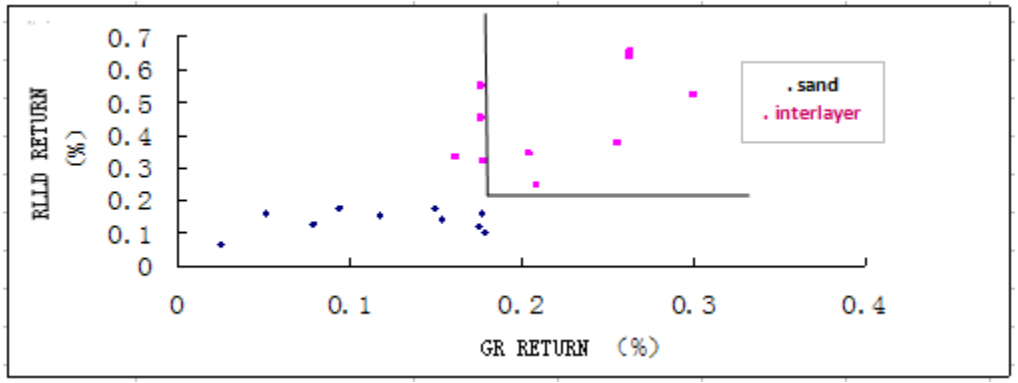


FIG.3-1c The Chart of the Degree of Relationship Between Natural Gamma Ray Retu and Deep Lateral Return

①The degree of return of deep lateral resistivity RLLD curve reaches18%, and deep lateral resistivity is less than 17Ω•m(FIG.3-1b), then deduct interlayer. The top and bottom boundaries of interlayer are decided by the piton. Corresponding to the depth of a third of the piton is interlayer interface. If the return of deep lateral resistivity RLLD curve is not obvious, however, other curves are clear, it needs comprehensive judgment.

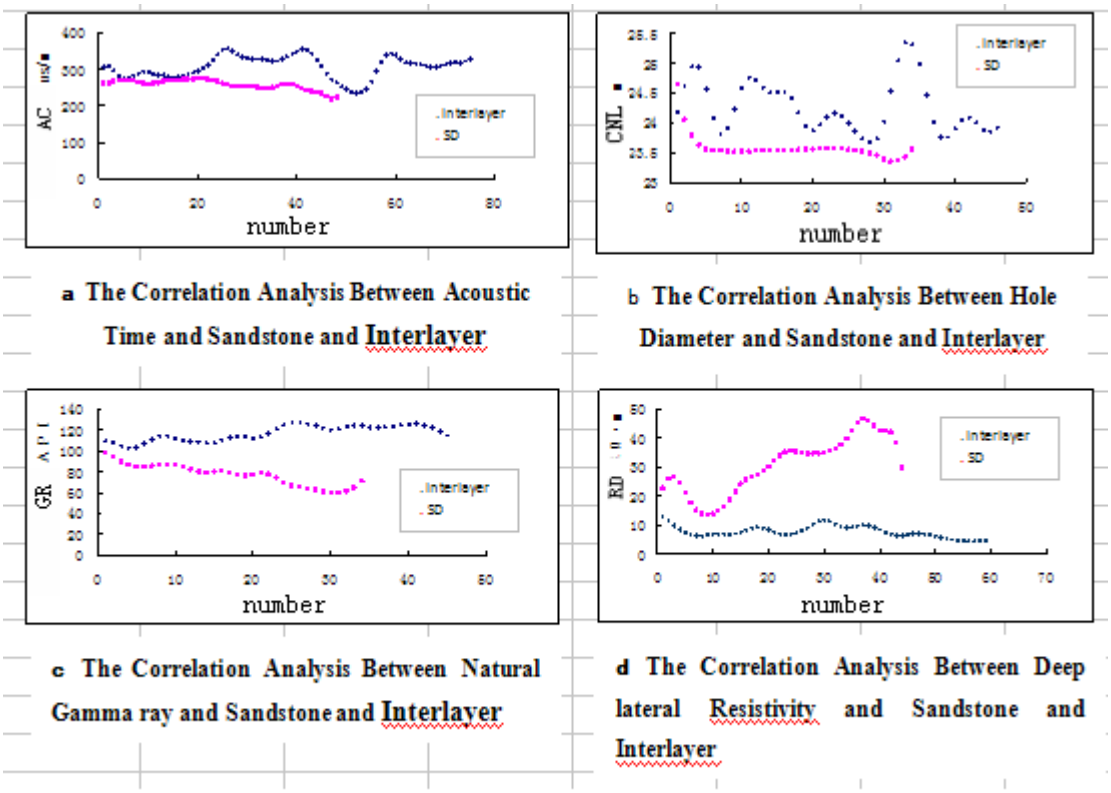
②Because the natural gamma ray value of partial Wells is less than 50 API, the degree of return is not obvious during 5-15API, according to the natural gamma curve determine the interlayer and if natural gamma ray rises at the point;

③If Deep lateral resistivity RLLD curve displayed on the interlayer is not obvious, it can be considered that refer to microelectrode curve on the basis of the natural gamma curve, and the degree of return of microelectrode curve reaches one third.

Through trial and error, finally select the basis of the interlayer judgment that the degree of return of deep lateral is more than 18%, the deep lateral resistivity is less than 17Ω·m and the thickness is more than 0.4 m. According to the interpretation standards, use the original Well logging curve and VB language to explain program, interlayers of 210 Wells are identified in all.

(3)The division standards of interlayer

At first, based on coring Well identify sandstone and interlayer. Do the single factor analysis of Well logging curve for sandstone and interlayer as shown in FIG. 3-2 to get the sensitive curve of sandstone and interlayer and make a comprehensive analysis. According to the explanation of sand body and small layers division to calculate the interbedded interlayer thickness and the interpretation result can be seen in FIG. 3-3.



a The Correlation Analysis Between Acoustic Time and Sandstone and Interlayer

b The Correlation Analysis Between Hole Diameter and Sandstone and Interlayer

c The Correlation Analysis Between Natural Gamma ray and Sandstone and Interlayer

d The Correlation Analysis Between Deep lateral Resistivity and Sandstone and Interlayer

FIG. 3-2 The Single Factor Analysis of Well Logging Curve for Sandstone and Interlayer

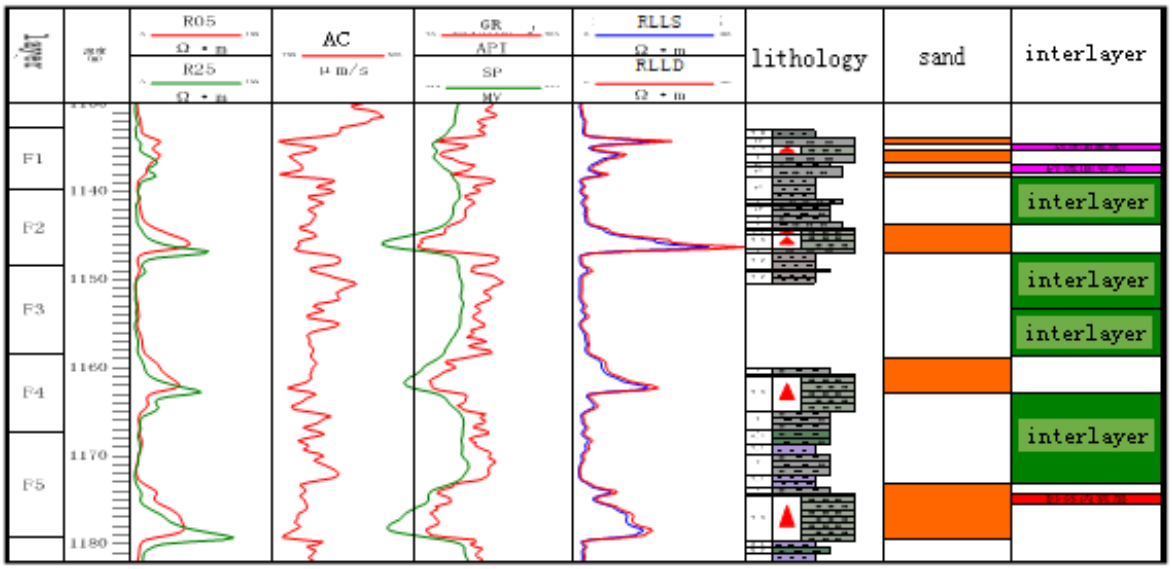


FIG.3-3 The Interpretation Result of the interlayer of Ji+28-015.1 Well 1132-1180m

V. CONCLUSION

(1) According to core observation and analysis of data, the interlayer of Xinli oilfield reservoir is mainly divided into three categories: Argillaceous interlayer, Calcium interlayer and Physical interlayer. The formation and control factors of each interlayer are different. Among them that argillaceous interlayer and physical interlayer are more developmental while the distribution frequency of the calcium interlayer is relatively high and more random.

(2) Through dealing with the standardization and normalization of Well logging curve, it is efficient to eliminate the system error between Wells and dimensional effect on different types of logging curve

comparison.Meanwhile amplify the response characteristics of Well logging curve of interlayer and reduce the recognition difficulty of hiding interlayer.

(3) Influenced by conventional logging curve vertical resolution, there is certain error with the above methods to identify , so it is needed to do further research.

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