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Genetic Analysis of Low Resistivity Reservoir

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Abstract: *With the improve of development and research in the Oilfield, many Oilfields were found to have lots of Low Resistivity Reservoir . there are two definitions for the low resistivity reservoir:For The first one ,Low Resistivity Reservoir is the oil reservoir which the rate of resistance augment is Less than 2, for The second one ,Low Resistivity Reservoir is the oil reservoir which the Resistivity of the oil reservoir is Less than the Reservoir Resistivity in the same Oilfield. In fact the second definition is based on the first definition . So the first definition is a more general significance.*

Keywords: *Low Resistivity Reservoir; water saturation; pore structure.*

I. INTRODUCTION

Many Oilfields were found to have lots of Low Resistivity Reservoir can explain that the existence of Low Resistivity Reservoir has certain conditions and regularity. Based on the characteristics of low resistivity reservoir indicated by well logging plot, the genesis of low resistivity reservoir is systematically studied in aspects of petrophysical property, reservoir height, cation-exchange in shaly sand, invasion of filtrate in drilling and influence of conductive minerals ,etc.

Through comparative analysis, summarized the formation mechanism of low resistivity reservoir, the research shows that factors can affect the low resistivity reservoir is divided into the following types:

II. LOW AMPLITUDE STRUCTURE

Under conditions of low amplitude structure ,effective driving force is small, differentiation of oil and water is bad,so that water saturation is high.Construction amplitude is one of the important factors controlling the magnitude of oil abundance.low Construction amplitude means as a driving force of buoyancy is relatively small, so the oil and gas can only enter into the aperture is relatively large, relatively small capillary pores of resistance.Due to the driving force and capillary resistance mismatch ,The rock with relatively small channels will become without oil, thus leading to a low oil-abundance in the conditions of low amplitude structure.

Theoretical calculations and experimental results show, Rock resistivity and the rate of resistance augment will significantly reduced With increasing of water saturation,so that Rock resistivity is Generally low in the reservoir with low oil-abundance.

III. COMPLEX PORE STRUCTURE

I Complex pore structure leads to the fixed water content increased, so that the reservoir resistivity decreases. It is One of the reason which lead to the low resistivity reservoir

The potential and force theory reveals that gravity and the forces caused by the g rounding water are the main driving forces, and capillary pressure is the main res istance force in the process of the migration and accumulation of oil/ gas. Because the capillary pressure is directly related to the pore structure, displacement pressure and the pore number that oil/ gas can enter, it plays the key function in the migration and accumulation of oil/ gas. According to the capillary theory and the characteristic of the migration and accumulation of oil/ gas in the low- resistivity reservoirs, expatiated is the formation mechanism of the low resistivity reservoirs.Because of the function of the capillary pressure, phenomena such as reservoirs far from the oil/ gas sources, fine lithologic reservoirs, complicated pore structures, huge storage capacity in single reservoir and amounts of vertically developed reservoirs, may cause the formation water not to be replaced by oil/ gas in the middle and small pores in low- resistivity reservoirs so that the water saturation is higher, and the reservoirs have the lower resistivity characteristics, that is, high water saturation results in low- resistivity reservoirs.

IV. ADDITIONAL ELECTRICAL CONDUCTIVITY

Clay mineral which Additional electrical conductivity is strong will make the Rock resistivity become low. Content and composition of clay minerals is another important reason leading to Low Resistivity Reservoir. Clay minerals contribute to conductivity of rock from two aspects.Firstly, Small particles of clay minerals will form a large number of micro pores in the reservoir, High bound water content can significantly reduce the resistivity of the rock, And with the increase of clay content ,the impact on the resistivity will increase. Secondly, Clay mineral which Additional electrical conductivity is strong will Contribution to the conductivity

of the rock, In some cases this effect is also very significant. Among all kinds of Clay mineral,Additional electrical conductivity of montmorillonite and illite mixed layer is very high.

At low water salinity background, clay minerals additional conductivity is a factor to be reckoned with low resistivity reservoir formed. On the one hand, the negatively charged surface of the clay particles can be directly adsorbed polar molecules cations,cations are adsorbed by clay hydration combined with the polar water molecules to form a bound water, clay particles in the surface of a thin film of water, resulting in bound water content increases. On the other hand, by cation exchange clay minerals make clay minerals produce additional electrical conductivity. Clay mineral distribution is mainly under pressure, controlled temperature conditions, so its distribution in the longitudinal depth is significantly affected. Transformed sandstone clay minerals with increasing depth, the performance by the smectite to montmorillonite, illite, kaolinite transformation and conversion to chlorite. illite mixed layer scanning electron microscopy showed a honeycomb or flocculent(Figure 2); kaolinite, scanning electron microscope monomer was false Hexagonal aggregates were pages like, worm-like or accordion-like(Figure 1); illite, scanning electron microscopy showed a wire , flake(Figure 3); chlorite, mostly leaf-shaped or pompon (Figure 4).

The cation exchange capacity of Montmorillonite and illite mixed layer are the strongest among all kinds of clay minerals. The lower formation water salinity, the more clay additional conductivity is.

Montmorillonite and illite mixed layer attached to the particle surface, forming a strong additional conductive so that the reservoir resistivity drop, is an important reason for the formation water under ambient light low resistivity reservoir development.

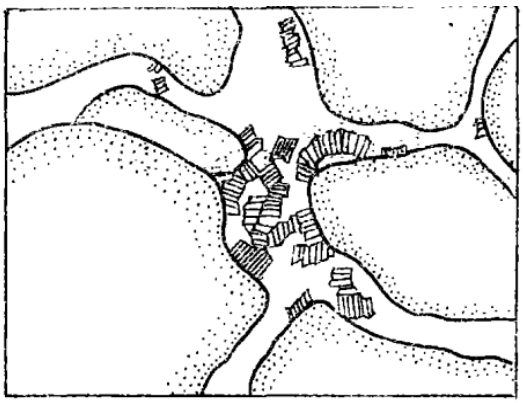

Fig 1 Dispersible form

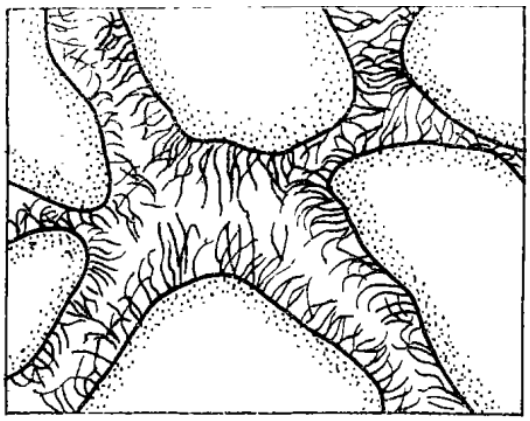

Fig 2 Bridge

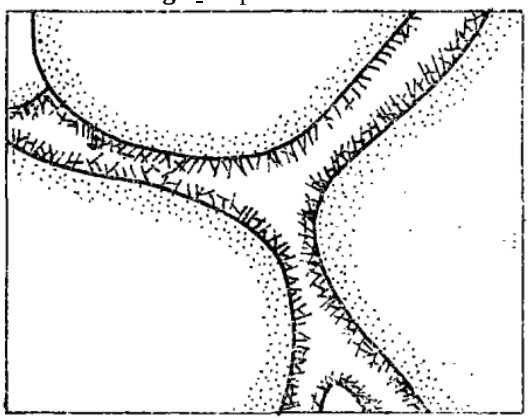

Fig 3 Thread

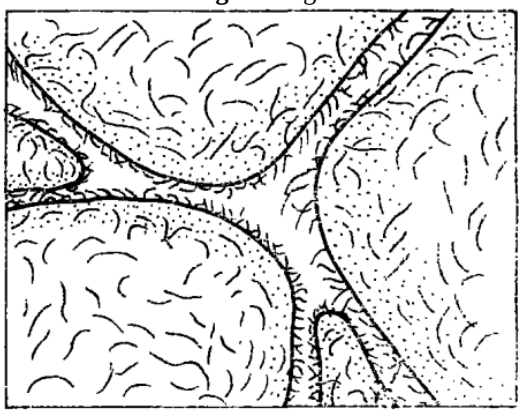

Fig 4 Thin film

V. THIN SAND-MUD INTERBED

Thin sand-mud interbed lead to Contradiction between resistivity macro anisotropy and resolution of logging instrument which results from thin sand-mud interbed can lead to Low Resistivity Reservoir.The resistivity between oil-bearing sandstone and mudstone is Different; The resistivity between oil reservoir and oil-water layer is Different,For a geological body which Contain Different parts of the resistivity, the resolution of conventional resistivity logging tool has some limitations.

VI. RESERVOIRS CONTAINING CONDUCTIVE MINERALS

Reservoirs containing conductive minerals ,such as pyrite ,is One of the reason which lead to the low resistivity reservoir.Pyrite is one of the common mineral components in clastic reservoir, with a high conductivity.as a Highly conductive mineral, Pyrite has a great influence on rock resistivity. Even reservoir contains only relatively small amounts of Pyrite, it can cause the formation of apparent resistivity significantly lower. The influence on rock resistivity which come from Pyrite can seriously interfere with the evaluation of fluid properties, the ability to use resistivity to distinguish oil and water layer becomes bad.

VII. CONCLUSION

Its cause analysis, for low resistivity reservoir logging evaluation and identification methods, mainly based on two aspects: First, expand basic research, by analyzing the characteristics of low resistance causes of conventional logging information implied in extracting the corresponding identification methods, improve or develop new methods of interpretation, strengthen research fine log interpretation technology; Second, improvements or development of new logging equipment, the use of new logging technology targeted for low resistivity reservoirs identify evaluated.

Irreducible water saturation - water saturation cross plot analysis：

1）Sw=Swi，Only oil-producing formation;

2）Sw>Swi, Formation oil also water;

3）Sw>>Swi, Producing only water.

irreducible water saturationThe key to this approach is for the prospective irreducible water saturationi, in the following ways:

1) Conventional method, by core analysis results, the establishment of the relationship between water and bound permeability, porosity, particle size in value.
2) NMR logging method, by T2 cutoff to seek.
3) Relationship core by capillary radius and capillary pressure measurements of the spectral distribution of T2 establish irreducible water saturation and permeability and T2 spectrum.

REFERENCES

[1]. Archie G E. The electrical resistivity log as an aid in determining some reservoir characteristics. Trans, AIME, 1942, 146: 54—62

[2]. Waxman M H, Smits L J M. Electrical conductivities in oil-bearing shaly sands. SPEJ, 1968, 8(2): 107—122

[3]. Clavier C, Coates G, Dumanoir J. The theoretical and experimental bases for the “dual water” model for interpretation of shaly sands. SPE 6859, 1977. 1—27.

[4]. Clavier C, Coates G, Dumanoir J. The theoretical and experimental bases for the dual-water model for interpretation of shaly sands. SPEJ, 1984, 24(2): 153—168

[5]. Silva L P, Bassioni Z. A shaly sand conductivity model based on variable equivalent counter-ion conductivity and dual water concepts. In: SPWLA 26th Annual Logging Symposium. Texas, 1985. 1—2.