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Daan Oilfield in Fuyu Reservoir of Ultra Low Permeability Sandstone Reservoir Seepage Parameter Technology

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Abstract: Oil-water relative permeability curve is used to describe two-phase fluid in reservoir porous media of non-linear percolation in the only way. Low permeability reservoir of oil and water relative permeability curves with high permeability reservoir of oil-water relative permeability curves of different features. Specific performance: the high bound water saturation, residual oil saturation is high, narrow range of oil-water two-phase flow, with the decrease of the saturation of oil phase, oil phase permeability decreases rapidly, and soon fell to zero, to form a high residual oil saturation and water flooding oil recovery rate is very low, and the aqueous phase effective permeability increases very slowly, resulting in low permeability reservoir well with increase of water content, the produced fluid index drop Low liquid production is very low. Fuyu oil layer in the study area mainly belong to low porosity and ultra low porosity and super low permeability non permeable reservoir, through the research found the oil-water two-phase flow characteristics is more complex, with middle high permeability reservoir and low permeability reservoir layer had greater differences.
Keywords: relative permeability curve; high bound water saturation; permeability reservoir layer.

CHARACTERISTICS OF OIL WATER PHASE PERMEABILITY CURVE

Through the comparison and analysis of the red 75-9-1 well's 7 oil-water two-phase flow samples of relative permeability curve found that sample bound water saturation is 24.2% ~ 38.6%, the average is 33.13%, the irreducible water saturation is relatively high, the residual oil saturation of water flooding is 9.7% to 24.9%, average value is 14.99%, water flooding residual oil saturation is low, oil-water two-phase seepage zone is relatively narrow from the point of view of curve shape, with the increase of water saturation, oil phase relative permeability declines faster, while the relative permeability of water is concave rise, rise speed is slow and the final value is low, the analysis thinks, extra low porosity closed hydrosphere to be gradually increased, when in the middle of the surface of the super low porosity and super low permeability non permeable reservoir throat small pore throat ratio, water adsorption in porous media and oil in the pore water flooding, water flooding along the pore wall surface water film along with water saturation, the water film thickness and oil flow gradually stuck off, a large number of oil and oil phase slowly by the continuous phase to a non-continuous phase, dispersed in the throat, and produces strong Jamin effect, the oil phase permeability sharply decreased, and water permeability increases slowly [1]. The seven samples were collected degree and permeability correlation studies show that recovery degree and permeability is not obvious positive correlation, correlation coefficient R2 is about 0.5, it shows that the permeability of the control effect on the degree of mining in general, the level of mining is not only affected by the permeability, but also by other factors

FINE DISSECTION OF OIL WATER TWO PHASE FLOW

Through the contrast analysis of red 75-9-1 wells of S50, s83, S108, three conventional mercury injection data samples (table1, figure.1), S50 air permeability of samples is 1.37mD, property is relatively good, but the recovery degree is low, and the s83, S108 air permeability of two samples respectively is 0.945mD, 0.65mD, property is slightly worse, two samples were collected from a relatively high degree, this phenomenon and conventional inconsistent [2]. Through comparative analysis of three samples of capillary pressure curve and various mercury intrusion parameters showed that, the S50 and s83, S108 two samples are compared, the sorting of pore throat relative Worse, therefore, it is concluded that the poor pore throat sorting may be an important reason for the low level of S50 samples.

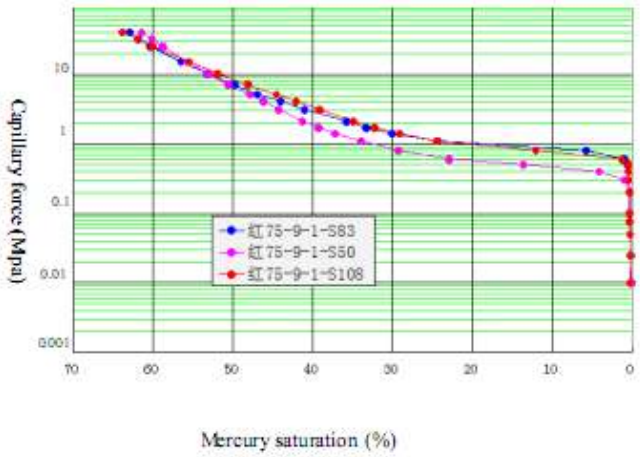

Fig. 1: normal pressure mercury curve of sample

Table 1: sample parameter statistics

Sample No.	Porosity permeability	porosity	Relative sorting coefficient	Characteristic structure parameter	Mining degree	
	mD	%			%VP	%OPI
S50	1.37	12.5	1.43	0.086	52.1	82.9
S83	0.945	13.3	1.297	0.222	55.3	81.3
S108	0.650	10.8	1.372	0.135	53.7	82.9

STUDY ON SEEPAGE CHARACTERISTICS BASED ON NUCLEAR MAGNETIC RESONANCE

The flow of fluids in porous media, in addition to the influence of pore structure characteristics, and the nature of the surface. Generally speaking, Exist in the central pore in porous media and fluid due to solid-liquid interaction effects are so small, and the flow pattern close to that of the conventional fluid, said movable fluid, and the surfaces of porous media fluid, due to the polarity of the molecules, resulting in fluid physical and chemical changes on the surfaces of porous media, the formation of a boundary layer of fluid or irreducible fluid, under a certain pressure gradient is difficult to use [3]. Therefore, by nuclear magnetic resonance (NMR) spectra of movable fluid, to reflect the reservoir fluid in the use of the degree of difficulty, so as to reflect the degree of difficulty of the oilfield development.

Basic characteristics of nuclear magnetic resonance

Red 75-9-1, Great Northern +10-12,these two wells' 23 NMR samples showed the Fuyu oil layer reservoir mobile water saturation is relatively high, movable water saturation is 32.8% ~ 63.7%, the average value is 52.64%.According to the experience of the development and production of low permeability oil and gas fields at home and abroad, the low permeability reservoir is divided into five types according to the level of the movable water saturation (Table.2), and according to the classification standard, Fuyu oil reservoir in class II reservoirs mainly, with up to 16 samples [4], class III reservoir levels, six samples, type IV reservoir at least, only one sample, reflecting from the point of view of movable fluid saturation, Fuyu reservoir layer is relatively good.

Average porosity 10.775% ,red 75-9-1 well's 12 nuclear magnetic resonance water samples were measured, the gas logging permeability average is 0.785mD and movable water saturation average is 53.56%, Dabei +10-12 well's 11 samples of nuclear magnetic resonance water logging porosity average is 8.904%, gas logging permeability average is 0.077mD and movable water saturation average is 51.64%. Two wells were significant difference, the movable fluid saturation is slightly different, reflecting reservoir movable fluid saturation is affected not only by physical effects, but also affected by other factors.

Table 2: Magnetic resonance mobile fluid saturation classification standard

Movable fluid saturation, %	Reservoir classification
＞65	Class I (good)
50-65	Class II (better)
35-50	Class III (medium)
20-35	Class IV (poor)
＜20	Class V (very bad)

Table 3: T2 spectral distribution kurtosis statistics

Well No.	Sample number	Shuangfeng left	Peak width	Conventional Shuangfeng	Shuangfeng right	Right single peak
Red 75-9-1	12	1/32.8	/	3/46	4/57.7	4/60.28
Dabei +10-12	11	1/55.24	2/42.52	4/51.63	3/52.72	1/63.03
All samples	23	2/44.02	2/42.52	7/49.22	7/55.57	5/60.83

Note: sample number / movable fluid saturation

Distribution characteristics of nuclear magnetic resonance T2 spectra

Through the statistical analysis of red 75-9-1, Great Northern +10-12 these two wells' 23 NMR samples found that Fuyu oil reservoir T2 spectrum distribution of various types, contain a bimodal slightly to the left, peak width, conventional bimodal, bimodal offset to the right, right unimodal multiple style (table.3), which with bimodal (including bimodal partial left, conventional bimodal, bimodal partial right) distribution, there are 16 samples [5], the proportion of 69.57%, reflect the reservoir pore structure is relatively complex right unimodal times, five samples, broad peak is the least, only 2 samples. Find all kinds of statistical kurtosis type of movable fluid saturation, kurtosis type and movable fluid full closely relationship, there are differences in different kurtosis type movable fluid saturation. Among them, right single movable fluid saturation highest reach 60.83%, bimodal partial right times, for 55.57%, conventional bimodal and bimodal partial left again, respectively 49.22% and 44.02%, the peak width was the lowest, only for the type of kurtosis 42.52%. Red 75-9-1 and the Great Northern +10-12 two wells distribution also have differences, spectral red 75-9-1 well T2 distribution slightly to the right, and physical, movable fluid saturation match.

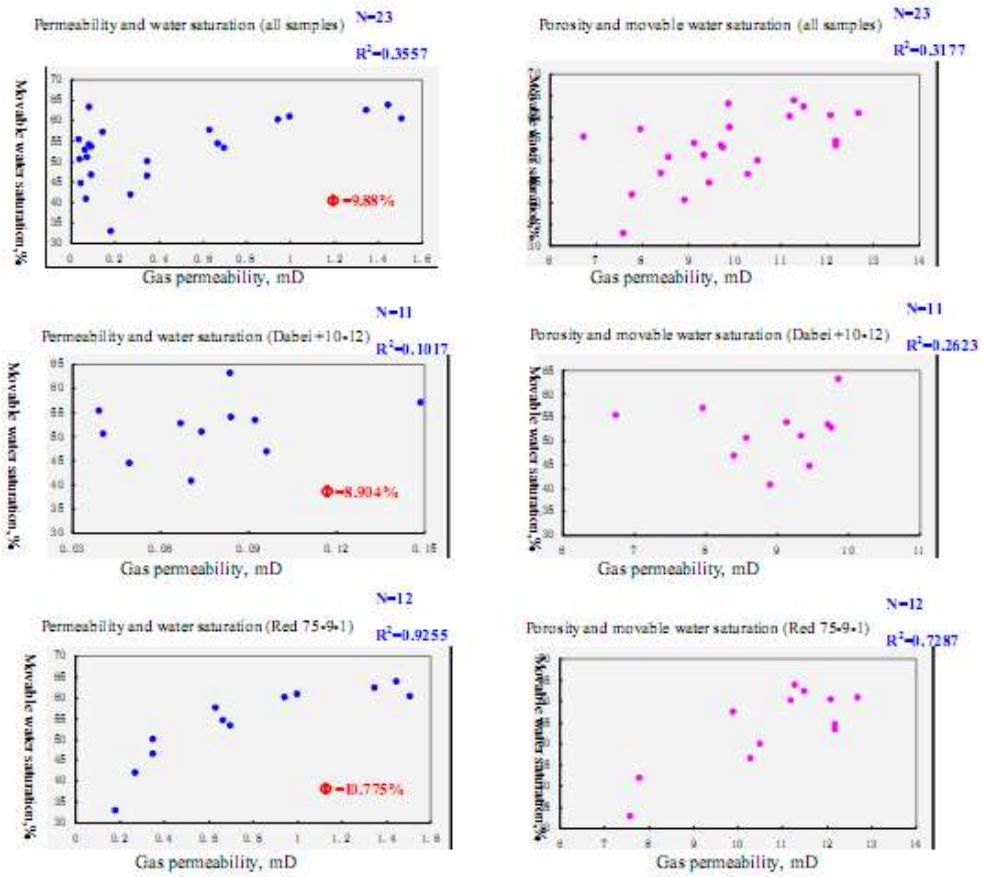

Fig. 2: Relationship between saturation and physical properties of movable fluid

Relationship between saturation of mobile fluid and physical properties

Using red 75-9-1. Dabei +10-12 these two wells' 23 NMR samples compiled the movable fluid saturation and object relation diagram (Fig. 2). Correlation of Fuyu oil layer of movable fluid saturation and physical properties were studied, Results showed that, all samples of movable fluid saturation and correlation deviation, correlation coefficient R2 is 0.3 ~ 0.4. The red 75-9-1 well movable fluid saturation

and correlation better correlation coefficient R2 is 0.7 to 0.9255. Dabei +10-12 well movable fluid saturation and poor correlation, correlation coefficient R2 is only 0. 1 ~ 0.3, visible different samples of movable fluid saturation and material of different correlation and differences [6]. The result showed that, red 75-9-1 well is good, movable fluid saturation and physical relevance is better, with the object of good, movable fluid saturation increasing, Dabei +10-12 well is poor, movable fluid saturation and poor correlation, reflect the ultra-low permeability non permeable reservoir mobile water saturation influence factors tends to be more complex, through the red 75-9-1 and Dabei+10-12 two wells contrast analysis draw a conclusion that, with the physical property variation, mobile water saturation and physical correlation variation, movable water saturation factors Become more complex.

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