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Daan Oilfield Low Permeability Sandstone Reservoir Petrology Characteristics

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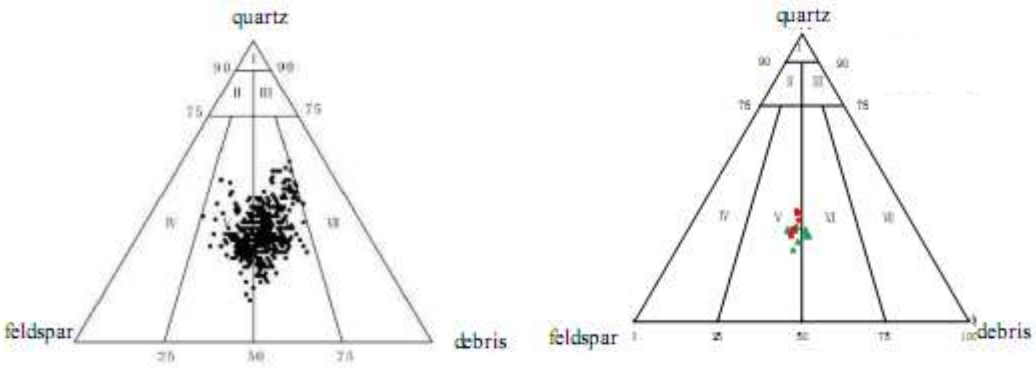
Abstract: In a large number of previous research results in the foundation, through core observation, systematic sampling and importance sampling combined and micro analysis and chemical analysis etc. method, analysis of reservoir rock type, reservoir physical properties and microstructure of petrological characteristics. The specific contents include rock composition, structure, matrix, cement and special matter contains.
Keywords: core observation; systematic sampling; reservoir physical properties.

ROCK COMPOSITION

Based on core observation, thin section analysis results, it is determined that the Daan oilfield Fuyu reservoir is lithic feldspathic sandstone and feldspathic lithic sandstone (Figure 1a). Results from the Daan oilfield sample thin section identification, detrital composition mainly as quartz, feldspar, debris storage [1]. Layer of quartz content general between 20 ~ 30%, the average content of 28.2%; average content of feldspar 36.8%, which potassium feldspar between 21 ~ 25%, the average content of 23% plagioclase general in 10 ~ 13%, the average content of 11%; cutting accounted for about 33 ~ 38%, average of 36%, which acidic extrusive clastic 29.2% The rock composition in the study area, the rock debris and feldspar content is higher than the regional rock (Figure 1b), the content of quartz is low, with the characteristics of low composition maturity, which laid the material foundation for the formation of tight reservoir.



a The study area and the surrounding rock composition triangle
b The rock composition triangle map of the study area (N=31)

Fig-1: Rock composition triangle

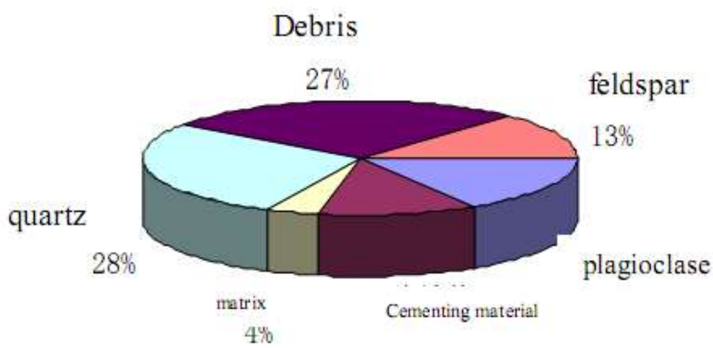


Fig-2: Composition of rock in the study area

FILLING CHARACTERISTICS

Fillings include miscellaneous base and cements, miscellaneous base is and clastic particles also deposited particles, filling pores in clastic particles between. Research areas with complex base is mainly composed of clay mineral composition, accounts for about 4%, on the whole the finer the particle size, impurity content more, cements using carbonate salts, mainly siliceous, average content is about 12%, local clay, high calcium (Fig. 2). Different samples in two kinds of cements the proportion of different [2]. Common sandstone layer to the bottom of calcium based, upper argillaceous components.

Clay minerals are illite, chlorite and illite smectite mixed layer, in different depth, different content of clay minerals, depth from 1700 to 1800 m, three ratio close to, and in 2200 ~ 2300m in Fuyang oil layer [3] .illite accounted for about 67.4% of the total amount of clay minerals.Chlorite and accounts for about 1%; illite smectite mixed layer accounted for 31.6%, to illite (Figure 3). From the scanning electron microscope (SEM), clay minerals more to bypass type and a film distribution in the surface of grain and the intergranular pore, reduces the effective pore radius, an increase of surface area, pore in the as cast thin sections were disseminated that clay minerals exist on sandstone permeability and wettability will cause greater influence .

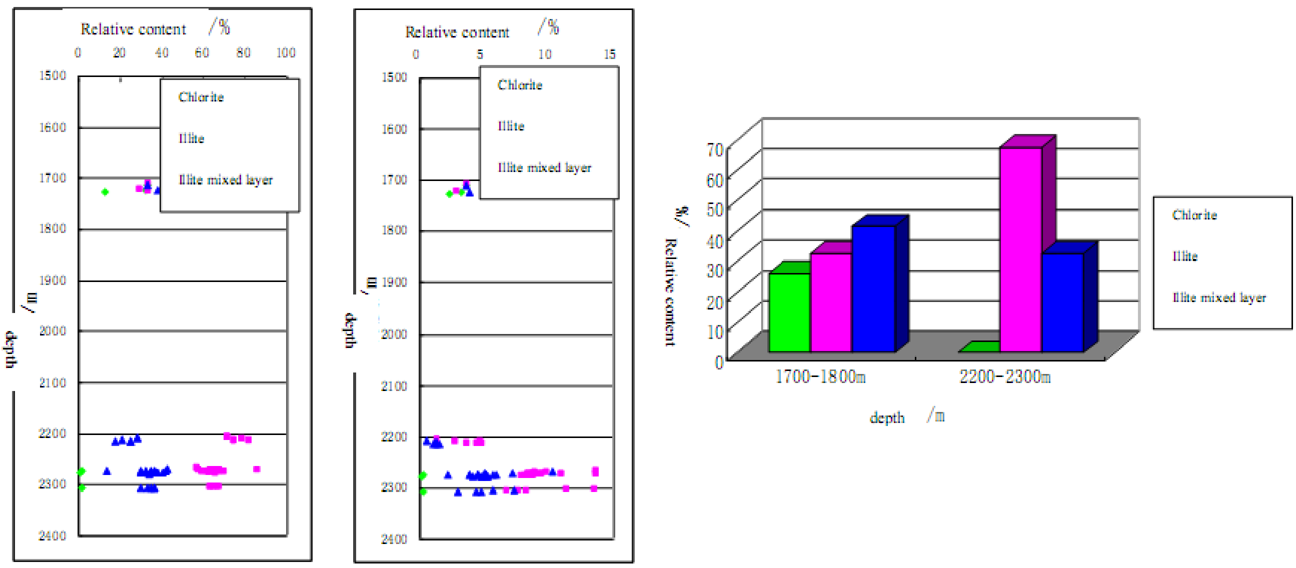


Fig-3: Clay mineral distribution map

LITHOFACIES CHARACTERISTICS

The study on the basis of previous research, the area within 8 takes heart wells (Da 19-3, Da 20-3. Da 20-1, red 88, Da 42-1. Red 75-9-1, Da 19-3, Dabei 10-012 wells) of core observation and petrographic analysis, the Daan oilfield sedimentation made more comprehensive understanding.

Fine sand fine sedimentary rocks formed under the lithofacies are specific depositional environment characteristics of the sum of the same facies represent the same sedimentary conditions of product [4]. By analyzing the different rock color, structure, sedimentary structure, type characteristics, can reflect the different genetic sand body process of hydrodynamic conditions, to restore the original sedimentary environment. According to the core observation, the area developed 8 kinds of main types of lithofacies. Respectively is: massive bedding sandstone facies (SM), parallel bedding facies (SH), cross bedding sandstone facies (FS), deformation bedding, mud silty sand facies (SD), wavy bedding, mud silty sand facies (FR), horizontal bedding, mud silty sand facies (Fh), the brown red mudstone (Mr), the gray - dark gray mudstone (Mg).

Massive bedding fine sandstone facies: mainly pale gray, gray green sandstone , single layer thickness, local oil, bottom contact mutation, bedding is not obvious, to transition to parallel bedding fine sandstone facies, formed to become fine positive rhythmic cycles, reflect more water dynamic conditions of rapid accumulation, mainly seen in the strong hydrodynamic distributary channel, underwater distributary channel and mouth bar.

Parallel bedding fine sandstone facies: mainly pale gray, grey fine sandstone, monolayer thickness larger, better sorting. Lamina thickness between 0.2 ~ 0.5cm, by parallel straight continuous or discontinuous texture composition, texture of charcoal and display, reflect the shallow water flow in acute and hydrodynamic conditions, mainly seen in mouth bar.

Staggered bedding fine sandstone facies: mainly pale gray, gray, gray brown fine sandstone, monolayer thickness larger, better sorting and by a series of skew in the layer interface of laminae composed, reflect the strong hydrodynamic conditions, mainly seen in mouth bar.

Bedding, mud silty sand facies deformation: the lithology is mainly pale gray, gray mud silty sandstone; reflect under the action of gravity, resulting in the deformation of the surface sediment. In the deposited layer laminae appears discontinuous deposition, mainly seen in far sand dam.

Wavy bedding argillaceous siltstone facies: lithology is mainly grayish, grey argillaceous siltstone. Layer interface is wavy, microwave shape, grain level irregular, intermittent or continuous forms, level see carbon strip belt, the main form of weak hydrodynamic condition of the environment, can be seen in the delta plain natural barrier, the front far sand dam.

Horizontal bedding argillaceous siltstone facies, lithology is mainly pale grey siltstone, mud silty sandstone and thinner. Reflect the lack of material supplies, mainly by suspended matter slowly hang to deposition of and, this kind of sedimentary structures mainly developed in the delta front sand dam, distributary Bay [4].

Brown red mudstone phase: lithology is mainly brown red mudstone, with massive bedding, low-energy hydrodynamic conditions of oxidizing environment deposited product, often forming in distributary channel.

Gray, dark gray mudstone phase: lithology is mainly grey, dark grey shale, with massive bedding, containing pyrite particles; rich in organic matter and level see plant debris, for low-energy hydrodynamic conditions to restore the environment of deposition product, often shaped components in the branches of the bay.

ROCK PHYSICAL PROPERTIES

According to SY / T 6285-1997 porosity and permeability classification standard, the reservoir rock permeability distribution in low permeability tight level and mainly in dense and ultra-low permeability; porosity distribution in low porosity and super low porosity level, and mainly in the extra low porosity and super low porosity. Thus it may be known of the reservoir rock and stone material poor [5].

Table 1: Classification criteria of physical property in the study area

Permeability K, mD			Porosity φ, %		
Grade	Range	Ratio %	Grade	Range	Ratio %
Extra high permeability	K≥2000	0	Extra high hole	φ≥30	0
Hypertonic	500≤K＜2000	0	High hole	25≤φ＜30	0
Infiltration	50≤K＜500	0	In the hole	15≤φ＜25	0
Low permeability	10≤K＜50	0.7	Low porosity	10≤φ＜15	4.9
Extra low permeability	1≤K＜10	2.8	Extra low hole	5≤φ＜10	57.3
Ultra-low permeability	0.1≤K＜1	55.9	Super low hole	0≤φ＜5	37.8
compact	0.01≤K＜0.1	40.6			

According to the further statistical analysis, it is found that the storage layer of rock grain size on the material has certain control effect. Dense low and ultra-low porosity reservoir rock in pelitic siltstone mainly; ultra-low permeability reservoir with low porosity layer rock siltstone percentage of highest pelitic siltstone and fine sandstone. Low infiltration reservoir with low porosity layer is mainly fine sandstone dominated.

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