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Research of characteristics of oil and gas transportation systems in LiuChu area

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Abstract: Based on a variety of factors, such as the certainty of oil-migrating faults and their sections of ridges, the matched pattern of fractures and sand body conductive systems, and superface structural forms of sand body conductive systems, in this paper we applied seismic inversion technique, moreover, we determine dominant horizons of oil and gas lateral distribution and the direction of oil and gas further migration. Thereby we established the pathway system of hydrocarbon source rock fracture and sand body trap, also used formation testing of agent review well, logging and electric logging interpretation data to verify the migration path of oil and gas. It turned out that the fault is the only path for of vertical migration of oil and gas, and the section of the ridge is the dominant path of oil and gas vertical migration. Oil and gas chose sand layer with good physical character to fill first, after that, it occurred lateral migration along the conducting ridge composed of structual ridge and high permeability sand body.

Keywords*: transportation systems, LiuChu area, lateral distribution*

I. INTRODUCTION

Liuchu structure left stuffing structure located in south-central recess of Raoyang in Bohai Bay Basin, East yuan Changlou - Yang Wu Village tectonic zone, west of the village of Liu low projection, Ulmaceae south tectonic belt, leaving the north and west tectonic belt connected Da Wangzhuang fault , left by the east side of the main body structure Liuchu left - two-way compression Huangfu village west of the fault and the fault and the late king Bones collapse NE towards the formation of an asymmetric collapse anticline area stretching effect on the double break fault displacement difference decreased during fault occurrence change rollover anticline formed. Is a typical complex fault block oil-bearing structures.

Two series of source rocks of Es1x and Es3s and reservoirs develop in this area, and among them, Es and Ed can both be considered as reservoirs. According to previous recognization of oil and source rock correlation, we realize that oil and gas generated from source rocks of Es1x mainly provide reservoirs of upper Es1s and Ed, which constitute superficial source-reservoir-cap assemblage. Oil and gas of Es2 and Es3 mainly come from source rocks of Es3s, which constitute deep-seated source-reservoir-cap assemblage. This passage mainly talk about the characteristics of superficial oil and gas conducting systems.

According to 3100 meters of hydrocarbon generation thresholds of Es1 in this area, we can limit distribution range of mature source rocks. Nowadays discovered reservoirs have a band distribution around the source centre, and show best at collapsed anticline core. The oil and gas distribute vertically three intevals of Ed, which have characteristics of a source layer reservoir forming and deep-seated oiliness better than superficial layer's in Ed. It is also proved that oil and gas main migration direction is vertical migration first and then lateral migration to reservoirs. In that way, the distribution of oil-migrating faults, the location of fracture surface ridges of oil-migrating faults, the matching relation of sand conductive systems and oil-migrating faults, and the position of sand conductive ridge all influence advantage migration way for oil and gas accumulation. To make sure the position oil-migrating faults and their fracture surface ridges, advantage layers of oil and gas lateral migration, and further migration way after oil and gas distributary has become the key to recognize regularities of reservoir distribution, On the basis of many factors, such as confirmation of oil-migrating faults and their fracture surface ridges, the matching pattern of fractures and sand conductive systems, and the top surface structural configuration of sand conductive systems, we tease oil and gas migration characters in Leave Chu area in order to provide theoretical foundation for this area oil and gas further exploration.

II. CHARACTERISTICS OF VERTICAL TRANSPORTATION SYSTEMS

1.1 Classification and Distribution of Conductive Fractures

Fractures communicating source rocks and reservoirs and acting in pool-forming period are called oil-migrating faults[1].Besides these, faults spatially contacted with oil-migrating faults and acting in pool-forming period can also be oil and gas vertical migration ways. In accordance with if it is an oil-migrating fault, if it is spatially contacted with oil-migrating faults, and if it communicates source rocks, research area's fractures can be devided into three categories, class I conductive faults are oil-migrating faults, class II

conductive faults are faults apatially contacted with oil-migrating faults and acting in pool-forming period. Class III conductive faults are faults not communicated with source rocks, that is to say, invalid conductive faults. In line with above classification schemes, we describe horizontal distribution of all kinds of conductive faults on the plane, and coincide oil and gas showing condition, so that we get the conclusion that oil and gas mainly distribute nearby class I conductive faults (Fig.1).

1.2Fracture Surface Ridges Are Advantage Ways of Oil and Gas Vertical Migration

As the only channel of oil and gas vertical migration, faults in most cases are rough geologic bodies in three dimensions. Fracture surface up raised positions constitute fracture surface conductive ridges, which are low potential areas of oil and gas transportation. In certain hydrocarbon cases, oil and gas first migrate along fracture surface ridges when they vertically migrate through faults[2].Fracture surface ridges close to source kitchens(effective hydrocarbon source rocks)can play a full role of oil and gas migration channel. However, fracture surface ridges far from source kitchens (invalid hydrocarbon source rocks) have no effect on transporting oil and gas.

On the basis of this principle, we recognize fifteen class I conductive fractures of the research area, define sixty fracture surface ridges, and classify three types according to communicating cases of fracture surface ridges and source rocks, class I fracture surface ridges: fracture surface ridges communicating with high effective source rocks of Es1,class II fracture surface ridges: fracture surface ridges communicating with effective source rocks of Es1,class III fracture surface ridges: fracture surface ridges communicating with inefficient-invalid source rocks. Finally we identify twenty-nine class I fracture surface ridges, thirteen class II fracture surface ridges, and eighteen class III fracture surface ridges.

For an example of Leave Chu-Huangpu village faults, we make out six conductive ridges which conclude two class I conductive ridges, three class II conductive ridges and one class III conductive ridge. In a case of misering nowadays, several commercial oil flow wells have been found near two class I conductive ridges developed in Leave Chu-Huangpu faults.

There are main developing antithetic faults in Leave Chu region, which are faults that their trendency and both blocks of faults' are on the contrary. The hanging side of antithetic faults is the low potential area of oil and gas migration, thus planimetric positions of fracture surface ridges are considered as filling points of oil and gas lateral migration from faults to reservoirs. Corresponding three types of conductive ridges, we classify filling points by the same rules and label positions of three types of filling points on the plane (Fig.1)

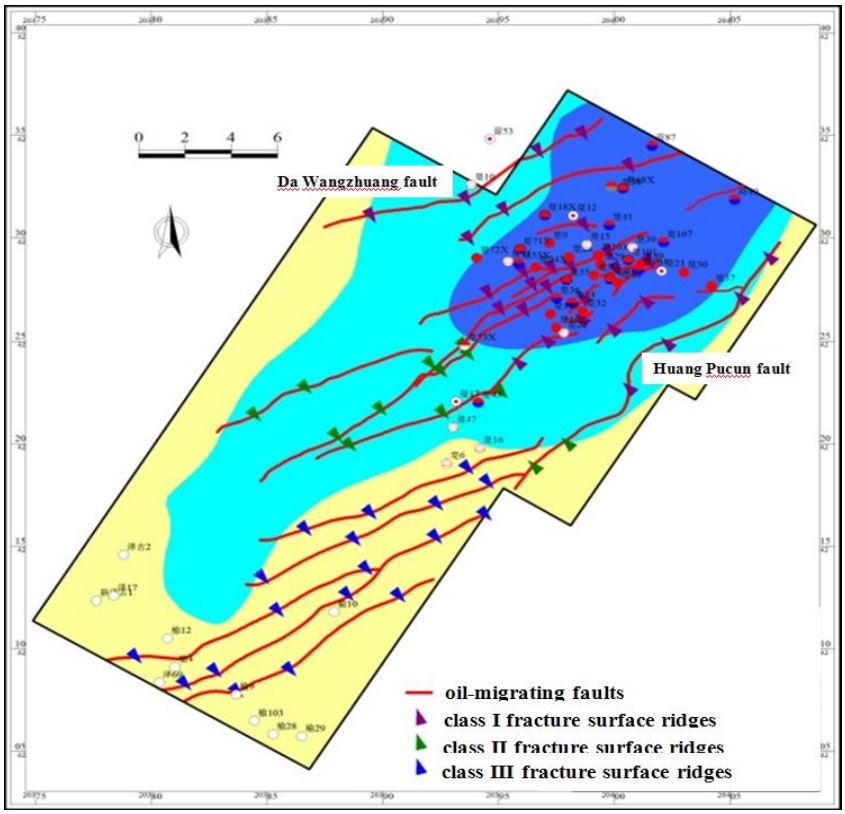

Fig.1：Different classes of fracture surface ridges and oil-migrating fault in liuchu area

III. ADVANTAGE LAYERS OF OIL AND GAS LATERAL DIVERSIONS

After oil and gas vertically migrate to superficial part along oil-migrating faults, they can only further migrate to sand reservoirs around in order to be accumulation possibly. In the course of oil and gas vertical migration, when they are covered by the overlying caprock, they will laterally migrate. Due to the fact that the research area belongs to meandering stram and braided fluvial facies, thin sand-shale interbeds develop vertically, which can be subdevided into several reservoir-cap rock combinations. That is to say, we ought to solve problems of which layers oil and preferentially fill.

Zeng Jianhui[3] made sand box analog models of oil and gas lateral diversions in 2003.The result is proved that oil and gas diverse along conductive layers with good poropern characteristics, no matter this series of conductive layers are at the upside or bottom.

In line with existing wells showings of Leave Chu area, there are also same regularities of single wells near class I filling points. Seen from the relationship of oil-water zones and industrial oil flow wells in each layers, with sand-shale ratio raising, the number of industrial oil flow wells increases. Seen from well 104 in Leave Chu area, when sand-shale ratio of reservoir is greater than 0.2,oil and gas can fill reservoirs.

IV. ADVANTAGE DIRECTIONS OF OIL AND GAS MIGRATION AFTER LATERAL DIVERSION

Oil and gas migration ways after their lateral diversion are controled by three-dimension morphology of sand conductive layer's surface or confining bed's subface. Channel sandstones and structural configurations of slops constitute lithology conductive ridges. Thus, conductive ridgess composed of structive ridges and high permeability sand bodies are advantage ways of oil and gas lateral migration after they run into reservoirs. However, due to the fact that several oil-migrating faults distribute subparallelly Leave Chu area, the distance of oil and gas migration on the plane of sole oil-migrating fault is often less than a fault space, and oil and gas of many oil-migrating faults have a relay style of migration on the plane.

Overall considerating oil-migrating faults' lateral filling points and three factors of structive ridges and distribution of channel sandstones in different areas, we detail layer conducting ridges of Leave Chu structure. Their distribution has characteristics as follows: Firstly, in the west, oil and gas have a relay style of lateral modulation from northwest to southeast along the direction of faults almost straight. Secondly, in the east, although migration ways seem like less, it also has the characteristic of modulation from east to west. As a whole, oil and gas accumulate from both eastern side and western side to the centre laterally. It reflects the characteristic of two-way for hydrocarbon. Combining filling points and conducting ridges, we can make sure lateral migration ways of layer oil and gas transporting into reservoirs from oil-migrating faults.

V. CONCLUSIONS

1.Faults are the only vertical migration channels of oil and gas, and class I oil-migrating faults have a controlling effect on the distribution of oil and gas.

2.Fracture surface ridges are advantage ways of oil and gas vertical migration, and oil and gas accumulate most near class I fracture surface ridges.

3.The minimum limit of oil and gas lateral filling sand-shale ratio is 0.2, and with the sand-shale ratio increasing, oil and gas fill the area more easily.

4.Conductive ridges composed of structive ridges and high permeability sand bodies are advantage ways of oil and gas lateral migration after they run into reservoirs.

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