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The advantage passageway of fault conducting oil and gas and its research methods

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Abstract: Within the basin of secondary hydrocarbon migration is a highly uniform process, in the oil and gas natural without outside interference priority flows through the channel called the advantage. Fault as one of the important channels of oil and gas secondary migration, there are also advantages migration path, advantages related to the fault lose conductor channels including flow channel and cross section advantages of two types. General physical simulation experiment method is used to study to superior channels, the section depth contour method with 3 d geological modeling research section advantage channel.

Keyword: *fault; oil and gas migration; dominant migrating pathway; research method*

I. INTRODUCTION

In recent years, a lot of physical simulation[1-2] and numerical simulation[3] have shown, in conducting layer of hydrocarbon migration is a highly uniform process, even within the homogeneous porous media, oil and gas migration along the path of the channel and limited only to occur, the volume is only 1% ~ 10% of all conducting layer, Along the distribution of oil source faults caused by the hydrocarbon trap has obvious differences of oil and gas accumulation. Fault advantage migration path changed in the past people think of open fault are oil and gas migration channel of wrong ideas, emphasize only along the fault edge migration channel for exploration targets, to find oil and gas reservoirs.

Due to the advantages of a channel is the actual path most of the oil and gas migration, the research on tracking source of oil and gas, predicting favorable trap has a very important role. Control the oil and gas fault in China calls for development, fault advantage migration channel and its analysis method for accurate determination of oil and gas migration trajectories and searching for favorable exploration targets will have important practical significance.

II. THE INTERNAL STRUCTURE AND FAULT FLUID CONDUCTING CHANNEL

Brittle fault fault zone and induced fault zone development as the main characteristics[5], which fault rock fault zone development (including bond force and no bond force 2 types) and associated faults, broken on both sides of the end of the limited area or fault stress release area development induced cracks. In the high plasticity of rock fault of ductile fault characteristics, cracks induced fault belt and associated with less development.

Breaking the internal structure of the different components have different ability of conducting. Associated fault development to improve the vertical permeability of fault，The advantage of oil and gas migration channel become faulting period. After the fault to stop the activity, these advantages of crack opening degree determines the fault vertical sealing. No bond strength of fault rock with low degree of cementation, it can become hydrocarbon migration channel mainly depends on the content of fault gouge. Have a bond strength of fault rock belt due to the decrease of the particle size and mineral deposition, compared with the surrounding rock, porosity decreased by one order of magnitude, permeability decreased by 3 ~ 6 orders of magnitude[5], hindered the vertical migration of fluid. For inducing crack, if development density is large enough, and in breaking dormant period in an open state, can also be effective hydrocarbon migration channel. As a result, fault zone to the nature of rock fault internal structure of heterogeneity, can control section advantages migration path of development. The advantage of brittle fault migration channel for fault rock associated faults, no bond strength of fault rock and induced fault can be used as a vertical migration channels, but migration channel is often not advantage. Plastic fault zone advantage migration channel development, only possible development induced cracks as vertical migration channels.

III. FAULT OF CONDUCTING THE ADVANTAGE OF OIL AND GAS MIGRATION PATH

Advantage channel refers to in the process of secondary migration of oil and gas natural priority flows through the channel without outside interference[6]. It is the heterogeneity of conducting system, the uniformity of the field and fluid flow, etc. The result of joint action of many factors. Constitute the advantage of oil and gas

migration channel can be faults, unconformity, and can also be a conducting layer of high permeability. Advantages related to the fault lose conductor channels including flow channel and cross section advantages of two types.

2.1 To superior channel

To superior channel refers to in the process of migration of oil and gas buoyancy effect difference caused by different fault dip and form the advantage of oil and gas migration path[7]. Under the condition of buoyancy for migration dynamics, oil and gas migration direction and channel controlled by buoyancy and fault Angle, the greater the Angle, more easy straight upward hydrocarbon migration; the smaller the Angle, the more difficult it is to suitable break up of oil and gas migration, it may be before haven't reached the top or the ground along the fault surface was along the edge channel diversion and hidden in the trap zhongfu integration.

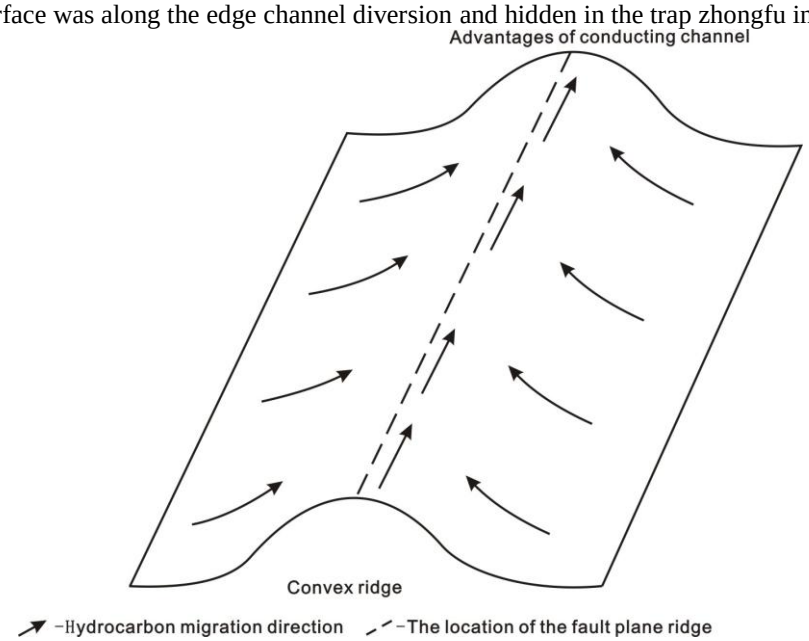

Fig.1 Section ridge formation of advantages of conducting channel geological conceptual model

2.2 The advantage of fault plane channel

Non uniformity by fault zone material and geometric shape is irregular, the influence of such factors as, the migration of oil and gas in the fault zone is inhomogenous, that the vast majority of oil and gas in the fault zone along a limited channel space migration, along the direction of fluid potential to reduce the largest oil and gas would follow and focus on the path of least resistance movement, the concave segment with relatively high oil and gas potential value, and convex with relatively low potential value, in the process of migration of oil and gas by the first place to the convex concave ridge ridge gathering migration, along a vertical migration convex ridge, thus forming the oil and gas along the vertical migration of oil source faults of channel section advantage[6](fig.1).

IV. FAULT OF THE ADVANTAGES OF CONDUCTING OIL AND GAS MIGRATION CHANNEL OF THE RESEARCH METHODS

3.1 Physical simulation experiment research to superior channel

The experimental process, the oil from the bottom of the slab model entrance into the lower part of fault, under the effect of buoyancy oil will be upward migration along the fault[7] (fig.2). Due to the vertical component of the role, part of the oil will be along the high permeability reservoir into a purpose layer from bottom to top respectively (D1), purpose layer 2 (D2), And purpose layer 3 (D3). Due to the different fault dip Angle, 3 sets of the position of the objective layer, and into the oil amount of them is different. (A) change fault dip, record under the condition of different Angle to the amount of oil in the layer, To study the change rule and restriction relationship between them. In each, filling volume and filling rate is constant.

Zhengxue jiang through physical simulation experiment reveals to superior channel control of the oil and gas enrichment, the experimental results show that, conducting oil and gas fault dip Angle is different, oil and gas in the sand layer in the allocation amount is different, with the increase of fault Angle near the fault in the lower sand falling oil accumulating quantity, and amount of oil accumulating in the fault of the upper sand layer is on the rise(fig.3). Therefore, to superior channel control of the reservoir distribution related to the faults can be understood as: Over the fault formation good sealing conditions and buoyancy as the main migration

dynamic conditions, rupture Angle is smaller, more easily in the oil and gas near the fault from deep strata in enrichment, conversely, the more easily in the shallow strata.

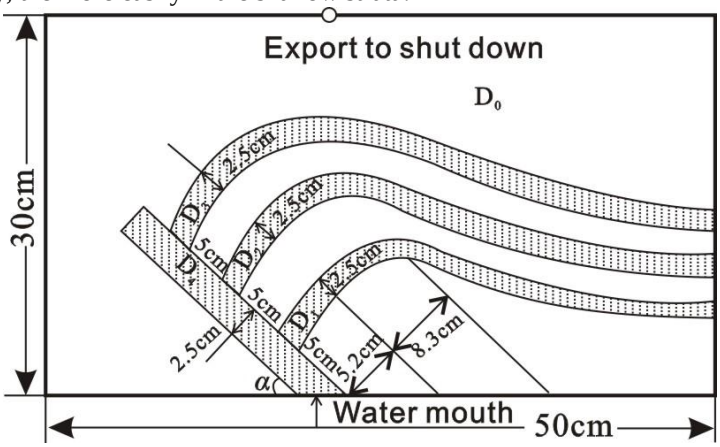

Fig.2 Accused of hydrocarbon to superior channels in the physical simulation model (Zhenxue jang,2005)

3.2 Section depth contour method with the advantage of 3 d geological modeling method research section channel

Advantage of oil and gas migration path is mainly affected by the cross section geometry and fluid potential, can be divided into the following three conditions (figure 4):(1) Planar fault doesn't change oil moving path, planar fault doesn't change oil moving path, advantages of migration channel is not obvious;(2) It is concave fault line up divergence, no advantage migration channel;(3) Convex fault line together to form the advantages of vertical migration pathway, obviously, fault convex ridge is low potential area not only, but also can make the oil and gas gathering, is the advantage of oil and gas along the fault plane of conducting channel, oil and gas to the first fault convex ridge converge, then the vertical migration along the ridge.

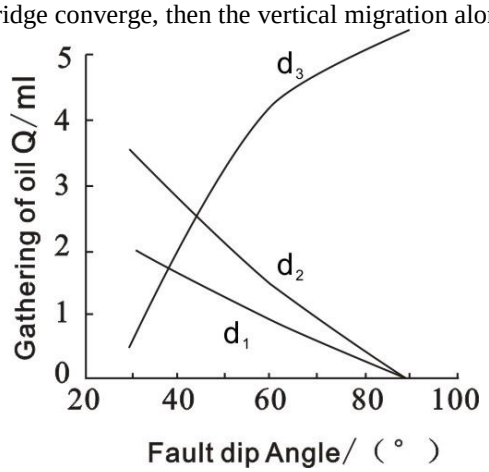

Fig.3 To superior control hydrocarbon role physical simulation experimental results statistical figure(Zhenxue jang,2005)

The method to determine the fault plane advantages of conducting channel three, is the section depth isoline method respectively, fault plane three-dimensional structure form and fault plane the ancient fluid potential method. In terms of the mechanism of oil and gas migration, fault plane the ancient fluid potential method can reflect the characteristics of the convergence and divergence of the fault activity and, but the current oil and gas exploration data and the limitation of research level, often lack of fluid information directly related to the fault plane, usually using the drilling data for indirect calculation, the process is more complicated, it is hard to a wide range of applications. Therefore, now more commonly used and effective method is to section depth isoline method and three dimensional structural form of area.

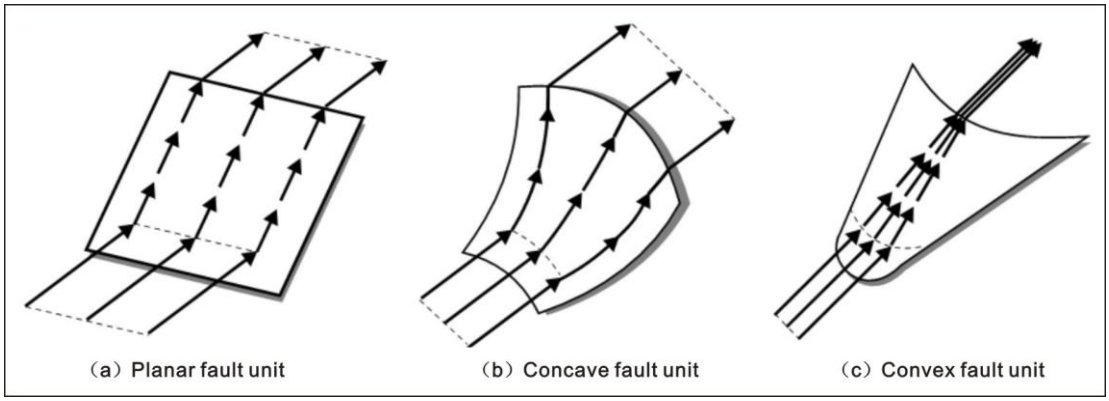

Fig.4 The fault surface shape effect on the distribution of oil and gas secondary migration path(AD. Hindle，1997[3])

Section depth isoline method in deformation and fault of oil and gas in conducting research is the most widespread, it is fault scenario into a surface, mainly through 3 d seismic data to determine the burial depth of the strata along the fault strike on the section variation law (figure 5a) , buried depth contour integral trend upward concave position is usually the fault surface "saddle", the section of low potential area, gathering of oil and gas, therefore, the cross section of the ridge position is the location of the fault surface advantage of oil and gas migration path.

In addition, with the improvement of oil and gas exploration technologyGeological modeling, and study of hydrocarbon migration, sealing ability gradually developed to the direction of 3 d visualization，by seismic interpretation platform software "Landmark", 3 d geological modeling software Petrel and fault sealing evaluation software Trap tester, etc are three-dimensional shape of the fault can be intuitive display, the fault plane three-dimensional form and depth change can quickly determine the section of "saddle" and "back", and then determine the advantage which is full of oil and gas migration channel (figure 5b).

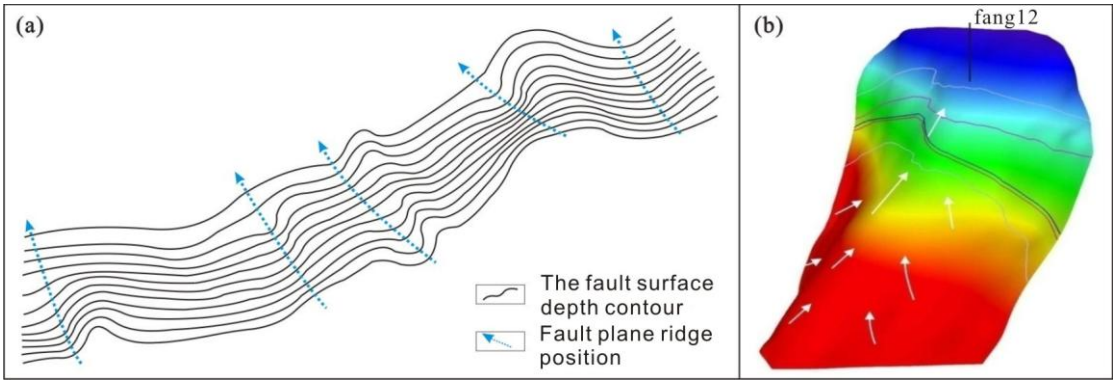

Fig.5 Method for determining the fault plane advantages of conducting channels
(a) The section depth contour;(b)Section 3 d shape

V. CONCLUSION

(1) Breaking the internal structure of the different components have different ability of conducting, the advantage of brittle fault zone for fault rock cracks accompanying migration channels, without bond strength of fault rock and induced fault can be used as a vertical migration channels, migration channel, but usually not advantage.

(2) Advantages related to the fault lose conductor channels including flow channel and cross section advantages of two types. General physical simulation experiment method is used to study to superior channels, using the method of cross section depth contour and 3 d geological modeling research section advantage channel.

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