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Discussion on the Possibility of Hydrocarbon Downward Migration of the Fuyang Oil Units of Songliao Basin in China

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SUMMARY

Hydrocarbon downward migration theory has existed the dominant figure for a long time, which is a relatively appropriate hypothesis to interpret the formation mechanism of hydrocarbon accumulation when there is no traditional effective source rocks below. Although hydrocarbon downward migration theory applied on model of Fuyang Oil units of Songliao Basin in China has been accepted by most scholars in China, there are still some controversial issues to be solved and not clearly to interpret the migration process of Fuyang oil or some oil units in other places, like Wiyuan Gasfield in Sichun Basin and Jinybian Gasfield in Ordos Basin. In this paper, we take the Fuyang oil of Songliao Basin in China for example to explore the possibility of downward migration model. Fuyang is very famous oil units that is the major hydrocarbon producer of Daqing oil field –the biggest oil output in China; Hence, researches on the controlling factors and model of hydrocarbon accumulation are essential with aspect of exploring development.

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Currently, Most of those geoscience scholars believe that formation mechanism of Fuyang oil result from this paralld hypothesis-hydrocarbon downward migration. Three major evidences are strongly support this view: Firstly, the effective overlying K¹qn¹source rocks can provide abundant organic matter-3.125% of organic carbon, 0.5% of chloroform bitumen 'A', Kerogen featured by type I and IIA, what is more, vitrinite reflectance ranges from 0.6%-1.2%^[1]. Second one is the powerful hyperpressure (even peak at 20 Mpa) is enough to drive the hydrocarbon migration downward. Additionally, the theoretical migration distance (over 300m) is applicable to the actual one around 200m^[2]. The third is fault distribution which is a bridge to connect the source rocks and reservoirs. Although all these reasons seems like valid, there are still queries about the hydrocarbon migration downward to understand the Fuyang oil accumulation. First one is the migration downward theory is not reasonable because physical principle of hydrocarbon buoyancy is upward and that is one of critical factors to control the oil and gas migration in low permeability. In addition, the hyperpressure, based on calculation from acoustic well logging, has not been proved in actual geology due to the true pore pressure we can not test and this migration dynamic is still studied deeper. And then hydrocarbon physical state from generation, migration and accumulation need to be considered fundamentally, which is very significant for solving the hydrocarbon expulsion process. Importantly, the lateral migration from other reservoirs also plays an essential roles.

For future work to testify this interesting problem, the author will carry out from the formula derivation (migration downward distance), physical simulation experiments and collecting the geological, well logging datum to complete a relatively migration mode, which provides a new exploration thought and approach in future hydrocarbon exploration and development.

[1] Liu Zongpu, Fu Xiaofei, Lu Yanfang, et al. 2009. Hydrocarbon reserved accumulation model of big depression syncline area: A case of the Fuyang reservoir in the Sanzhao depression. Geological review, 55(5): 687-692.

[2] Fu Guang, Feng Heeqing. 2012. Lateral migration model of oil in combination of upper source rock and lower reservoir and oil accumulation in depressed area: An example from Fuyu and Yangdachengzi oil layer in Sangzhao depression, Songliao Basin, Lithological Reservoirs, 24(3): 11-16.