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Petroleum Accumulation: from Continuous to Discontinuous

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Based on an extensive investigation and a comprehensive study of conventional and unconventional accumulations, we demonstrated that petroleum accumulation is a process from continuous to discontinuous accumulation and three basic types of accumulation are resulted from this process, namely continuous, quasi-continuous and discontinuous accumulations. (1) Continuous accumulation. Schmoker [1, 2] attributed shale gas, coalbed methane, tight gas and some other varieties of unconventional hydrocarbons to this category. However, we argued that the authentic continuous accumulation mainly occurs within a source rock that also acts as a reservoir [3]. Many or even most of the shale hydrocarbon and coalbed methane reservoirs belong to this type. It is characterized by that hydrocarbon distribution is extensive and continuous within the scope of effective source rocks; neither defined boundaries nor bottom or edge water can be observed; accumulation is largely in situ or near where the hydrocarbons are generated and no prominent migration is needed; and accumulation is controlled mostly by subtle traps such as stratigraphic traps and hydrodynamic traps. (2) Quasi-continuous accumulation. This type of accumulation occurs predominantly in tight reservoirs and many or even most tight oil and gas reservoirs can be attributed to this type [3-5]. It is distinguished by that hydrocarbon distribution is extensive geographically and each accumulation comprises numerous contiguous but not connected small- to medium-sized reservoirs; the accumulation has no defined boundaries and neither prominent water lag nor noticeable updip water is present; hydrocarbon charge is pervasive and the accumulation is the direct result of primary migration or short-distance secondary migration, and the migration is principally driven by non-buoyant forces and is primarily in non-Darcy flow; and hydrocarbon accumulation is governed principally by stratigraphic traps. (3) Discontinuous accumulation. Also known as conventional trapped accumulation, this kind of accumulation occurs mostly in conventional reservoirs or quality reservoirs. It is characterized by that hydrocarbon distribution is discrete geographically, each accumulation has explicit boundaries and water lag is commonly existed, migration is generally in the Darcy flow and can occur over long distance and the driving force is mainly buoyancy, and that accumulation is strictly governed by multiple traps including structural, stratigraphic and combination traps.

Actually, the above 3 types of accumulation could be formed from a single source kitchen. In that case, close relationship and unique laws governing hydrocarbon distribution must exist among them, and their richness of hydrocarbon resources is assumed to be negatively proportional to each other. As a result, they ought to be taken into consideration as a closely related entirety in the study and exploration of petroleum systems to enhance the success rate.

References:

- [1] Schmoker J W (1995) In: *1995 National Assessment of United States Oil and Gas Resources—Results, methodology, and supporting data*: U.S.Geological Survey Digital Data Series DDS-30 (CD-ROM)
- [2] Schmoker J W (2002) AAPG Bull 86(11): 1993-1999

[3] Zhao J (2012) *Natural Gas Geos* 23(3): 393-406

[4] Zhao J et al. (2012) *Acta Petrolei Sinica* 32(s1): 37-52

[5] Zhao J et al. (2013) *Oil & Gas Geol* 34(5): 573-583

