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Talk about the Difference and Connection between Conventional and Unconventional Oil

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As all the nations in the world demand for more and more oil and gas resources and it is decreasing continually, unconventional oil and gas with the large resource potential gradually become the new exploration areas. Unconventional oil has been attached great importance by countries and companies. It'll become the inevitable trend of industry development that the extension from the conventional oil and gas to unconventional oil and gas in oil and gas exploration and development field. Conventional and unconventional oil and gas is obviously different in geological characteristics, the principle of gather, exploration methods, the evaluation of "dessert" area, the way of development, etc. Conventional hydrocarbon pools include structural reservoir, stratigraphic reservoir, lithologic reservoir, etc. Structural reservoirs mainly are isolated type or larger area of cluster type. Trap boundaries are visible. Reservoir space is mainly mm-micron grade pore system. The research object is trap and reservoir. The research core is trap and its effectiveness. Theory is based on theory of buoyancy accumulation. Unconventional oil and gas accumulation include the dense oil and gas, shale oil and gas, coal-bed methane, etc. Unconventional oil and gas mainly stays in situ or migrate short distance. The object of study is the hydrocarbon core and "dessert". The core is the configuration of source and storage. Conventional oil and gas evaluation focuses on generation, reservoir, cap, trap, migration, and preservation –"six elements"–and the best matching relationship. It focuses on evaluation of high quality hydrocarbon source, favorable reservoir, efficient transportation systems and the scale of trap, etc. Unconventional oil and gas evaluation focuses on hydrocarbon source rock characteristics, lithology, physical properties, brittleness, oil-gas possibility, stress-induced anisotropy –"six characteristics"– and the matching relationship. There are eight evaluation about

"dessert" area, of which three keys indicators are more than 2% of TOC, high porosity (dense oil and gas>10%, shale oil and gas>3%) and micro fracture growth. The similarities of conventional and unconventional oil and gas are the same hydrocarbon source system, the same force of the primary migration, similar oil and isotope composition, etc in the same petroleum system. Conventional and unconventional oil and gas is correlative in genesis and symbiotic in space, displaying ordered aggregation of conventional and unconventional oil and gas.

1 The Difference between Conventional Petroleum and Unconventional Petroleum

1.1 Concepts of Conventional Petroleum and Unconventional Petroleum

Unconventional petroleum cannot obtain natural industrial production by traditional ways. It must use new technology to improve reservoir physical properties of reservoir like permeability or fluid viscosity to exploit continuous and quasi-continuous gas and oil resources. Unconventional petroleum has two key markers: ①Continuous distribution of large area of oil and gas; ambiguous trap boundary; complicated relationships between oil, gas and water. ②lack of stable natural industrial production; Darcy seepage is not obvious; water power is difficult to play a role. And two key parameters: ①Porosity less than 10%; diameters of pore-throats are less than 1μm or permeability is less than 1mD. The main characteristic of unconventional petroleum is source-reservoir symbiotic relation, continuous and quasi-continuous distribution. Main types of unconventional petroleum include tight oil and gas, shale oil and gas, low permeability and heavy oil, coal bed gas, biogas, natural gas hydrate, oil sands, oil shale, etc.

However, conventional petroleum refers to the oil and gas resources that can obtain natural industrial production

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and can be put into economic exploitation directly. Distribution of conventional petroleum is controlled by specific trap boundary; has stable natural industrial production; obvious effect of buoyancy. Porosities of conventional reservoir are more than 10%; diameters of pore-throats are more than 1 μ m or permeability more than 1mD. Conventional petroleum can be divided into structural pools, lithologic pools and stratigraphic pools by trap types.

1.2 Characteristics of Reservoir

The differences in reservoir between conventional petroleum and unconventional petroleum can be summarized as follows:

(1) Unconventional reservoir is tight with poor physical properties. For example, the Quan 4th sandstone reservoir in Songliao basin, “Rang” wellblock slope zone Fuyu oil layer. Porosity of 1%~19%, the average of 10.7%; permeability of 0.001~10mD, the average of 1.82mD. Generally, conventional reservoir permeability is more than 1mD, Porosity of 10%~18%.

(2) Unconventional reservoir has a diversity of litho, and the scale of effective reservoir is small. The litho of unconventional reservoir in China is sophisticated, such as sandstone, limestone, shale, coal, hybrid sedimentary and so on.

(3) The microscopic pore-throat structure of unconventional reservoir is complex. Most of their diameters are less than 1 μ m. Unconventional reservoir has various pore types, both intergranular dissolution micro-pores, intergranular primary micro-pores, Intragranular primary micro-pores and organic matter micro-pores, intercrystalline micro-pores, micro-fractures and so on.

1.3 The Main Gathering Types of Oil and Gas

Oil and gas gathering includes four basic types: isolated type, cluster type, quasi-continuous and continuous. Conventional oil and gas gathering is given priority to with isolated type and cluster type, the isolated type main for structural reservoirs, the cluster type main for stratigraphic reservoirs and lithologic reservoirs. Unconventional oil and gas gathering is given priority to with quasi-continuous and continuous, quasi-continuous including carbonate fractured-vuggy oil and gas, volcanic fractured-vuggy oil and gas, metamorphic fractured-vuggy oil and gas, heavy oil, tar sands, etc, Continuous including dense oil and gas, shale oil and gas, coal bed gas, biogas, oil shale, gas hydrate, etc.

1.4 The Accumulation Mechanism of Oil and Gas

Unconventional oil and gas gathers in or proximal within the hydrocarbon source rock without buoyancy,

which does not conform to Darcy's Law, water dynamic effect nor obvious, the distribution of oil, gas and water complex. Gathering motivity is given priority to with residual pressure in hydrocarbon source rock, controlled by hydrocarbon-generating pressurization, uncompacted, tectonic stress, etc. Gathering resistance is mainly the capillary resistance. The two control the oil and gas boundary.

Conventional oil and gas reservoirs mainly develop mm-micron grade pore system, of which the capillary resistance is smaller, in which oil and gas migration-accumulation conform to Darcy's law. A fundamental characteristic of conventional oil and gas is “seepage” and “pipe flow” of oil and gas accumulation, which determine the oil and gas distribution in single types and cluster type.

2 The Relationship between Conventional and Unconventional Oil and Gas

Conventional and unconventional oil and gas aggregate orderly, in other words, in the same petroleum system, source rocks with high organic matter abundance generation and expulsion of hydrocarbon and reservoir space of different reservoir storage are change with the evolution of buried depth, the whole process of which is coupling. Oil and gas is continued filling in time domain and orderly distribute in space domain, forming a unified conventional and unconventional oil and gas gathering system. Practices show that conventional oil and gas discovery indicates the unconventional oil and gas symbiotic in the direction of hydrocarbon supplying, and unconventional oil and gas discovery indicates possible existence of conventional oil and gas in outer space.

3 Collaborative Development of Conventional and Unconventional Oil and Gas

Conventional and unconventional oil and gas obeys the rule of “order aggregation”. Using of the diversity and complementary characteristics of oil and gas production, different types of hydrocarbon resources in different epochs shall be explored and developed in the mode of stereo exploration and collaborative development.

Currently multiple well platform “factory” production mode is commonly used at home and abroad. Namely in similar geological conditions or basic clear underground geology conditions, according the way of placing wells in large platforms, a batch of similar wells shall be developed intensively for multiple well platform “factory” production. “Artificial reservoirs” will formed under the ground by using horizontal well length as volume unit and artificial compression fracture network as flow channel.