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Theory of Petroleum Geology and Exploration in Superimposed Sedimentary Basins around China

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The sedimentary basins in China have experienced a long and multi-period history of tectono-sedimentary evolution. Exhibiting composition and superimposition of different proto-type basins during geological periods, the superimposed basins are common around China, such as Tarim, Junggar, Qaidam, Ordos, Sichuan, Bohai Bay, Songliao, Pearl River Mouth, and South China Sea basins, and so on. The theory of petroleum geology on superimposed basins has been built and got to mature based on the exploration practices over the century, especially of the last 40 years. In those basins, hydrocarbon source rocks of the marine facies, transitional facies and continental facies become mature differently with the development of thermal systems, being characteristic of multistage generation and expulsion. Marine carbonate rocks, volcanic rocks and clastic rocks developed into effective reservoirs via diagenesis and structural modification, and they, combined with gypsum and salt, gypsiferous mudstones and mudstones, formed many sets of reservoir-seal assemblages. Hydrocarbons migrated along unconformities and fractural zones and accumulated in a number of stratigraphic horizons under multiple stages. Influenced by all the Cenozoic structural tectonic movements, hydrocarbons accumulated in the late period or after the adjustment in the late period. Hydrocarbons are abundant in uplift zones, slope zones, fractural zones or unconformity surface related to traps. Hydrocarbon accumulations in multiple horizons and of various types have led to a number of peak periods for oil and gas discoveries.

With hydrocarbon exploration efforts made in the past six decades, the oil and gas production from these superimposed basins reaches 210×10^6 tones and 1329×10^8 cubic meters in 2014 respectively. A series of large and medium-size oil and gas fields have been found not only in continental formations but also in underlying transitional and marine formations, such as Sulige, Jingbian, Tahe, Anyue, Puguang, Yuanba, and Long gang. Some large oil and gas fields were also discovered in deep-seated volcanic rocks of basins, such as Xushen, Kelameili and Niudong. The thinking and practice of "stereoscopic exploration" offer an important guarantee for future high-efficiency oil and gas explorations in the seven major areas in China , including highly explored areas, lithologic strata, foreland basins, middle-lower assemblages of superimposed basins, new onshore basins, offshore areas, and non-conventional oil and gas resources.