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PETROLEUM GENERATION, MIGRATION AND ACCUMULATION IN THE CENTRAL AREA OF JUNGGAR BASIN, NW CHINA: INSIGHTS FROM BASIN MODELLING

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As a typical superimposed petroliferous basin, Junggar basin is formed in a varying tectonic cycle setting. There are many uncertainties in further commercial petroleum exploration business induced by the special geological environment, although there is a promising explorable prospect in hinterland area. By providing the timing framework for petroleum generation, migration, accumulation and reservoir and trap formation, basin modelling has been a popular valuable tool of risk reduction (Düppenbecker, et al., 1998). This paper focuses on petroleum generation, migration and accumulation in the central area of Junggar Basin by using basin modelling as well as combining with geological, geochemical and geophysical data, aiming at reducing risk in exploration prospetivity assessment.

Basin modelling was performed in four wells which are located in the West of Well Pen1, North of Dongdaohaizi, and Changji depressions, respectively. Results indicate that the lower Permian Fengcheng Fm-sourced oils have a minor contribution to current reservoirs in that the timing of significant hydrocarbons generation and expulsion is not consistent with the entrapments formation. Conversely, the upper Permian Lower Wuerhe (LW) Fm-sourced hydrocarbons play important roles in reservoirs-forming, and are probably contaminated by the Jurassic generative hydrocarbons. Due to their better quality (type II kerogen) and higher maturity calculated with LLNL-EASY%R_o model than the Jurassic (mainly type III kerogen), the Permian source rocks have a much higher petroleum expulsion efficiency (>50%) than the mid-lower Jurassic source rocks (<40%), the cumulative of expelled petroleum was calculated with porosity saturation method. While it also suggests that the uplifting event occurred during the middle to late Jurassic seemly has a limited influence on the early Permian, but may have important impacts on the late Permian, the resulting effects are a much longer time of hydrocarbon-yielding and a two dominating stage process of petroleum-expelling (Fig.1).

The analysis of supporting histories of burial, hydrocarbon occurrence, expulsion and timing of trap formation indicates that there are three periods for hydrocarbon accumulation, which was also confirmed by fluid inclusions data with burial and thermal history (Fig.1). The tectonic movements have critical effects on hydrocarbon migration and accumulation system.

Early, affected by the Indo-China activity, it was a stable sedimentary basin, and petroleum that stemmed mainly from the LW migrated laterally from the depocenters to the tectonic highs; Because of the uplifting events in the I and II episodes of Yanshan orogenesis period, the earlier formed reservoirs readjusted and petroleum primarily remigrated vertically along faults into the Jurassic; Terminally, due to the late Yanshan and Himalaya movements, the sedimentary formations were southwardly inclined, petroleum generally migrated laterally along the Jurassic from the southern Changji Depression to the north region, migration directions were also associated with regional highs or uplifts. Most importantly, the late significant natural gas occurrence led to microfractures formation, they were composed of the preferential pathways for petroleum migration from the deeper buried formations to the shallow Jurassic reservoirs, resulting in shaping the mixed sources oil-gas pools, as was suggested by the synthesis analysis of hydrocarbon sources and regional geological data.

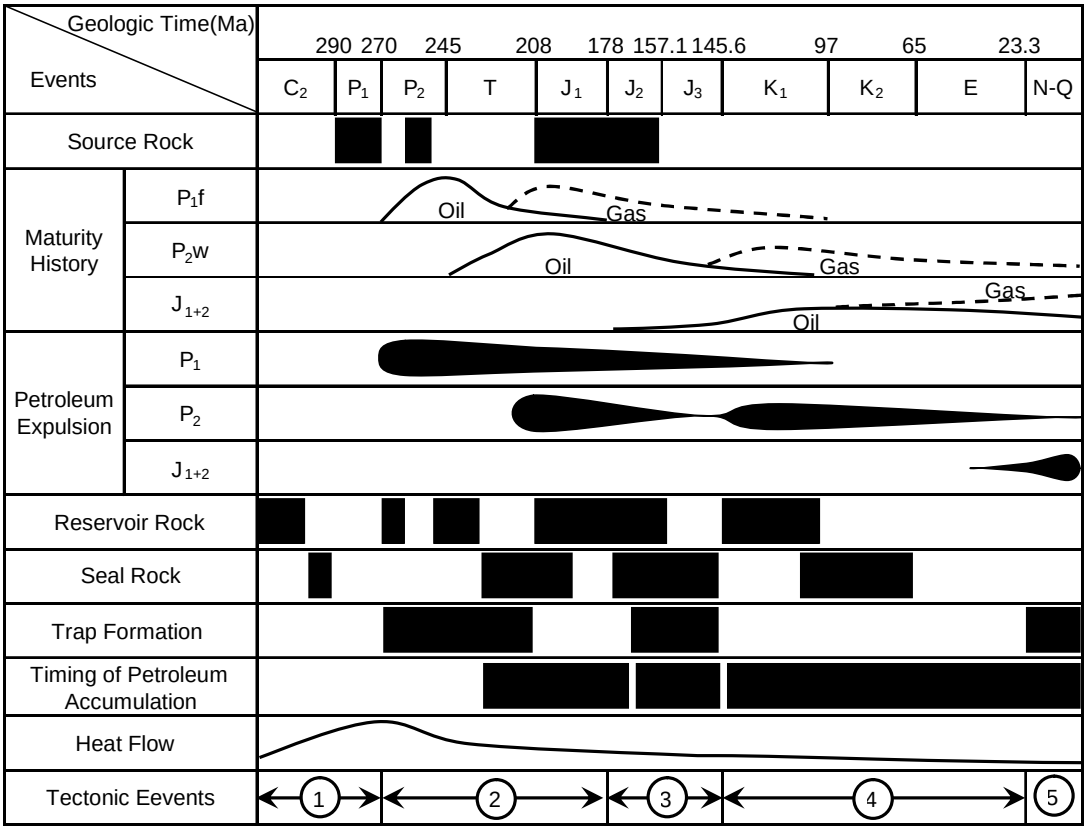

Figure 1. Events chart, illustrating petroleum generation, migration and accumulation in the central area of Junggar Basin during periods of the 1. middle Hercynian, 2. late Hercynian and Indo-China, 3. I and II episodes of Yanshan, 4. III and IV episodes of Yanshan, 5. Himalaya movements.

REFERENCE

Düppenbecker, S.J. & ILIFFE, J.E. (eds), 1998. *Basin modelling: Practice and Progress.* Geological Society, London, Special Publication, **141**.