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Identification of Source Rocks and Quantitative Evaluation of Accumulation Contribution in Residual Basin: Taking Pre-Jurassic in the Tainan Depression, Turpan-Hami Basin

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Residual basin is formed from prototype basin through powerful transformation after late tectonic movement. The tectonic settings and sedimentary filling of pre-jurassic is obviously different from that of the overlying strata, forming two sets of structural layers with large different tectonic deformation features. The Identification of source rocks and Accumulation contribution in Pre-Jurassic Residual Basin are difficult to conduct because of the complicated tectonic evolution history. In this study, the Residual Basin tectonic development features and evolution history was confirmed through structural geology and seismic stratigraphy related theory, And original sedimentary environment of hydrocarbon source rock development was restored through core observation, rock samples analysis and combination of sedimentology and geochemistry. Based on Identification and prediction of source rocks, the accumulation contribution was evaluated by oil-source correlation and genetic method, and the hydrocarbon accumulation model was determined at the end. The results of the study indicate that:

(1) From the core reveal source rocks on both sides of northern margin fault Kumu swell, we can see that Taodonggou has source rocks development in thrust fault hanging wall, no source rocks development in footwall, and it is best in top of hanging wall, bad in back limb, no source rocks development in western segment, showing that controlling-depression fault developed weaker in faulted period, activity characterized by strong east west weak characteristics. Because of the sliding friction resistance, an inverse traction characteristics appeared on the layer of rollover near controlling-depression fault of rift basin, concaving down along seismic event, arching

upward in Central rift basin. The characteristics of the lower beds downwarping and the upper beds upwarping was formed (F.O. Marques, 2014; Li Wenyong, 2013; Marco Bonini), which was a common positive inversion structure.

(2) In early permian, pre-jurassic was in Bogda Rift intensive stretching environment in the Tainan depression, Turpan-Hami Basin, forming a number of intracontinental rift, chasmic and half-graben basin. Its strata structure was stable, in the stage of continuous deposition, and layer mainly developed dark mudstone, which was the most important hydrocarbon source rocks layer in Turpan-Hami Basin pre-jurassic; With the movement of Late hercynian happened in late permian, the Jueluotak mountain uplifted, Bogda Rift began to return, part of normal faulting began to structure thrust inversion, and the layer of Yingyeer structural belts uplifted then was eroded, part of belts was missing. The layer of Wutonggou Formation was generally eroded depleted, part of Wutonggou layer was eroded, erosion thickness range from 0 to 100 meters, and denudation thickness center in central structural belt, presenting the radiated trend around.

(3) The layer's source rocks have a single facies belt, the main lithology is dark mudstone, the peak height of 20R-aaa-C₂₇, 20R-aaa-C₂₈ and 20R-aaa-C₂₉ presents reverse "L" type and contribution of terrestrial plant. The percentage composition of C₂₇, C₂₈ and C₂₉ have little difference. The input of source rocks are mixed with terrestrial plant, phytoplankton and algae, and the content of tricyclic terpane and gammacerane are very high, Ts << Tm. The range of Ph/Pm is from 0.14 to 0.78, and all of that are smaller than 0.8 with the reflection by algae. The salinity in water is higher, Comprehensive

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indicating that sedimentary background of the Permian is strong reductivity, salt water and deep lake facies sedimentary environment.

(4) Sedimentary paleogeography of permian in Tainan depression has revealed the ancient rivers flow from west to east in Yingyeer structural belts. Along the ancient river, the distribution of sedimentary facies contains fan delta front, fan delta plain and shore-shallow lacustrine to deep and hemi-deep lake, of which the deep and hemi-deep lake distributed in most the Central and Southern area of Yingyeer structural belts, and Northwestern and northeastern edge is thin out. Because of tectonic inversion in the Late Permian, Original deep and hemi-deep lake Sedimentary Depression area was inverted to structural high part and then was eroded. Sedimentary palaeogeography and tectonic movement controlled the distribution of source rocks, and the residual thickness was between 15m to 200m, TOC content of this source rocks 0.01%~5.36%, content of S_1+S_2 0.03~16.85mg/g, and HI 5.11~743.46mg/g TOC. Organic matter type mainly contains III- II₂ type, and the vitrinite reflectance is 0.64%~0.79%. Now all are in the mature stage.

(5) Due to the inversion of layer, it suffered from denudation, causing the source rocks thermal evolutionary maturity discordance with the buried depth. the graph of Ro-depth indicated that source rocks Ro is obvious higher

than numerical value, and Ro has reached to 0.5% in the depth of 1250m. Source rocks began to mature into oil threshold and generated a large amount of hydrocarbon about 20 million years ago (miocene), and the quantity of its hydrocarbon expulsion was 1.66×10^8 t. Oil and gas generated moved vertically along the fracture to Wutonggou, and mixed with inspissated pool which was biodegraded come from Taipei depression about 175 million years ago (early middle jurassic), forming pattern characteristic of full saturated hydrocarbon and degradative regular sterane. Pool-forming pattern is hydrocarbon supplying for two sources. The contribution ratio of oil and gas in Tainan and Taipei is 1:7.

References

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