Formation of the Neoproterozoic Rifting Depression Groups of the Tarim Basin and its Hydrocarbon Potential: Responded to the Initial Opening of the Proto-Tethys Ocean

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Abstract: The largest and superimposed Tarim basin developed on the one of the three bigger craton, Tarim Craton, in China. The early Paleozoic is the heyday of its development and cratonization, and then changes to the different property basin. The reserved sedimentary strata of Neoproterozoic are recognized mainly in the local of outcrops periphery orogenic belts, but drilling core in the basin reveals them seldom. The proto-type of the initial Tarim Basin always is a mystery. The vast desert, huge-thickness of sedimentary strata, multiple tectonic movements, and a low quality of deep data are the keys to getting to know him. We comprehensive field outcrops, wells, seismic reflection profiles with higher SNRs and aeromagnetic data, recognized about 20 normal fault-controlled rifting depressions of the Cryogenian and Ediacaran, which scattered throughout the basin, and developed on the Precambrian metamorphic and crystalline basement. The structural framework is clearly different from that of the overlying Phanerozoic. The rifting depressions consist of mainly half grabens, symmetrical troughs and horst-grabens. From the northeast to southwest of the basin, they are divided into three rifting depression groups (RDG) with the WNW, ENE, and NW-trends that are mainly controlled by normal faults. From the Cryogenian to Ediacaran, most of the main inherited faults to active and eventually ceased at the end of the Ediacaran or Early Cambrian, while subsidence centers appeared and migrated eastward along the faults. They formed under the NNE-SSW oriented and NNW-SSE-oriented extensional paleo-stress fields (relative to the present) during the Neoproterozoic, and were accompanied by clockwise shearing. According to the analysis of the activities of syn-sedimentary faults, filling sediments, magmatic events, and coordination with aeromagnetic anomalies, the tectonic properties of the fault depressions are different and are primarily continental rifts or intra-continental fault-controlled basins. The formation of the rifting depression was associated with the initial opening of the South Altun-West Kunlun Ocean and the South Tianshan Ocean, which were located at the northern and southern margins of the Tarim Block, respectively, in response to the break-up of the Supercontinent Rodinia and the initial opening of the Proto-Tethys Ocean.

In the RDG developed fluvial, shallow marine and carbonate platform facies, accompanied with multiple phases of magma activities and glaciations during the Cryogenian and Ediacaran. The structural architectures of interfaces between the Neoproterozoic and Cambrian are mainly angular and parallel unconformities in the RDG. Over the parallel unconformities in the RDGs are beneficial for the organic-rich and /or phosphorites of the Yuertus Formation of the Lower Cambrian. The main fault belts of RDGs also controlled the small platform margin and slope break belt of in the Cambrian. The Neoproterozoic and the Lower Cambrian petroleum systems of the basin might be controlled by the RDGs in the initiation of the Tarimcraton.

Key words: rifting depression group, unconformity between the Neoproterozoic and Cambrian, Petroleum system, Tarim Basin, Proto-Tethys Ocean

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