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Initiation of the Tarim basin in the northwest of China

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The Tarim Basin is the largest, very complex, oil-bearing basin of northwest China, surrounded by the Tianshan-Beishan, West Kunlun and Altyn Tagh mountain belts to the north, south, and southeast, respectively. It developed as a large-scale Phanerozoic marine to continental sedimentary basin overlaying Neoproterozoic metamorphosed basement. The initial structural architecture and its implications on subsequent basin development are poorly studied because of the wide cover layers, the adverse natural environment and seldom borehole data. This prevents understanding the process of formation and evaluation the potential of oil and gas resources of the basin.

Using new wells and seismic data, multiple normal fault-controlled and strike-slip fault controlled depressions of late Precambrian age are recognized. They consist of symmetrical trough, half grabens and horst-grabens. They are distributed underlying the northern depression zone of the basin, the Tazhong uplift, Bachu uplift and Maigaiti Slope between 800 and 1000 m, and the Yingjisu depression, up to 4600 m, where they are covered by an unconformity and a first unified cover layer of Lower Cambrian sediments with about 120 m to 600 m, which deposited in a basin-shelf-platform sedimentary setting. The faults were controlled by NE-SW, NW-SE extensions, with local parts under E-W extension. These initial faults have usually no inheritance in the Lower Palaeozoic basin sequences, but some of them were resurgent in the Upper Ordovician and Permian sequences and associated with multiple intrusive rocks.

The basin filling have four types of seismic facies in response to different petrographic facies and depositional environments, such as: fluvial, littoral, shallow marine, and carbonate platform facies. These are often accompanied with multiple phases of magma activities^[1-6] and glaciations^[6-7] during the Nanhuanian and Sinian (Cryogenian and Ediacaran).

The geochemical and chronological data from basalts, andesites, mafic dykes and granites from the drilling cores in the central of the Tarim basin^[1], the Aksu area^[2, 3 and 5] in the northwest part of the basin, and the Kuluketagh area along the northeastern margin of the basin^[4-5], we suggest that the initiation of the Tarim Basin (between around 755 to 615 Ma) during the Neoproterozoic was caused by continental rifting associated with the opening of the South Tianshan Ocean and the West Kunlun-South Altun Oceans, located at the north and south margins of the Tarim block, respectively, in response to break-up of the Rodinia supercontinent.

References:

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