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The Formation Model for Marine Potash Deposits within China's Small Continental Blocks

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Chinese geologists have always been expecting to find out a large scale of potash deposits in marine basins, but only one small-middle scale industrial solid potash deposit had been found at Mengyejing in Langping-Simao basin in China so far (Zhang et al., 1980), which maybe is related to marine origin. In Sichuan basin, the Triassic polyhalite deposits had been discovered (Huang, 1996), but it's hard to industrial exploit. Moreover, some thin potash minerals layers had been found in Ordovician strata of the Erdos Basin, northern Shaanxi Province (Liu et al., 1997), a layer of potash mineralization being as thick as 1 meter found in recent years (Zheng et al., 2009). The Tarim Basin itself is a giant superimposed basin, where there are several marine-related sub-basins, such as Kuqa basin and Shache basin. Some potash minerals had been found in the Tertiary strata of Kuqa basin (Liu et al., 2008, 2013). Thick layers of evaporates had precipitated from the Cretaceous to Tertiary succession in Shache basin. In addition, the marine gypsum deposits had been discovered in the Jurassic strata of the Qiangtang Basin in Tibet. Although, after many years' efforts, many potash-bearing clues have been found out in these ancient marine-related basins, a big breakthrough for large-size potash-deposit has not been made yet.

The gigantic potash deposits in the world were mainly formed in basins on stable giant cratons, but China's marine evaporates were mainly formed in relatively small continental blocks. The potash-forming environments between giant cratons and small blocks were widely different from each other, then can the large-size potash deposits origin from marine be formed in China's small continental blocks?

The marine basins had been developed on China's small

blocks, but their realms are very small compared with the marine basins of giant Craton. Naturally, those basins had been vulnerable to the short-term sea-level or runoff-event oscillations under eustatic or climate controls, even a small scale of sea-level oscillation maybe would have affected the whole basin strongly. Multi-stages of sedimentary rhythm prevail from Ordovician in northern Erdos basin to Miocene in Kuqa basin in China's evaporates basins. The rhythms had boomed from the first-grade rhythm (rhythm I) to the forth-grade rhythm (rhythm IV); and the basic sediment units of forth rhythm are usually the fine-grained clastic and salt rocks, the single layer of the basic unit being as thick as meters or more. These rhythms reflect that the depositional environments had oscillated rapidly in these evaporate basins. The Paleogene saline basin in Kuqa basin developed to amount as many as 508 in number. In a word, it has been deemed that those unstable depositional environments might have impacted negatively the potash-forming when the brine concentrated constantly in the ancient saline lake or even destroyed the process of potash-forming. Meanwhile, those basins had undergone a few periods of tectonic separations and reversion of basement. Therefore, being effected by the above-mentioned factors, large-size marine-related potash deposits can be generated in China's marine basins? If possible for the formation of potash deposits, what's about the model?

Based on our survey on marine basins and observation of the potash-forming process in modern saline lake of Lop Nur over ten years, we propose a model for marine potash-forming in China's small blocks as follows:

(1) Extremely arid events in short-time are needed for brine evaporating very quickly

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This kind of climate events can make the brines to continue concentrating after the precipitation of massive halite, and finally precipitated potash minerals in a short time which may avoid the freshening of wet period. This kind of climate change had made a great influence on potash mineralization in Lop Nur saline basin, possibly being related to the mega-warm period in Holocene.

(2) The tectonic movements result in the basin's separation and forming of sub-basins

The potash deposit need not only extreme arid environment, but also had to formed in an appropriate tectonic depression or hollow which could overcome the oscillation of the frequency climate changes. For example, Lop Nur depression, by the scissors-like stress between Tian Shan Mts and Altun Mts or Qing-Tibet Block, had been remold from inner structure to basement; its basement had been reversible, that is, the depression's northeast part rising and southwest part sinking. Thus, the single basin system of the depression had evolved into a dual-basin system consisting of a big fresh-hyposaline lake and a relatively small salt lake; the former inherited the single basin system's properties such as large area and constantly recharged from rivers; the latter, situated in tectonic uplift area, is a small and more closed sub-hollow which was more suitable for brine keeping on concentrating. When gypsum precipitated after the primary concentration, water from the big lake as the

preparing basin (Valyashko, 1965) flowed into the small one through the narrow channel between them. This water-supply model is similar to those of "Caspian sea and Kara Bogaz Gol basin" system (Warren, 2010).

(3) The model for marine-related potash deposits

China's small continental blocks, such as the upper Yangtze block in Triassic, Qiangtang block in Jurassic and Lanping-Simao block in Cretaceous, were all subject to the scissors-like stress clamping caused by the small blocks collision from their northern and southern, as a result, seawater retreated westward because of their collision beginning and uplifting in the east. In this condition, the system of marine basins in small blocks was separated into dual-lake system in which small salt lakes could absorb the oscillation effects caused by eustatic or climate oscillations and keep on the continual process of evaporate concentration in sub-hollow.

Under the coupling of extremely arid in a short time and the tectonic separation, the marine-related potash deposits would be formed in marine basins within China's small continental blocks.

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