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The Formation of The Potassium-Rich Hot Brine in The Rifting Depression of Jiangling, Hubei Province, China

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The rifting depression of Jiangling covers an area of 6500 km², located in southwestern Jianghan Basin, Hubei Province, and is a rift basin whose fill rests on a pre-Cretaceous marine succession. Tectonically, it belongs to a part of NE trending the Tertiary New Huaxia rift system in Eastern China. Volcanic rocks are well developed with an area of 3527 km² and an average thickness of 123 m. The sedimentary succession is mainly composed of the Late Cretaceous to Tertiary continental lacustrine sequences with massive evaporite deposits in the Paleocene Shashi Formation. A possible transgression is indicated by the presence of several foraminifera and high content of Br in the Tertiary potassium-rich brines. The potassium-rich hot brine discoveries have recently been made in the Depression where production tests were successful at three drilled wells. The brine is characterized by high temperature (97°C) in the mouth of one well and wellhead pressure and occur mainly at the pore of sandstones and volcanic rocks in the Late Cretaceous Honghuatao Formation and the Shashi Formation, and fractures of mudstones in the Eocene Xingouzui Formation. The brine is of CaCl₂ type similar to most of oilfield brines with total dissolved solids (TDS) concentrations of 337 g/L. The chemical compositions of the brine are characterized by relatively high Na⁺ (119.35 g/L), K⁺ (9.72 g/L), Ca²⁺ (4.14 g/L), Cl (200.09 g/L),

and very low SO₄²⁺ (0.83 g/L), Mg²⁺ (0.17 g/L). Moreover, the brine has high contents of minor and rare elements, such as, Li₂O (173 mg/L), B₂O₃ (2877 mg/L), Br⁻ (230 mg/L) and I⁻ (31 mg/L) with Rb (80 mg/L) and Cs (32 mg/L). Metal elements such as Zn, Mn, Ce, Ba, and Cu are also detected. Combined with geochemical composition, we propose a model for formation of the brine. During the Paleocene, a dry-hot climate prevailed according to the sedimentary recordings and fluid inclusions in halite. Massive halite sequences were deposited due to strong evaporation and the brine was reserved in intercrystalline pore of halite. Extensive volcanism and transgression in the Eocene took large quantity of ore-forming materials into the depression. Magma water, seawater, and water-rock interactions resulted in enrichment of potassium in the brine. The brine in the intercrystalline pores of halite crystals was expelled into the pores of sandstones and volcanic rocks and fractures of mudstones during post-sedimentation and diagenetic stages. Sulfate reduction of the brine and dolomitized aragonite-rich carbonates had resulted in massive uptake of Mg from brine and release of Ca into the brine during the long-term geologic time scale.

Key words: potassium; hot brine; rift depression of Jiangling; formation

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