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HYDROGEOCHEMISTRY AND ENVIRONMENTAL ISOTOPE COMPOSITIONS AND THEIR EVOLUTION IN GEOTHERMAL GROUNDWATER IN YIZHANG, HUNAN PROVINCE, CHINA

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Abstract

Yizhang, located in south of Hunan province of China, is rich in geothermal resources. This paper aimed to study the concentrations of cations, e.g., K^+, Ca^{2+}, Na^+, Mg^{2+} and conducted the analysis of the environmental isotope characteristics of δD, $\delta^{18}O$ and ^{13}C; and further explained the rules of the generation and evolution of geothermal groundwater in Yizhang. The temperature of geothermal groundwater in Yizhang was between 34.2 and 45.4 °C, with a neutral pH and a high electrical conductivity. The hydrogeochemical characteristics changed in the order HCO_3-Ca, HCO_3-Ca, HCO_3-SO_4-Ca, SO_4-Ca-Mg corresponding to surface water–underground cold water–Yongkou hot springs–Yiliu hot springs in Yizhang area. Compared with that in Yongkou area, the water-rock interaction of groundwater lasted for a longer time in a more enclosed environment in Yiliu area. The δD-$\delta^{18}O$ isotope analysis showed that the geothermal groundwater was generated from atmospheric rainfall and the recharge height of geothermal field was between 695~1040m. The ^{13}C isotope analysis demonstrated that the CO_2 generated during water-rock interactions was induced by factors of biogenetic, atmosphere, mantle and carbonate rocks degeneration. The result of this study was that the geothermal groundwater in Yongkou and Yiliu was formed from the same thermal resource in the same environment. Our research contributed to the determination of the border of geothermal groundwater fields, the modeling of the geological thermal reservoir structure, and the environmental evaluation of the groundwater in Yizhang, Hunan province, China.

Key words: hot springs, environmental isotope, hydrogeochemistry, Yizhang, China

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