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Hydrochemical characterization and genesis of the Jinjiang springs in Arxan, Northeastern China

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In this work, the hydrochemistry and genesis of Jinjiang springs in Arxan is discussed. There are two springs with totally different temperature, while the distance between them is less than 5 m, which is rare nationwide. As a result, it is necessary to figure out the genesis of the springs. The environmental isotope data were applied to understand origins of the springs. The reservoir temperature and mixture ratio of the thermal spring was calculated using mineral saturation indices and geothermometers methods.

The temperature of S01 is 25.5 °C and classified as a cold spring, while S02 has a temperature of 12 °C and classified as a warm spring. The groundwater of the springs has low value of the total dissolved solids, and its main water type is HCO₃-Na-Ca. Based on the isotope data, the $\delta^{18}\text{O}$ and $\delta^2\text{H}$ data points of Jinjiang springs is near the global meteoric water line, indicating that the spring water is mainly recharged by meteoric precipitations. The aquifer in which S01 occurs is the shallow cold aquifer of Jurassic system related to local groundwater system with groundwater age about 30 years. S02 occurs in a deep geothermal system recharged by deeply circulating groundwater. The springs rise from the deep basement faults in the form of hot fluid with the groundwater age about 80 years.

The estimated thermal reservoir temperature is about 50°C according to calculations using chalcedony geothermometers and computation of saturation indices for different solid phases. The circulation depth of the meteoric water is about 800 m. Although S01 rise from the deep geothermal system, the water type is similar with S02 mainly due to the mixture of shallow cold water, and the estimated proportion of cold water is about 72% calculated by mass conservation method of enthalpy and silica dioxide concentration. According to the hydrogeochemical results and hydrogeological features of the study area, a conceptual flow model for circulation of meteoric water is given to describe the low-medium temperature geothermal system of the Jinjiang springs in the study area.

Key words: Thermal Springs, Hydrochemistry, H and O Isotopes, Northeastern China

