Geochemical characteristics of underground fluid observation points in the north Tianshan

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In the process of underground fluid observation about earthquake, the characteristics of groundwater recharge sources, circulation and evolution are the basis for earthquake precursor analysis relevant to underground fluid. Currently, the methods of water chemistry, environmental isotopes and groundwater dating are becoming useful tools in the research on the groundwater recharge and evolution. These methods also can be used to both study the hydrogeological environment of underground fluid observation sites and analyze the groundwater recharge sources and circulation of the sites, all of which will provide theoretical evidence and reference information to analyze earthquake precursory.

The groundwater chemistry types, water-rock interaction, groundwater reservoir temperature, circulation depth, recharge sources and height of the underground fluid observation sites in the study areas were analyzed and calculated, as well as groundwater age. Upon these, the following conclusions were acquired:

(1) the water chemistry types of Urumqi No.9 and 10 springs are similar, the recharge and actual elevations has little difference. Both of them have short runoff time and distance. Part of the recharge source is precipitation, and both of them are shallow groundwater. No.4 spring and No.4 well have a large proportion of SO42- , and the water-rock interaction condition is part-balanced, and both of them have been mixed with deep groundwater and circulated deeply. No.15 spring has a complex groundwater chemistry type, and water-rock interaction has been completed. Its recharge elevation is lower than the actual elevation, which means that the precipitation entered the aquifer in lower places and then come into being the spring through circulation.

(2) No.21 spring is formed by infiltration, deep circulation and discharge of precipitation and surface water.

(3) The water chemistry types of No.501 and 39 springs are Na-Ca-SO4-Cl, both of which are at the beginning of water-rock interaction. They have been through deep circulation and formed by the discharge of circulated precipitation and surface water.

(4) the sites in the northern Tianshan, including Shawan, Wusu and Bole, are formed by both surface water and groundwater at different degrees. The groundwater has a deep circulation and long runoff distance, and the groundwater ages are more than 500 years.

(5) the forming mechanisms of fault springs in Nileke and Tekesi are similar, which were recharged by precipitation and melting glaciers. After recharged, the water would discharge as springs through a certain depth and time circulation.

(6) the evidence of tritium age proved that most of the observation sites have modern groundwater and are suitable for seismic information of groundwater chemical component observing.

The study on the hydrogeology environment of underground fluid monitoring sites in earthquake belts will contribute to the application of water chemistry, environmental isotopes and groundwater dating in earthquake monitoring field. Although the methods especially groundwater dating have been applied few times in the science and research of earthquake underground fluid, they can be widely used in the near future according to the examples of relevant subjects.