Groundwater Recharge and Hydrogeochemical Evolution of Longdong Loess Basin, NW China

XINYING LING[1,2], JINZHU MA[1], PEIYUAN CHEN[1]

[1] Lanzhou University, Department of Hydrology and Water Resources, Lanzhou, China, xinying.ling@ttu.edu
[2] Texas Tech University, Department of Geosciences, Lubbock, TX, USA

The groundwater recharge mechanisms, the interaction between groundwater and surface water, the hydrogeochemical evolution characteristics and its renewability in the Longdong Loess Basin are analyzed by the distribution of chemical ions, stable isotopes, radiocarbon isotopes, and the reversed hydrogeochemical simulation. Groundwater of Dongzhi Tableland is HCO_3-Ca-Na type with low salinity and good quality, and dissolution of calcite, limestone and carbonate minerals and cation exchange between Ca^{2+}, Mg^{2+} and Na^{+} are the main water-rock interaction in the groundwater system; while groundwater of Malian River is with high salinity and poor quality, dissolution of halite, gypsum and sodium sulfate are the main water-rock interaction. $\delta^{18}O$ (-11.70‰~-8.52‰) and $\delta^{2}H$ (-86.15‰~ -65.75‰) of groundwater are depleted, and the age of groundwater is from 7000~25000 a, which indicates the groundwater mainly receives paleo precipitation recharge during the late Pleistocene and Holocene humid and cold periods, and the temperature is approximately 5.12℃ colder than present. Surface water in the middle and lower reaches of the Malian River mainly receives the recharge from groundwater on both sides of the valley, while the source of the Malian River mainly receives local precipitation recharge. For ^{14}C correction models, Vogel Model, Tamers Model, CMB Model and F-G Model are suitable in study area, and we also improved Pearson Model whose results are more accurate than the original Pearson Model. The reversed hydrogeochemical simulation is applicable in the flow path of G35~G47, and the simulated age of G47 (23254~25846 a) is close to the results of mathematical models (24281~25788 a). Spatially, the ages of groundwater outwards are generally older (G22, G47 and G59) than the center part of Dongzhi Tableland (G2, G35 and G43), and the renewability of Dongzhi Tableland groundwater is poor. The results have important implications for the local groundwater resources management and protection.