Strontium isotopic characteristics and water-rock interaction of shallow groundwater in an arid desert area

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Groundwater is a major component of water resources and plays an important role in hydrological cycle in the Badain Jaran Desert, North China. Many stable isotopes (e.g. ^{2}H, ^{18}O) and radioactive isotopes (e.g. ^{3}H, ^{14}C and ^{222}Rn) have been used to determine the recharge sources of shallow groundwater in this desert. However, few strontium isotope data have not been reported until now. In this study, the Sr isotopic composition of shallow groundwater has been analyzed in detail.

In common, shallow groundwater should have the similar Sr isotope value to that of local precipitation if the water-rock reaction is weak or aquifer tocks are consistent in Sr isotope composition with local precipitation. In addition, the carbonate fraction has high Sr^{2+} concentration but low $^{87}Sr/^{86}Sr$ ratio while the silicate fraction has low Sr^{2+} concentration but high $^{87}Sr/^{86}Sr$ ratio in the Badain Jaran Desert. In detail, the $^{87}Sr/^{86}Sr$ ratios vary from 0.713214 to 0.729186 for silicate fraction and from 0.710077 to 0.711881 for carbonate fraction in this desert. The Minor difference of $^{87}Sr/^{86}Sr$ ratio between shallow groundwater and local precipitation indicates that the shallow groundwater is recharged by the local precipitation. Therefore, the Sr in shallow groundwater can be affected by the recharge source and catchment weathering.

To quantify the two end-members contributions Sr to the shallow groundwater in the Badain Jaran Desert, the contributions of individual sources can be calculated by the isotope mass balance equations. Further, the relative Sr contributions of local precipitation are > 94% whereas the catchment weathering of aquifer rocks contributed < 6% Sr to shallow groundwater in this desert. This result demonstrates that the local precipitation is the dominant contributor to shallow groundwater and the catchment weathering is weak in the Badain Jaran Desert.