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Rainfall– Recharge relationship in local and regional scale in Granite terrain of India through Tritium tracer studies

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The Cenozoic formation consists of thick Tertiary and Quaternary deposits represent the most important aquifer in the North China Plain. The present work was conducted along the Chaobai River Basin and Yongding River Basin beginning from Yanshan mountains to identify the chemical characteristics and the origin of groundwater in shallow and deep aquifer under semi-arid climate. Isotopic and hydrochemical compositions combined with geological and hydrogeological data were used for this purpose. The groundwater types are recognized: Ca – Mg – HCO_3 in mountain area, Ca – Mg – HCO_3 – CO_3 and Ca – Mg – Cl – SO_4 in piedmont alluvial fan with different aquifers, Na – Mg – HCO_3 and Na – Cl – HCO_3 – SO_4 in lowland area. Chemical patterns evolve in an order of Ca – Mg – HCO_3 > Na – K – HCO_3 or Ca – Mg – Cl – SO_4 > Na – Mg – HCO_3 or Na – HCO_3 – Cl – SO_4 as groundwater flows from mountain area to lowland area.The groundwater is saturated and slightly supersaturated with respect to carbonate minerals and undersaturated with respect to evaporite minerals, which means that the groundwater composition is largely controlled by the dissolution of carbonate rocks known in both of the basin.
Stable isotope distribution of the study area also has a good corresponding relation with other chemical characteristics. The δD and $\delta^{18}O$ values of groundwater were light in mountain area(ranged from –61.5 to – 77.0‰ and –7.15 to –10.2‰ respectively), heavy in piedmont alluvial fan(ranged from –44.8 to – 67.5‰ and – 3.86 to –7.75‰ respectively), light in lowland area(ranged from –73.9 to – 81.9‰ and –7.23 to –10.41‰ respectively). The isotopic composition enriched with shallow groundwater in a front of Yanshan Mountain where located which of the high populated, industrial dynamic Beijing City (especially west part of Beijing) and it is very suited to other chemical characteristics. Tritium value ranged from 0 to 65 TU. Tritium contents are more than 30 TU in the mountain area and piedmont alluvial fan with shallow groundwater. The distribution of tritium suggested that in shallow aquifers contain modern recharge water in the piedmont alluvial fan. Depend on the ^{14} C values of groundwater the groundwater originated during the period from 30 ka – 15 ka before present in lowland area with deep groundwater. The hydrogen (δD) and oxygen ($\delta^{18}O$) isotope signatures reveal a significant infiltration before evaporation takes place, indicating a major recharge directly from fractures in the crystalline and limestone formations of Yanshan Mountains. The very low tritium values suggest that the groundwater recharge follows a long flow path and a mixing between old and modern water is shown.