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Connectivity between aquifers: evidence from $^{87}Sr/^{86}Sr$ ratio and from stable isotopes case study of Oman

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ABSTRACT

Isotope techniques are powerful tools in hydrological studies such as determination of groundwater age, recharge source, groundwater mixing etc. The aim of this study is to identify physico-chemical processes that control groundwater in North Oman. We have collected several groundwater samples in North Oman from different geological units namely the tertiary formations, Hajar super group (HSG) formations and ophiolite which comprise different aquifers. All groundwater samples were analyzed for strontium $^{87}Sr/^{86}Sr$ ratio and environmentally stable isotopes ($^{18}O/^{16}O$ ($\delta^{18}O$) and $^{2}H/^{1}H$ ($\delta^{2}H$)). The analysis of the stable isotopes data ($\delta^{2}H$ and $\delta^{18}O$) suggests (1) a groundwater recharge to the ophiolite from the HSG and from direct infiltration and (2) groundwater in the tertiary formations formed from meteoric and evaporated waters. The different aquifers have shown variable $^{87}Sr/^{86}Sr$ ratio that ranges between 0.70840 and 0.70864 for the ophiolite aquifer, 0.70776 and 0.71141 for groundwater from the Tertiary aquifer and from 0.70798 to 0.70938 for the groundwater from the HSG aquifer. The relationship between $^{87}Sr/^{86}Sr$ ratio and 1/Sr indicates aquifers' inter-connectivity and suggests recharge from the HSG into the ophiolite. Groundwater of the Tertiary aquifer is from two main reservoirs: (1) a reservoir generated by a mixture of groundwater from the ophiolite and HSG aquifers and (2) a reservoir generated by a direct infiltration of rainwater and its interaction with evaporites.

Keywords: Isotopes; Mixing; Recharge; Strontium; Aquifer

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