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Noble-gas evidence on the groundwater origin in the coastal plain of Salalah, Oman

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Shallow to moderately deep ($<$ 70 m) groundwater wells are the most important drinking water resources in the semi-arid coastal plain of the Sultanate of Oman. Multiple hypotheses about the groundwater recharge exist and clarification is needed due to increasing groundwater extraction at the Salalah coastal plain.

A dataset of environmental traces including noble gases (He, Ne, Ar, Kr and Xe), water chemistry and field parameters (electric conductivity, water temperature and pH) were collected during a campaign in 2016. This measurements aim to indicate water residence time, recharge conditions and the origin of the groundwater.

The origin of groundwater was identified by using light noble gases. The $^{3}He/^{4}He$ and Ne/He ratios indicate that the groundwater samples can be interpreted in terms of an ideal two-component mixture between recently infiltrated meteoric water (high $^{3}He/^{4}He$ ratio) and old groundwater loaded with radiogenic/crustal He (low $^{3}He/^{4}He$ ratio). Samples of the shallow and even some of the deep aquifer show atmospheric $^{3}He/^{4}He$ ratios, thus excluding significantly contributions of tritiogenic ^{3}He. Samples from the deep aquifer show commonly high loads of isotopically heavy He, which most likely indicate long water residence times. There is no clear correlation between water depth and He excess. However, large amounts of excess air are found in the recharge area in the top of coastal plain near the Dhofar mountains.

Our data on the water dynamics in the coastal plain of Salalah adds to the conceptual frame to understand groundwater evolution in Salalah, Oman.