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Assessment of groundwater dynamics by applying rare earth elements and stable isotopes – the case of the Tiberias Basin, Jordan Valley.

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The Tiberias basin, situated in the northern part of the Jordan-Dead Sea Transform Valley, is hydraulically connected to the surrounding aquifers of Cretaceous to Cenozoic age. As a result of the local erosion base, the basin hosts Lake Tiberias, recharged mainly by the Upper Jordan River and by fresh groundwater from the Galilee and Golan Heights. However, variably ascending deep-seated brines enhance the chlorinity of the lake to about 250-280 mg/l. In addition to these hot brines, also hot fresh waters emerge on surface, particularly to both sides of the Yarmouk gorge, SE of the basin.

Investigation of rare earth element patterns and stable isotopes of water and sulfur, in combination with major elements reveal, that the gorge acts at least partially as a water divide between north and south with enhanced hydraulic conductivity along its axis. Although there are no geological evidences given, we suppose a swarm of hydraulic active fractures/faults parallel to the Lower Yarmouk gorge axis, which force the upward movement of hot fluids, as also suggested by numerical modeling. Additionally, these faults may channel SW-oriented groundwater flow, which has its origin in the Syrian Hauran Plateau.

Although exercised in the Tiberias Basin, the application of trace and major element geochemistry in combination with stable isotopes allows analyzing (supra-) regional groundwater movements. This method is even more relevant in areas with either limited access to recharge areas or boreholes along proposed flow-paths and particularly in areas suffering from data scarcity and poor infrastructure.