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Investigating Western Dead Sea spring systems and their origin by application of hydrogeochemical patterns

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One of the ecologic and touristic hot spots along the western Dead Sea shore is the spring system of Ein Feshkha (Enot Zukim), which suffers from a changing environment. Its feeding Cretaceous aquifers are hosted in the western Graben flank of the Jordan-Dead Sea Rift. However, the origin of water and the ratio of influence of the unconsolidated Quaternary Graben fill is a controversial issue. The aim of the study is to combine hydrogeochemical information of the spring waters and the potential source aquifers to characterize and differentiate the groundwater origins, groundwater flow paths and eventually groundwater mixtures. Within this case study, which is embedded in the SMART II project (Sustainable Management of Available Water Resources of the Lower Jordan Valley), the investigation area extends in the Judean Mountains from the vicinity of Ramallah down to Hebron and ends along the north-western shoreline of the Dead Sea. The Cretaceous limestone aquifers of Turonian/Upper Cenomanian and Albian age are widely separated by a clayey aquiclude. That so called Judea Group is underlaid by the Kurnub sandstone aquifer. Mainly due to the development of the Rift, the entire area is intensely folded and crossed by faults. Groundwater recharge takes place in the uplands and the groundwater flow gradient is oriented towards the Valley, where it transgresses into the Quaternary Graben fill. Our hypothesis is that Ein Feshkha springs are fed by groundwater originating in general in the mountain range, which also takes a detour through the Graben fill in the north of the Dead Sea. Groundwater from these aquifers emerges along the coast of the Dead Sea through springs.

The methodological approach is to use geogenic and anthropogenic hydrochemical parameters like major- and trace elements, stable isotopes like δ2H, δ18O or δ87Sr and heavy metals. Sampling campaigns were and will be carried out quarterly within one hydrological year to uncover possible seasonal variations. Samples are taken from the different aquifers over the whole investigation area. The first results represent the variability of the groundwater chemistry in terms of their TDS contents and their stable isotope signatures. The measured stable isotope ratios of Strontium, which refer to the geological background, show a differentiation between the groundwater of the main Judean aquifers. In combination with stable isotopes the composition of major- and trace elements including heavy metals improve the aquifer differentiation against the background of changes in geological formations.