

New types of submarine groundwater discharge from a saliferous clay formation – the case of the Dead Sea

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Along the coastline of the hyper-saline and dramatically dropping Dead Sea, fresh to highly saline groundwaters discharge abundantly from dry falling lakebed. During its history, the level and hence salinity of the lake strongly fluctuated, resulting in the deposition of an alternating sequence of clayey and chemical sediments (mainly halite, carbonates and sulfates), intercalated by thick beds of halite and of coarse clastics around wadi outlets, respectively. Due to the asymmetrical shape of the lake's basin, these strata are deposited unequally along the eastern and western flank, why only groundwaters coming from the west have to pass thick layers of these sediments on their way into the lake.

On the base of trace elements (REE), element ratios, stable and radioisotopes and microbiological findings, the observed onshore and offshore springs revealed, freshwaters discharge from both Cretaceous limestone aquifers and efficiently dissolve the easily soluble halite and flush the interstitial brines from the saliferous clay formation, immediately after entering the sedimentary strata. Abundant microbial activity result in the widespread production of sulfuric acid, accelerating erosion of carbonates and sulfates. These processes result in a fast and striking karstification of the strata, enabling groundwaters to transcend the fresh/saltwater interface through open pipes. As results, submarine groundwater discharge (SGD) occurs randomly and in addition to terrestrial, submarine sinkholes develop very quickly too.

Due to the variable maturity of the flow paths, salinity and chemical composition of SGD shows an extremely wide range, from potable water to TDS of >250 g/l. Submarine emerging groundwaters with salinities even higher than that of the Dead Sea and distinctly different chemical and isotopic composition from outlets, which are not known elsewhere and represent a novel and unique type of SGD, only observed in the Dead Sea yet.