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Exploration of SGD structures by remote sensing technologies and aquatic geochemistry

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As in many other regions of the world, where groundwater migrates through soluble rocks and sediments, the shoreline of the Dead Sea is extremely endangered to the formation of sinkholes. Additionally, in those areas, where enhanced subrosion dynamics are recognisable, groundwaters emerge submarine either diffuse or from open holes, suggesting a strong connection between both phenomenon: SGD and sinkholes. Independently from the source shapes, submarine groundwaters emerge with a wide range of salinity, from brackish (12 mS/cm) to briny (229 mS/cm).

Along their way from the hard-rock mountains to the Dead Sea, groundwaters must pass in places several 1,000 meters of unconsolidated highly saline sediments, a fact which should impede the observed freshness of the discharging waters. However, geochemical and isotopic investigations in the groundwaters prove the origin in remote recharge areas in the mountain ranges to both sides of the sea.

By observing the SGD-locations by applying echo sounding, side scan sonar and thermal imaging, it could be found SGD occurs through open holes and seems to be organised along lineaments, which follow +/-the regional neo-tectonic patterns. At the same time, deep shafts and craters were discovered, some of them reaching depths of 20 m and more. Particularly the high discharging brackish springs are mostly on the base of such a caldera, which might be a submarine sinkhole with slipped walls. Scuba diving discovered, these springs often discharge from the sediment through open holes, some of them up to 0.8 m wide. They are considered to be microbial forced karst structures. Investigations are continuing.

Although exercised in the hyper saline Dead Sea, the application of aquatic geochemistry and isotope methods in combination with microbial investigations and remote sensing techniques allows integration of SGD into a broader (hydro)geological and structural framework, which is often much better understood on land. This methodology is even more relevant in areas with considerable amounts of SGD spots spread over large areas and particularly in areas where the environment is hazardous and risky as in the lethal Dead Sea.