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SING (salt induced noble gas diffusion) in Stassfurt, Germany

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Subrosion is a common problem in areas of former salt mining activities, equally in the former potash mining town of Stassfurt, Germany. To assess the stability of such a system, it is necessary to identify whether salt dissolution processes are still proceeding and if and how the surrounding groundwater interacts with the salt structure. Aquifers in Stassfurt were investigated for hydrodynamics and groundwater interaction with the underlying Zechstein strata using chemical and isotopic fingerprints (Stadler et al., 2012) to identify potential implications for land subsidence. Measured noble gas values (He, Ne, $^3He/^4He$) showed strong variations and exceptionally high excess air values: i) The He content in the sampled waters does not seem to further increase below a depth of about 100 m b.g.l. ii) Ne solubility equilibrium at the site's infiltrations conditions (9.9° C and 70 m altitude) corresponds to a Ne concentration of $2{\cdot}10^{-7}$ cm^3 STP/g, and Ne concentrations found range from half this value up to 2.5-fold this value which is a larger scatter than generally observed for excess air (Heaton & Vogel, 1981; Aeschbach-Hertig et al., 2001). These patterns are unusual and may be interpreted in terms of flow paths, velocities and geochemical evolution. In our contribution we discuss the role of salt dissolution and diffusive processes in the aquifer. We can show that the noble gas data can be qualitatively explained by the impact of the high subsurface increase in salinity which induces noble gas diffusion controlled by solubility gradients (Suckow & Sonntag 1993).

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