



Stable isotope study of submarine groundwater discharge at the Hanko Peninsula, south Finland

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A submarine groundwater discharge (SGD) site was recently documented at the Hanko Peninsula in south Finland, northern Baltic Sea. The local stratigraphy and aquifer geometry were studied using a multifaceted dataset of offshore seismic sub-bottom profiles, multibeam and sidescan sonar images of the seafloor, radon measurements of seawater and groundwater, and onshore ground-penetrating radar and refraction seismic profiles. The aquifer is hosted in the distal sand-dominated part of a subaqueous ice-contact fan that belongs to the First Salpausselkä ice-marginal formation. The SGD takes place predominantly through pockmarks on the seafloor. The pockmarks are present on the edge and slope of a sandy shore platform, at the water depths of ca. 11 meters. Elevated Rn-222 activity concentrations in near-bottom water at the pockmark locations strongly indicate groundwater influence, and permit calculating a rough estimate of 1 cm/d for the discharge rate.

Porewater profiles of elements of marine affinity such as Cl show strong vertical gradients in sediments below the pockmarks. The isotopic ratios $\delta^{2}\text{H}$ and $\delta^{18}\text{O}$ measured for local groundwater, pockmark porewater and local seawater demonstrate that waters discharged from the pockmarks are mixtures of the groundwater and seawater end-members. The share of fresh groundwater in the pockmark porewaters is ca. 83%, whereas it is ca. 9% in the water column above the pockmarks.

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