



Hydrochemical and isotope analysis of the natural salinisation processes in Eastern Brandenburg (Germany)

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Upward migration of saline fluids into freshwater aquifers has long been known in Eastern Brandenburg and resulted in certain regions in a contamination of drinking water resources. In this context it is important to understand the processes and interactions between deep saline and shallow freshwater aquifers as well as the migration pathways and the origin of the saline waters.

The study area ($50 \times 50 \text{ km}^2$) is located in the southeastern part of the intracontinental North East German Basin, the hydrogeology of which is characterised by large salinity gradients due to dissolution of great amounts of halites from evaporite-bearing Permian strata.

About 100 new groundwater samples from depths down to 450 m and samples from deep geothermal aquifers with depths down to 1700 m were taken. A combination of field parameters, hydrochemical indicators (anions, cations, trace elements) and stable/ unstable isotopes ($^{18}\text{O}/^{2}\text{H}(\text{H}_2\text{O})$, $^{34}\text{S}/^{32}\text{S}(\text{SO}_4)$, ^{87}Sr , ^{3}T , ^{3}He , ^{14}C) were used to study the sources of salinisation, the ongoing processes and the interaquifer flow.

Freshwater-saltwater dynamics in the investigation area are mainly controlled by the local recharge/discharge conditions and the presence of hydraulic pathways through the Rupelian clay which is the most important confining layer between deep saline and shallow freshwater aquifers. In discharge areas shallow aquifers may become salinised which seems to be confirmed by chloride concentrations up to 10000 mg/l. However, in recharge areas downward freshwater migration in deeper aquifers can be predominant resulting in decreased salinity. This is comprehensible for topographic highs in the investigation area where the chloride concentrations in the aquifer below the Rupelian clay are only up to 2500 mg/l. The Br^-/Cl^- ratio as well as the ^{2}H - and Cl^- - data were used to identify the origin of the saline waters. Brines originating from Permian and Mesozoic formations are considered as main sources, in situ brackish and marine waters from Tertiary sediments seem to play a minor role. Conversely, most of the sampled waters, except the geothermal waters, are isotopically characterised by Holocene or/ and Pleistocene recharge conditions so that a deep reaching interaquifer flow and mixing processes can be assumed.

Comparing old and new data suggests that natural salinisation processes have only a slow temporal dynamic.