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The use of chemical data for investigation of the groundwater flow conditions (Lwówek region, Poland)

Krzysztof Dragon
Adam Mickiewicz University in Poznań, Poznań, Poland (smok@amu.edu.pl)

The presented research was conducted in regional recharge zone of the Quaternary aquifers located in central Wielkopolska (Lwówek region, Poland). In this region relative high nitrates concentration (>15 mgNO_3/l) was detected at a great depth (>80m). To explain groundwater chemistry changes the net of multilevel piezometers were constructed. The results of performed investigation show that in shallow part of the aquifer the concentration of nitrates exceed 30 mgNO_3/l, indicating high level of groundwater contamination. The nitrates migrate downward to a deepest parts of the flow system in regions of groundwater withdrawal (where high nitrate concentrations are detected at a great depth). Under natural conditions (where the water withdrawal is not performed) this contamination is not yet observed in deep part of the flow system. The isotopic investigation indicate relative high tritium content in shallow part of the aquifer (>6.0 T.U.) and in deep part in groundwater withdrawal area (4.0 T.U.), while in deep part of the aquifer in the region without exploitation there is no tritium. Also 14C groundwater age is significantly higher in that part of the aquifer than in shallow one (groundwater 14C age 2100 years in deep part comparing to recent infiltrating water in shallow part). Based on research performed the conceptual model of groundwater circulation was formulated. The most intensive groundwater recharge occurs in the unconfined parts of the flow system in the regions of groundwater extraction. In the regions under natural gradients existence (without water extraction) the recharge in shallow part of the aquifer is also intensive but young water do not reach deep part of the flow system. In this condition in deep part of the aquifer typical stagnation zone exists (as defined by Toth, 1963), what is manifested by completely different groundwater chemistry than in shallow part of the aquifer. The presented research is a great example how chemical data can help to investigate groundwater flow conditions. This work has received funding from the National Science Centre of Poland (grant no. 2014/15/B/ST10/00119).