Can dating MRT of groundwater with C-14 be reliable in alluvial aquifers?

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Introduction

The mean residence time (MRT) of groundwater plays important role in the determining origin and recharge of groundwater and especially in contamination and risk assessment [1]. In the study area which is located in the Varaždin area (NW Croatia), an alluvial aquifer represents the main source of potable water for the town of Varaždin and the surrounding settlements. Due to favourable climatological and hydrogeological conditions, intensive agricultural practices exists and subsequently led to high nitrate concentrations in the alluvial aquifer which has caused the shutting down of one of three pumping sites. The alluvial aquifer is composed of sediments of the Quaternary age as a result of accumulation processes of the Drava River [2]. Mineralogical composition of this sediments are: mainly carbonate minerals (dolomite and calcite), feldspar, mica, silica etc. To determine MRT of the groundwater, combinations of different isotopic techniques had be applied at five observation wells. Following isotopes were determined: $\delta^{18}O$, $\delta^{2}H$, ^{3}H, ^{14}C and ^{13}C for correction of ^{14}C measurements.

Discussion and Results

It was observed that calculations of MRT obtained from $\delta^{18}O$, $\delta^{2}H$ and ^{3}H measurements were similar and the MRT was in the range from 5.5 till 12.2 years. Observation wells which are closer to the river and wells which have higher porosity of aquifer matrix in its catchment, have shorter MRT. Results for calculated MRT obtained from ^{14}C measurements varied from recent waters till 1400 years. It was depended which model we applied. Which methods should be applied for calculation of MRT depend upon the aquifer system but it is also good to use more than one to ensure good results.

[1] Karlik (2015) *Procedia Earth and Planetary Science* **13**, 301 – 306. [2] Prelogović et al. (1988) *Geol. vjesnik* 41, 237–253.