Isotopic composition and hydrogeochemistry of groundwater and surface water in Awash river basin, Ethiopia

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We report new data on water isotopes ($\delta^{18}O$ and δD), and hydrogeochemistry of ground and surface water in Awash River basin (ARB), Ethiopia. Awash River which passes through diverse geological environments, starts from high-rainfall Ethiopian plateau and passes through the main Ethiopian rift and finally reaches the Afar rift, with a total area of the basin ~113,709 km^2. Groundwater $\delta^{18}O$ and δD values are found in the range of -4.77 to 0.66 ‰, and -30.24 to 7.81‰, respectively. Surface water $\delta^{18}O$ and δD values are found to vary from -0.51 to 8.48 ‰, and 0.32 to 44.92 ‰ respectively. Groundwater from aquifers of the rift floor are relatively depleted in $\delta^{18}O$ and δD which could be due to recharge of the aquifers from heavy rain. On the other hand, lakes and river samples from basin are found to be highly enriched in water isotopes compared to ground water possibly due to evaporation effect. We find high fluoride contents in Bora well (4.58 mg/l), Amibara well (3.93 mg/l), Fentale well (3.55 mg/l) and Sodere hot spring (2.95mg/l). Groundwater availability and quality in rift floor aquifers is a function of their connection to aquifers in high rainfall plateau, and the residence time of groundwater prior to reaching the rift floor [1]. We find that the Total Dissolved Solid (TDS), pH, Na, K, HCO_3^- and CO_3^{2-} of groundwater increases from the high land area to the rift area. This could be related to the increase in geothermal activity and dominancy of felsic volcanic rocks, and sediments reworked from hard rocks in the rift. TDS increases 89% along the transect from highland area to the rift floor.Trends in both major and trace elements (Co, Cr, Fe, Li, Mn, Pb, Rb, Sr, Cd, Ni, Mo and Sn) indicate a progressive change in groundwater geochemistry along the flow path. In hot springs, Na, K and HCO_3^- contents reach up to 335.12, 14.6, 1049.54 mg/l respectively. High NO_3^- concentration reaching up to a maximum value of 9.71 mg/l in well water, is found in agricultural cropped area.

Key Words: Trace elements, Water isotopes, Ethiopia, Ground water, Awash River basin

[1] Mechal *et al.*(2017) *Hydrogeol J* **25**, 519–538.