Abstract

The interpretation of monitoring of Groundwater from the springs along Wadi Al-Qilt stream in the Jerusalem–Ramallah Mountain slope area and in the Jericho Plain, West Bank, Palestine, and for the precipitation in the Jerusalem Ramallah sub-basin during the hydrological year 2006-2007 has been carried out. Intended for the anthropogenic nitrate and dissolved organic carbon in the springs and precipitation, along with spatially and temporally variations of other geogenic (natural) and anthropogenic chemical composition of the groundwater as will as stable isotopes $\delta^{18}O$ and $\delta^{2}H$.

A detailed analysis of dissolved species reveals that besides dissolution of carbonates, also nitrate, chloride, and sulfate are leached from soil and the aquifer rocks together with small amounts of Mg. Thus, Mg not only originates from carbonates but also from Mg-Cl saline waters included in the rocks. The Mg-Cl saline water problem should be handled in proper way as a potential source for freshwater deterioration that is drained from the upper mountain and deteriorate as soon approach further to the east near Jericho boarder.

The spatial temporal changes in the hydrochemistry of the aquifer reveals that the problem of freshwater deterioration complicated as a function of groundwater residence time and it's long contact with the aquifer matrix and saline bodies. The main factors affected the groundwater residence time and flow rate are the geological structure of the aquifer, the amount of active recharge to the aquifer, and the recharge mechanism. The residence time as well as the intensity of recharge (precipitation) plays the important role and found to be responsible in controlling the changes in the chemical composition of spring water which is mainly affected by the distance from the main recharge area. It was found that the groundwater in the springs near Jericho boarders, namely Sulatn and Dyouk springs have long residence time and older age than those springs in the upper part of Wadi Qilt. This was indicated by the relatively higher Mg/Ca molar ratio as well as more enriched ^{2}H isotopic signature.

A very important indicator is the oxidation of organics derived from sewage and garbage resulting in variable dissolved CO_2. High CO_2 yields lower pH values and thus under saturation with respect to calcite (and dolomite). Low CO_2 concentrations result in over saturation, witch means that calcite saturation accrues at the end of the rainy season. This observation was clear at the beginning of the winter season effect is particularly high at the beginning of the winter season and lowest at its end. While the springs water show a

shock in the NO_3 and DOC values several weeks after a significant storm event. The values of DOC in groundwater reach over than 12 mg/L in Qilt and Dyouk springs in values which might consists a potential health risk if the water was chlorinated for drinking purposes.

The rainwater samples show a high nitrate values after the first rain event and directly after dry period between storms. These values tend to get lower as the winter season proceeds under the washout effect for the atmospheric pollutants. The response of the karstic systems to the precipitations and the nitrate content are quite heterogeneous and depend on the hydrological state of the system as well as the time and the intensity of the storm events. The effluent of different anthropogenic pollutants from sewage water of the settlements, Bedoins, and animals surrounding the wadi was varied also depending on the storm intensity and the length of dry period between each rain event. The degradation of dissolved organic matter is a major source for increase the water hardness and mineralization

The isotopic signatures for the rain events along the rainy season found varied depending on the weather conditions, Orographic effects (altitude effect). The local meteoric water line (LMWL) was**: $\delta^2H = 7.95\ \delta^{18}O + 19.75$ ‰ SMOW**.

Two zones of recharge are distinguishable. Zone 1 represented by Ein Fara and Ein Qilt, witch is fed directly through the infiltration of meteoric water and surface runoff from the mountains along the eastern mountain slopes with less groundwater residence time and high flow rate. Zone 2 appears near the western border of Jericho at the foothills, which is mainly fed by the underground water flow from the eastern slopes with low surface infiltration rate. But it shows higher groundwater residence time and slow flow rate than zone 1. Both zones have varied isotopic signatures where the later zone shows more enriched deuterium values in the early season which confirmed the long residence of the groundwater that flushed out later and replaced by the new replenished groundwater with more depleted values. The main factors affected the groundwater residence time and flow rate are the geological structure of the aquifer, the amount of active recharge to the aquifer, and the recharge mechanism.

The results thus might be very useful for more efficient freshwater exploitation in the region, therefore pre-cautions should take place for the replenished water. The runoff water should not be freely infiltrated along the Wadi since it has a bad infiltration zone in one of its parts (zone 2) and thus much more water could be lost by evaporation.