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Evidence of Hydrogeological Connection between the Mountain and Plio-Plistocene Aquifer Systems, Using Pharmaceutical Residual- case study Jericho area/Lower Jordan Valley

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Jericho Oases (-258 m b.s.l) is known through the history for its fertile soil, date trees, and sweet fruits. Groundwater is the only water sources for domestic and agricultural activities, where about 8 MCM/a discharge form three major springs groups, in addition to 20 MCM are taped from 45 shallow boreholes (10-180 m) in the Plio-Plistocene aquifer system. The current and future availability of groundwater of the shallow Plio-Plistocene aquifer system is the key factor for the economical development of agricultural sector, where during the last 10 years around 50 million USD are invested in this sector. Green houses agriculture, and date trees farming become the major groundwater consumers. From the hydrological point view, the study area is part of the eastern Wadi Al Quilt drainage system, where recharge take place along the mountain range in the western part of the catchment area. The shallow aquifer system consists of gravel; sand and silt inter fingering with clay layers. Chalk and chalky limestone formation of Senonian age separate the shallow aquifer from Mountain aquifer which consists of limestone, and dolomite. Both aquifer systems are part from the Eastern Basin where groundwater flows towards the Jordan River-Dead Sea basin. Direct recharge from rainfall to the shallow aquifer system is neglected due to the high evaporation rates, and only about 1 MCM/a of flooding water infiltrate into this aquifer. The hypotheses of this study is an indirect groundwater replenishment take places in certain sites along the N-S-major fault system, and groundwater flow through passages into the Plio-Plistocene aquifer systems. We tried to use pharmaceutical residuals to trace groundwater flow regimes in the Mountain and Plio-Plistocene aquifer system.
Twenty eight water samples were collected during the hydrological year 2011 (in March and July) from 19 sampling sites (springs and boreholes). Few samples were collected from Al Bereh waste water treatment plant as well as from flooding water. The groundwater samples present the Mountain and the Shallow aquifer systems. The Pharmaceutical residuals were analyzed using the HPLC-ESI-MS-MS method. The result show that six pharmaceutical residuals were detected in groundwater samples from the two aquifer systems in addition to the waste water. These are Anti-Epileptic Carbamazepine, the lipid lowering agent Fenofibrate, and the X-ray contrast agents Diatrizoic acid, Iohexol, Iopromide and Iopamidol. Source of these compounds is waste water from Al Bereh Treatment plant and raw waste water from different communities. These compounds are found in springs water drain from the Mountain Aquifer as wells as in boreholes from the shallow aquifer system. The areal distribution of these compounds in groundwater extends about 4 km from wadi Al Quilt drainage system northwards to north of wadi Nueimah. The result of this study confirm the hypotheses that there is an indirect recharge from the Mountain aquifer into the shallow Plio-Plistocene aquifer system in Jericho area. It is expected that S-N- major fault system, and the 80 m thick Chalk-Chalky limestone of Senonian age does not act as barrier between the two groundwater systems.
Key words: Jericho, Shallow Plio-Plistoces and Mountain aquifer systems, Pharmaceutical Residuals, indirect replenishments