Geophysical Research Abstracts
Vol. 14, EGU2012-10489, 2012
EGU General Assembly 2012


# Effect of artificial recharge by treated wastewater on the quality of the Korba coastal aquifer (Cape Bon, Tunisia): insights from Boron isotopes.

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Mediterranean coastal aquifers are highly stressed, partly because of intensive agricultural activities in semi-arid or arid context. Water quality of groundwater is often degraded by different processes: salt water intrusion, diffuse pollution... In this context, the Korba aquifer on the eastern coast of Cape Bon (Tunisia) undergoes overexploitation. Since the 60's, reversal of hydraulic gradient and saline intrusion were studied (Ennabli, 1980; Kouzana et al. 2009a , 2009b; Kouzana et al., 2010) and the groundwater hydrogeological functioning was modeled (Kerrou et al., 2010; Panicoti et al. 2001a, 2001b; Zghibi et al., 2011). Crucial for local agriculture, aquifer management led to the implementation of artificial recharge with treated wastewaters at the end of 2008. Since then, groundwater quality was monitored to trace the effectiveness of artificial recharge, based on boron isotopes, to better determine the different system components. Samples were taken from recharge control piezometers and in farmers' wells.
Cation exchange was demonstrated to be one of the main processes controlling the groundwater quality. Sodium, potassium and boron were clearly in deficit compared to a mixing line with seawater, whereas calcium, strontium and bicarbonates were in excess. Treated wastewaters were concentrated in chloride and sodium and sometimes more than in wells, equivalent to a mixing of 6 to 14 % with sea water. The 2009 isotopic signatures in wells were clearly distributed on a mixing line between a nitrate-polluted and salinized pole especially constituted by abandoned wells and which had already reached equilibrium governed by cation exchange or sorption processes, and fresh groundwater. This mixing line explained the intermediate composition of a less salinized groundwater pole of intensively pumped wells. In 2010, in a context of low rainwater inputs, a general decrease of $\delta$11B in the same wells may indicate mixing with deeper groundwaters and a continuous isotopic re-equilibration between the two previous end-members according to the different inputs, e. g. rainwater recharge or river flows. $\delta$11B increased between 2010 and 2011 up to their 2009 value. Such a variation between 2010 and 2011 cannot be linked to a simple cation exchange but appear more reasonably linked to a higher rainfall recharge after a rainy winter. The mixing of treated wastewater was estimated at a maximum of 30 % with groundwaters and seemed very local. According to fluxes directions, artificial recharge could clearly not influence some wells composition.
The impact of artificial recharge seemed thus very limited in terms of quality: recharge waters were salted and poorly contribute to refresh the system. Ultimately, the degradation of irrigated soils and crops diversity, currently limited by salt tolerance, will not improve. Moreover, B isotopes showed that artificial recharge seemed to influence some piezometers at vicinity but had low impact, if any, on close farmers' wells.