IDENTIFYING SOURCES AND PROCESSES OF GROUNDWATER QUALITY CHANGE IN RECIFE METROPOLITAN REGION (PE, BRAZIL): CONTRIBUTION OF BORON, STRONTIUM AND WATER ISOTOPES

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The Franco-Brazilian COQUEIRAL project led by USP (Proc. FAPESP 2011/50553-0), UFPE and the French Geological Survey (BRGM) aims at identifying the salinization and contamination sources and processes in the Recife Metropolitan Region (RMR) aquifer system, composed of continental and marine sediments, and which appears to be a typical "hot spot" illustrating the climate and land uses changes impact in coastal cities. To achieve this objective, combined evaluations of hydrochemistry (major + traces elements) and isotopes ($\delta^{11}B$, $^{87}Sr/^{86}Sr$, $\delta^{18}O$, $\delta^{2}H$) were carried out in 59 wells and 3 surface waters during high and low flow periods. The results should help determine hydrogeological scenarios of the current functioning of the system. By combining this information with predictions of the future hydrological and socio-economical conditions, an integrating numerical model should be proposed to help the management of the area. This approach highlights the complexity of sources and processes in the system. The H and O isotopes show that the groundwater originates from meteoric waters, acquiring then, as suggested by the $^{87}Sr/^{86}Sr$, their mineralization through interaction with siliciclastic rocks originated from regional basement ($0.716<^{87}Sr/^{86}Sr<0.730$) and/or Phanerozoic carbonate rocks ($0.707<^{87}Sr/^{86}Sr<0.709$). Water rock interactions are also reflected by $\delta^{11}B$ signatures slightly enriched in some wells ($41.0< \delta^{11}B <49.9‰$) in comparison to seawater ($\delta^{11}B \approx 40‰$) that shows the influence of clays (preferential adsorption of ^{10}B) along with seawater intrusion. Clays are also involved in cation exchange as displayed by concomitant Ca-Cl water types. Locally, very high $\delta^{11}B$ ($63.7<\delta^{11}B <68.5$ %) also argues for the influence of strongly evaporated seawater trapped in the sedimentary terrains. In addition, an anthropogenic source (e.g. sewage waters) is evidenced by typical depleted $\delta^{11}B$. Coupled with dissolved element concentrations, these tools allow us to determine that the water quality changes involve different sources with both natural and human induced complex processes.