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On the origins of hypersaline groundwater in the Nile Delta Aquifer

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The fresh groundwater resources in the Nile Delta, Egypt, are of eminent socio-economic importance. These resources are under major stress due to population growth, the anticipated sea level rise and increased groundwater extraction rates, making fresh water availability the most challenging issue in this area. Up till now, numerous groundwater studies mainly focused on sea water intrusion on the top 100m of the groundwater system and assumed salinities not exceeding that of Mediterranean sea water, as there was no knowledge on groundwater in the deeper coastal parts of the Quaternary Nile Delta aquifer (that ranges up to 1000m depth). Recently, however, the Egyptian Research Institute for Groundwater (RIGW) collected salinity measurements and found a widespread occurrence of "hypersaline" groundwater: groundwater with salinities largely exceeding that of sea water at 600m depth (Nofal et al., 2015). This hypersaline groundwater greatly influences flow patterns and the fresh water potential of the aquifer. This research focuses on the origins of the hypersaline groundwater and the possible processes causing its transport. We consider all relevant salinization processes in the Nile Delta aquifer, over a time domain of up to 2.5 million years, which is the time span in which the aquifer got deposited. The following hypotheses were investigated with a combination of analytical solutions and numerical modelling: upward salt transport due to a) molecular diffusion, b) thermal buoyancy, c) consolidation-induced advection and dispersion, or downward transport due to d) composition buoyancy (salt inversion). We conclude that hypotheses a) and b) can be rejected, but c) and d) are both possible with the available information. An enhanced chemical analysis is suggested for further research, to determine the origins of this hypersaline water. This information in combination with the conclusions drawn in this research will give more insight in the potential amount of non-renewable fresh water in the Nile Delta aquifer.

References:
Nofal, E. R., Amer, M. A., El-Didy, S. M., & Akram, M. F. (2015). Sea Water Intrusion in Nile Delta in Perspective of New Configuration of the Aquifer Heterogeneity Using the Recent Stratigraphy Data. Journal of American Science, 11(6), 567–570.