Temporal Spatial and Depth Variations of Ground Water Chemistry: An Indicator of Hydro-Geochemical Evolution in Shallow Coastal Aquifers, South Texas

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GCAGS Explore & Discover Article #00022*
http://www.gcags.org/exploreanddiscover/2016/00022_khan_et_al.pdf
Posted September 13, 2016.

*Abstract extracted from a full paper published in the *GCAGS Transactions* (see footnote reference below), which is available as part of the entire 2016 *GCAGS Transactions* volume via the GCAGS Bookstore at the Bureau of Economic Geology (www.beg.utexas.edu) or as an individual document via AAPG Datapages, Inc. (www.datapages.com), and delivered as an oral presentation at the 66th Annual GCAGS Convention and 63rd Annual GCSSEPM Meeting in Corpus Christi, Texas, September 18–20, 2016.

ABSTRACT

Available water chemistry data collected between 1965 and 2013 from the Chicot and Evangeline aquifers in coastal South Texas were studied to identify time dependent depth variations and spatial differences in total dissolved solids (TDS) ground water level (GWL) and ground water TDS varied noticeably. This study analyzed correlation relationships among several water chemistry parameters and spatio-temporal variations in selected water chemistry parameters such as pH, Mg^{2+}, and F^-, at varying depths. Hydro-chemical analyses reveal that both the Chicot and Evangeline aquifers water are Na–K–Cl–SO_4 type, while the Evangeline aquifer showed higher proportions of Na^+ and Cl^- compared to the Chicot aquifer, suggesting that the hydrogeochemical processes operating in those two aquifers differ significantly. Major ions such Na^+, Cl^-, SO_4^{2-}, and F^- showed significant spatial and depth variations. In the deeper part of the Evangeline aquifer, $SO_4^{2-}$and F^- concentrations gradually increased with depth, while HCO_3^- and Ca^{2+} simultaneously decreased with depth. Time dependent spatial and depth variations of the concentrations of total dissolved silica, Ca^{2+}, F^-, and HCO_3^-, along with ground water level fluctuations in the Chicot aquifer, suggest the hydrogeochemical processes are not in hydrodynamic equilibrium condition, but datasets with much higher spatial and temporal resolution would be required to establish this with sufficient confidence.

Originally published as: Khan, R. H., J. Smith-Engle, P. Tissot, and D. Murgulet, 2016, Temporal spatial and depth variations of ground water chemistry: An indicator of hydro-geochemical evolution in shallow coastal aquifers, South Texas: Gulf Coast Association of Geological Societies Transactions, v. 66, p. 313–329.