The challenge of using geochemical tracing for surface water source identification in hot and arid climates

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Urbanization and agricultural development in Saudi Arabia are sustained by the exploitation of the Kingdom's vast groundwater resources. Wastewater outflows generated from the extensive groundwater use in farming and urban centres have augment the size of existing surface water bodies (lakes, wetlands) originally recharged by shallow groundwater springs, or have resulted in the creation of new water bodies/wetlands. These wetlands support vibrant wildlife habitats with a surprizing diversity of bird, mammal and reptilian species, and that has recently prompted interest in their conservation and development for recreational use. However, the hot and arid climate as well as the already elevated dissolved mineral contents of the wetlands' principal water sources could lead to gradual salinization and concomitant loss of floral and faunal diversity. Hence, proper understanding of the wetlands' water and dissolved solute budgets is needed to determine their long-term fate.

Natural geochemical tracers (e.g., $\delta^{18}O$, $\delta^{2}H$, $\delta^{13}C$, $^{87}Sr/^{86}Sr$, Cl, Br, B) have been used in an attempt to identify and apportion water and solute sources at two wetlands in the eastern province of Saudi Arabia. One of these wetlands is recharged predominantly by a mixture of local shallow groundwater and a municipal wastewater outflow sourced from a deep groundwater aquifer, while the other is recharged mainly by an agricultural water outflow originating from a local aquifer traditionally used for irrigation. Contribution of water/solutes from other sources (i.e., industrial wastewater) to both wetlands has also been suspected.

Preliminary results demonstrate that the application of geochemical water/solute tracers in the wetlands is complicated by processes such as evaporative loss, mineral dissolution and precipitation, other water/mineral interaction, and/or biologically mediated reactions as well as by anthropogenic factors such the addition and/or removal of dissolved constituents to and from the wastewater outflows. This presentation will focus on the challenges and solutions to developing a simple yet accurate methodology for geochemical surface water source tracing in hot, arid climates.