An Isotopic Investigation of Salinity and Water Sources in the Souss-Massa Basin, Morocco

B. Ekwurzel 1,2, J. E. Moran 1, G. B. Hudson 1, M. Bissani 1, R. Blake 1, M. Krimissa 3, N. Mosleh 3, H. Marah 3, N. Safsaf 3, Y. Hsissou 4, L. Bouchaou 4

1 Lawrence Livermore National Laboratory, USA
2 University of Arizona, USA
3 Centre National de L'Energie des Sciences et des Techniques Nucleaires, Morocco
4 University of Ibnou Zohr, Morocco

ABSTRACT

Seawater intrusion, and other processes that contribute dissolved solids to groundwater are a major threat to water quality in the heavily exploited Souss-Massa Basin nestled between the High Atlas and Anti-Atlas mountains of Morocco. A hydrogeologic investigation using isotopes such as 18O, 4He, 36Cl, and 129I is being carried out with the goal of determining the source of water, the source of salinity, and the age of the water for groundwater samples from the Souss-Massa. Information regarding the relative importance of various salinity and water sources can be used to make informed decisions about water resource allocation and possible remediation strategies.

Preliminary results from eighteen groundwater samples from the central and south Souss-Massa Basin suggest that relatively old water is mined at these wells, and that seawater intrusion is just one component of the dissolved solids present in these waters. Radiogenic 4He excess from U and Th decay ranges up to 2 × 10^-7 cm^3 STP g^-1 indicating ages as great as several tens of thousands of years. The long-lived isotopes of chlorine (36Cl, half-life = 300 ka), and iodine (129I, half-life = 15.6 Ma) can be used to distinguish modern seawater, ancient seawater, agricultural water, and evaporite-derived water. The relative abundances of these anions, along with bromide, indicate that while dilution of intruded seawater from west to east is taking place, another significant source of TDS is water/rock interaction.

Keywords: Geochemistry, Isotope tracers, Saline Groundwater

Corresponding author: Brenda Ekwurzel, Assistant Professor, Department of Hydrology and Water Resources, J. W. Harshbarger Bldg., University of Arizona, Tucson, Arizona, 85721-0011, USA. Email: ekwurzel@hwr.arizona.edu