

Chemical and Isotopic Characterization of a Karst- Dominated Watershed

ABONGWA, PRIDE¹, DEN, WALTER¹, GONZALEZ,
SAMANTHA²

Department of Science and Mathematics, Texas A&M
University, San Antonio

¹Institute for Water Resources Science and Technology

²Biology Program

The Edwards Aquifer is a karst watershed and aquifer in South-Central Texas spanning over 2 million acres that support water supply and agriculture for over 3 million people and 40 rare or endangered species. Karst formations are composed of soluble carbonate rocks that would dissolve to produce large voids and conduits, making these systems susceptible to pollution. Dissolved concentrations of Sr and B were found to be the highest along the San Antonio River which is fed by the Edwards Aquifer, and the correlation with the presence of ethylenediaminetetraacetic acid (EDTA) suggests that the complexation of the trace metals with EDTA could be the cause of the elevated metal concentrations. Elevated NO₃ concentrations relative to national background values and the widespread detection of pesticides indicate that the Edwards aquifer is vulnerable to contamination. Greater vulnerability of groundwater and urban rivers/streams was evident from results of streams and urban groundwater sites, which generally had higher NO₃ concentrations, elevated δ¹⁵N-NO₃ values (1.1‰ to 15.4‰), a greater diversity of pesticides, and higher pesticide concentrations.

In addition to physical water quality parameters (pH, temperature, alkalinity, conductivity) and chemical constituents (total organic carbon, inorganic ions, trace metals), we also analyzed multiple isotopes (C, S, Sr) as a tracer of the dissolved constituents in an attempt to clarify the origins of the chemical constituents. ⁸⁷Sr/⁸⁶Sr and ¹³C/¹²C gave indication to the extent of water-rock interaction and thus the likelihood of groundwater mixing with recent, more geochemically variable recharge, particularly in shallow, unconfined carbonate aquifers. δ⁸⁷Sr values ranged from 0.788‰ to 0.710‰ which corroborated with δ¹³C values of 0.923‰ to -12.12‰ indicating the dissolution of the marine carbonates that make up the aquifer and the equilibration of carbon with soil CO_{2(g)}. Relatively high As concentrations were preferentially aligned to high values of ⁸⁷Sr and ¹³C measured, indicating that the As could have been dissolved into groundwater from aquifer material and younger alluvium.