THE CHEMICAL EVOLUTION OF MUNICIPAL WATER IN THE NATURAL HYDROLOGIC SYSTEM: URBANIZING WATERSHEDS

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ABSTRACT

Texas's population is projected to double by the year 2050, with the most growth being concentrated in major cities. This poses challenges to urban watershed resilience in terms of both water quality and quantity. As municipal supply and wastewater networks age, they leak anthropogenic waters into streams and aquifers. Although there is evidence for significant losses of water from municipal infrastructure, little is known about the evolution of such water once it enters the natural hydrologic system. The City of Austin sources municipal water from the Colorado River, which has elevated $^{87}Sr/^{86}Sr$ ratios relative to Austin-area streams that incise Cretaceous carbonate bedrock. I apply this isotopic disparity as a tracer for municipal water inputs to determine the extent of municipal containment failure in creeks across seven Austin-area watersheds. I couple this with stream water cation and anion concentrations to gain insight to hydrogeochemical processes in the most extensively-urbanized watershed in Austin – Waller Creek. Stream water $^{87}Sr/^{86}Sr$ ratios decrease and cation concentrations increase as water interacts with the limestone bedrock. $^{87}Sr/^{86}Sr$ vs Sr/Ca concentrations plotted with water-rock interaction models indicate groundwater residence times and inferred physical flow paths. Sr isotope and anion concentrations follow trends of modeled fluid mixing between rural creek waters and municipal supply and waste water. Waller Creek stream water $^{87}Sr/^{86}Sr$ data suggests limited groundwater residence times and thus less chemical evolution compared to stream waters from all seven studied watersheds. However, these urbanized waters also exhibit a significant trend of Ca to Sr concentrations that follow the modeled dissolution of the underlying Austin Chalk. The limited geochemical evolution processes reflected in Waller Creek may be a consequence of the low permeability and fracture-dominated flow in the chalk.

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