Effect of Focused Recharge on the Geochemistry of Barton Springs, Edwards Aquifer, Central Texas during Base-Flow Conditions

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Abstract

Geochemical variability of karst spring flow has been shown to be closely linked to storm events (for example, Andrews and others, 1984; Ryan and Meiman, 1996; Personné and others, 1998; Vesper and White, 2004; Mahler and Massei, 2007). Less attention, however, has been paid to the relation between focused recharge and spring geochemistry under base-flow conditions. The Barton Springs segment of the Edwards aquifer, Austin, Texas, is well situated for studying this relation: An estimated 85 percent of aquifer recharge occurs as focused recharge through the beds of six ephemeral creeks, and an estimated 90 percent of aquifer discharge occurs at Barton Springs (Slade and others, 1986). Concentrations of major ions, nutrients, soluble pesticides, and volatile organic compounds were measured at Main Barton Spring at two or three week intervals from 2003 through 2005 (Mahler and others, 2006). The relations between estimated recharge rate through creek beds and concentrations of major ions, nutrients, the pesticide atrazine, and the volatile organic compound tetrachloroethene in spring flow were investigated. Recharge rate was inversely correlated with concentrations of some constituents and contaminants, including sodium, chloride, and nitrate. This indicates that concentrations of these compounds are higher in water stored in the aquifer than in focused recharge, which dilutes them as it mixes with water already in the aquifer. Recharge rate was positively correlated with other constituents and contaminants, including tetrachloroethene, indicating that focused recharge are transporting these compounds into the aquifer. Additionally, some relations indicated that geochemical processes were ongoing within the aquifer, including water-rock interaction and degradation of organic matter. The results highlight the quantifiable influence of surface-water quality on karst ground-water quality under a range of flow conditions.

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