A salinization study within the San Acacia region, Sevilleta National Wildlife Refuge (SNWR), New Mexico (abs.)

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The arid climate of the American southwest poses concerns in water management for both ground and surface waters in the Rio Grande rift corridor. High salinity and elevated trace element concentrations tend to impair water quality; hence identifying sources of these contaminants remains an important ongoing challenge. Geochemical studies show an increase in salinity in the Rio Grande near San Acacia, located at the southern end of the Albuquerque Basin. Alternate models contend that: A) deep-seated faults within the rift provide conduits for the ascent of deeply-derived saline fluids, and B) upwelling of sedimentary basin brines takes place at interbasin constrictions. We used aqueous geochemical techniques (field parameters, major and trace elements, Cl/Br ratios, δ¹⁸O and δD) and geochemical modeling to identify salinity components in the middle Rio Grande basin. An integrated study of spring geochemistry centered at the SNWR with factors related to poor water quality will allow for an improved comprehension of natural contaminants in the Rio Grande hydrochemical system. Results show that the Rio Salado Box (RSB) and San Acacia (SA) springs are both major salinity inputs. SA contains the highest salinity concentrations of all SNWR waters, and it is observed to influence the nearby canals. The increase in salinity in the Rio Grande appears to be caused by SA springs and its evaporative pools. Major ion, stable isotope, and trace element analyses suggest that SA is chemically similar to the RSB waters and that the SA brine pool has evolved through evaporative concentration. RSB has been established as having deeply-derived fluid sources based on He isotopic data. We conclude that rift-bounding and intra-rift basement-penetrating faults can provide “fast paths” for the ascent of saline fluids. These endogenic waters are potentially influenced by relatively small volumes of upwelling fluids through granitic basement (with associated increases in F, Li and Ba) and the Socorro Magma Body (excess CO₂). Within the SA region there are numerous springs that are all potential fault-controlled endogenic fluid sources. Salinity sources that contribute to the salinization of the Rio Grande through fault conduits at San Acacia degrade the water quality of the Rio Grande and its aquifers, posing a hazard to downstream users.

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