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Interpreting groundwater characteristics in Eocene aquifers by isotopic measurements: Piceance Basin, Colorado

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An array of isotope measurements has been used to refine Piceance Basin hydrologic model inputs. Water-bearing strata between kerogen-rich Eocene oil shale layers yield isotopic data that constrain groundwater sources, age of recharge, flow paths, flow velocities, and a number of water-rock reactions. Sr isotopes from the upper part of the stratigraphic section (Uinta) to the lower water-bearing units (base of Parachute Creek) record mixing of a relatively low volume of water. Oxygen isotope analysis demonstrates that some recharge to deeper units occurred prior to the last ice age or even much earlier. $\delta^{34}\text{S}$ values in dissolved sulfate, increase down-gradient in the Parachute Creek, whereas the carbon isotopes decrease down-gradient in the Uinta. The first trend is likely a result of biogenic sulfate reduction, and the latter a result of carbonate dissolution. These results demonstrate that inclusion of isotopic data significantly augments traditional approaches to basin hydrologic modeling.