The hydrogeochemical evolution of basinal fluids in the Paradox Basin: implications for sources, flowpaths, and residence time

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The Paradox Basin in the Colorado Plateau has abundant manifestations of paleofluid flow, including sandstone bleaching and ore mineralization, salt tectonics, and hydrocarbon, CO_2, and He reservoirs. Formation water and dissolved gas samples were collected to evaluate the hydrochemical composition, sources, and residence time of remnant fluids as an indicator of the long-term evolution of the Paradox Basin fluid-rock system, using major ion and isotopic ($\delta^{18}O$- & $\delta^{2}H$-H_2O; $\delta^{34}S$- & $\delta^{18}O$-SO_4; $^{87}Sr/^{86}Sr$) signatures of fluids and preliminary radio-krypton (^{81}Kr) dating results from produced gases. Pennsylvanian Honaker Trail Formation brines (~0.5 Ma; ^{81}Kr water age) are a mixture of (1) paleo-evaporated seawater (PES) from the underlying Paradox Formation (>1.5 Ma; ^{81}Kr water age) containing high concentrations of Fe, Mn, and Cu; (2) (partially evaporated) seawater; and (3) more recent evaporite-derived brines from influx of meteoric water that oxidized sulfides and acquired radiogenic Sr from the overlying Permian Cutler siliclastic formations. Mississippian and Devonian formation waters (~0.8 Ma; ^{81}Kr water age) were surprisingly young and likely represent PES that was diluted by topographically-driven meteoric recharge, which interacted with radiogenic basement rocks or arkosic sandstones adjacent to the Uncompaghre Uplift, and dissolved evaporites at the base of the Paradox Formation.