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450,000 years of groundwater $(^{234}U/^{238}U)_0$ variations in SW Nevada, USA

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Subaqueous speleothems represent a unique archive for geochemical variations in regional groundwater systems. Devils Hole 2 cave, located in SW Nevada, USA, is an open fault zone intersecting the Ash Meadows groundwater flow system. Speleothem layers that coat the submerged walls of Devils Hole 2 cave record the isotopic composition of groundwater uranium at the time of precipitation. Past variations of $^{234}U/^{238}U$ initial activity ratios in groundwater may provide insight into paleohydrological conditions, such as changes to groundwater flow rates or source inputs. We aim to reconstruct 450 ka of groundwater $(^{234}U/^{238}U)_0$ variations at Devils Hole 2 cave. To do so, an 80 cm-long core was drilled from the cave wall. Over 100 $(^{234}U/^{238}U)$ and U-Th ages were measured in order to calculate initial activity ratios. Despite relatively constant uranium concentrations and growth rates throughout the core, preliminary results show a range in values (2.851 -2.616) deviating from modern day groundwater $(^{234}U/^{238}U)_0$ which we measured to 2.762 ($\pm$0.002). $(^{234}U/^{238}U)_0$ variations appear to follow interglacial-glacial cycles from 450 ka to present day, such that maximum $(^{234}U/^{238}U)_0$ ratios identified at roughly 43, 185, 289, 374, and 449 ka correspond to glacial periods, while minimum $(^{234}U/^{238}U)_0$ ratios at roughly 5, 121, 239, 336 and 422 ka correspond to interglacial periods. Focusing on the last 200 ka, we observe increasing $(^{234}U/^{238}U)_0$ ratios coupled with depleted Devils Hole 2 $\delta^{18}O$ values and water table high-stands (Moseley et al. 2016, Science 2016). We suggest that $(^{234}U/^{238}U)_0$ variations are positively correlated to precipitation amount, contrary to dripstone speleothem records in the Great Basin region. Mechanisms driving the fluctuation in $(^{234}U/^{238}U)_0$ values are still uncertain, but may be due to increased inputs of additional minor groundwater sources to the Ash Meadows flow system during pluvial periods.