

Variability in the uranium isotopic compositions of surface water in the Mono Basin, California, USA

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We collected a suite of water samples from the lake, thermal springs, and streams in the Mono Basin, located in the southwestern corner of the US Great Basin, and analyzed their uranium isotopic compositions. First, our results show that the $\delta^{234}\text{U}$ mean value of present-day lake water is approximately $183\pm 1\%$, which updates the previously reported $140\pm 10\%$ (Anderson et al., 1982). Second, spring water samples present a quite large range of $\delta^{234}\text{U}$ values. To the east of the lake, thermal spring water $\delta^{234}\text{U}$ is $\sim 250\%$, while the spring water samples from the northwest shore have $\delta^{234}\text{U} \sim 160\text{-}180\%$. The relatively low values in the western spring water suggests a mixture of lake water, or less preferential ^{234}U leaching from bedrock along a short transport distance from the Sierra Nevada, or a combination of both. The spring water from the south shore has the lowest $\delta^{234}\text{U}$ values, $\sim 100\text{-}140\%$. This may suggest that the spring water in the south shore is sourced from the Mono Craters to its south, where ^{234}U and ^{238}U in rocks may have been reset to a secular equilibrium state during the recent volcanic activities. And third, the majority of U in the lake water is probably contributed by the creeks from the Sierra Nevada, which flow through glacial moraines to the northwest of the lake. For example at present, Lee Vining Creek contributes $>50\%$ of U to the lake water.

Our $\delta^{234}\text{U}$ data in water samples from the Mono Basin suggest that the leaching of ^{234}U in the western basin, particularly through physical weathering of glacial moraines, is likely a dominant factor in controlling of lake water $\delta^{234}\text{U}$. The elevated $\delta^{234}\text{U}$ in tufa carbonates during the deglacial wet periods probably indicates a much stronger physical weathering in the Sierra Nevada, which boosted ^{234}U release from glacial grinded rocks.