

Water uranium isotope systematics in the Mono Basin

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We collected a suite of water samples from the lake, thermal springs, streams and melted snow in the Mono Basin, located in the southwestern corner of the US Great Basin, and analyzed their U concentration and isotope ratios. We found that the U concentration and $\delta^{234}\text{U}$ of today's lake water are ~ 300 ppb and $\sim 170\text{‰}$, respectively. U concentration in spring water can vary from ~ 0.02 ppb for samples collected a few hundred meters away from the shore, to ~ 25 ppb for samples collected near the shore. Spring water samples also have quite different $\delta^{234}\text{U}$ values. To the east of the lake, thermal spring water $\delta^{234}\text{U}$ is $\sim 250\text{‰}$, while the spring water samples from the northwest shore have $\delta^{234}\text{U} \sim 160\text{-}180\text{‰}$. The relatively low value in the western spring water suggests a mixture of lake water, or less $\delta^{234}\text{U}$ 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 $\delta^{234}\text{U}$ value, $\sim 100\text{-}140\text{‰}$. 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. Nevertheless, the $\delta^{234}\text{U}$ value in spring water is similar to, or lower than that in melted snow and water from creeks in southwestern basin, which has a $\delta^{234}\text{U}$ value of $\sim 200\text{-}300\text{‰}$, although their U concentration can be as low as 0.006 ppb. A water sample from the Mill Creek, which flows from the Lundy Canyon and through glacial moraines to the northwest of the lake, registers the highest $\delta^{234}\text{U}$ value, $\sim 500\text{‰}$ among all samples.

Our preliminary $\delta^{234}\text{U}$ data in water samples from the Mono Basin therefore 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 could indicate a much stronger physical weathering in the Sierra Nevada, which boosted ^{234}U release from glacial grinded rocks.