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Lithium isotopes geochemical behavior in a small mountainous river of the Tibetan Plateau

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Lithium (Li) and its isotopes are potential tracers of silicate weathering in river basins. However, the relationship between Li isotopic composition (δ^7Li) in rivers and silicate weathering intensity remains unclear. This study analyzed Li concentration and isotopic composition in river waters from the Nyang River, southern Tibetan Plateau. The results show that these samples have significantly variable Li concentrations and δ^7Li values, and herein high δ^7Li values are in some tributaries. Calculations indicate that dissolved Li in river water is predominantly derived from silicate weathering and geothermal water. Geothermal waters have low δ^7Li values in the Tibetan Plateau. Differences in the proportional contribution of dissolved Li in river samples from silicate weathering and geothermal water may be the main reason for the spatiotemporal variation in riverine δ^7Li values. The samples have higher δ^7Li values when the Li in the samples is mainly derived from silicate weathering contributions, and lower values when the contribution from geothermal waters is high. Besides, the interaction of dissolved Li from geothermal water with secondary minerals results in Li isotopic fractionation, which may also contribute to variations of river water δ^7Li. It is generally accepted that the lower weathering intensity in orogenic (or mountainous) area compared to floodplains is the main controlling factor for the lower δ^7Li value in rivers. This study indicates that geothermal water influx may cover up the Li isotopic signal of silicate weathering in river water, which in turn affects the accurate understanding of the relationship between riverine δ^7Li values and the silicate weathering intensity. Therefore, whether the lower δ^7Li values of river waters in hydrothermal-rich orogenic areas are mainly controlled by the regional weathering intensity or by the input of geothermal waters (or both) needs to be studied in depth, and this is the key to accurately establishing the relationship between the Li isotopic composition and silicate weathering intensity in the river basin.