Anthropogenic and natural impacts on Mo isotope composition in river water—a study from the Liuxihe River, in South China

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Constraining the river input $\delta^{98}Mo_{NIST}$ to ocean is a prerequisite for $\delta^{98}Mo_{NIST}$ used as a tracer for redox state in ancient oceans. Evaluating the anthropogenic and natural impacts on the rivers water $\delta^{98}Mo_{NIST}$ is of great significance for constraining the river input $\delta^{98}Mo_{NIST}$ to ocean, however, at present, which are not well understood.

Within this context, we report a one-year long time series of Mo concentrations and $\delta^{98}Mo_{NIST}$ in river water collected in source area (Dongxing station), upper (Wushi station), middle (Xiawanna station), lower reaches (Jianggao station) reaches of the Liuxihe River (XJR) in southern China. The results show that the Mo concentrations and $\delta^{98}Mo_{NIST}$ are displaying obvious differenc in temporal (seasonal scale) and spatial variation in these four reaches of XJR. In seasonal scale, both the source area and lower reaches are showing a small variation in river water, from 0.66 to 0.82‰, from 0.38 to 0.60‰, respectively, inversely, the upper and middle rechees are showing a large seasonal variation, from -1.24 to 0.82‰, from -0.14 to 0.64‰, respectively. In spatial scale, the $\delta^{98}Mo_{NIST}$ in source area is highest, followed successively by the upper and middle, with the lower reaches lowest in summer. In winter, the $\delta^{98}Mo_{NIST}$ in source area is followed successively by the lower and middle, with lowest in the upper reaches.

According to the background condition in Liuxihe river basin, four factors have been proposed, including rock chemical weathering, spring input, agriculture input, and industrial sewage input, to interpret the temporal (seasonal scale) and spatial variation in $\delta^{98}Mo_{NIST}$ for these reaches. The $\delta^{98}Mo_{NIST}$ in source area is mainly controlled by rock chemical weathering, the upper reaches influenced by spring water input, the middle influenced by agriculture input and spring water input, and the lower reaches influenced by multi factor (industrial sewage, agriculture input, spring water input).