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Molybdenum isotopic fractionation in small mountainous rivers of Taiwan

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Molybdenum isotopic compositions for major river catchments, including some bedrocks and sediments, throughout Taiwan have been studied, in order to better understand the geochemical behavior of Mo and the mechanisms responsible for the observed Mo isotopic fractionations in these riverine systems. In general, the riverine Mo and $\delta^{98/95}$Mo varies between 1.94 and 45.09 nM and from -0.53 to +1.35‰, respectively, with an average $\delta^{98/95}$Mo of +0.70 ± 0.31‰ for the wet season. In contrast, the riverine Mo and $\delta^{98/95}$Mo ranges between 2.15 and 58.27 nM and from -0.48 to +1.09‰, respectively, with an average $\delta^{98/95}$Mo of +0.74 ± 0.28‰ for the dry season [1]. Overall seasonal $\delta^{98/95}$Mo variation is quite small in the river catchment of Taiwan. The dissolved riverine $\delta^{98/95}$Mo are heavier than those of the bedrock (~ -0.72 to +1.03‰), but these rivers flow through quite different lithologies, and are thus difficult to identify a common cause responsible for the observed Mo isotopic fractionations. However, $\delta^{98/95}$Mo of bedload sediments from three rivers seem to show a negative trend with trace elements such as Nb, Mn, and Ti, enriched in fine-grain residual Fe-Ti oxides, e.g.,titanite, rutile, and ilmenite, that are also important hosts for Mo. Consequently, the bedload sediments may be the sink for light $\delta^{98/95}$Mo, which drives the dissolved load towards a heavier $\delta^{98/95}$Mo through adsorption processes [1]. Furthermore, Mo isotopes can also be used to identify anthropogenic inputs in polluted rivers [2]. Lastly, the rivers of Taiwan discharge a significant flux of sediments and a heavier mean $\delta^{98/95}$Mo (+0.75‰) to the oceans than that of the mean global rivers (~ +0.55‰). The results of the rivers in Taiwan could help better constrain the global Mo cycle, short-term seasonal variations, e.g., precipitations, however, they do not exhibit significant effect on the Mo cycle in the oceans [1,2].

[1] Ekka et al. (2023), *Chemical Geology* 620, 121949.

[1] Ekka et al. (2023), *Water* 15, 1873.