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Concentrations and isotope ratios of Mo and W in Okinawa Trough hydrothermal fluids: Novel probes for hydrothermal processes in a back-arc basin - *Geochemical Society of Japan Award Lecture*

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Concentrations and isotope ratios of molybdenum (Mo) and tungsten (W) are expected to be proxies for paleoceanography. We found that the concentrations and isotope ratios of Mo and W are uniform in the modern ocean but that they are affected by anthropogenic sources [1]. However, the effects of other sources on the isotope ratios of Mo and W are still unknown. In this study, we observed the concentrations and isotope ratios of dissolved Mo and W in hydrothermal fluids at 9 sites in Okinawa Trough (Higashi Ensei, Iheya North, JADE, Hakurei, Higashi Izena, Daisan Kume, Yokosuka, Futagoyama, and Hatoma Knoll). Excluding the Hatoma Knoll, Mo concentration was from 8.1 nmol /kg (Izena) to 154.6 nmol /kg (Izena), and $\delta^{98/95}$Mo was from -0.17‰ (Izena) to 3.92‰ (Yokosuka). W concentration was from 1.7 nmol/kg (Yokosuka) to 238.0 nmol/kg (Izena), and $\delta^{186/184}$W was from -0.03 ‰ (Izena) to 0.11 ‰ (Izena). At the Hatoma Knoll, Mo concentration was 4.2–410.9 nmol/kg, $\delta^{98/95}$Mo was 1.27–3.07, W concentration was 0.9–98.9 nmol/kg, and $\delta^{186/184}$W was 0.05–1.08‰ [2]. For the endmembers of high temperature hydrothermal fluids, W concentrations were 200–5200 times higher than those of seawater. Mo concentrations were less than 10% of those of seawater due to removal of thiomolybdate. In contrast, Mo concentrations of low temperature fluids reached up to ~4 times that of those of seawater. In addition, W was effectively removed from low temperature fluids with high concentrations of Fe. It was because of Fe oxyhydroxides formed by oxygen from seawater and resulted in decrease in W concentration and increase of $\delta^{186/184}$W in the Hatoma Knoll. These contrasting behaviors of Mo and W will be useful to characterize the hydrothermal fluids for not only the modern but also geological hydrothermal activities.

1. Matsuoka, K., et al., *Distribution of stable isotopes of Mo and W from a river to the ocean: signatures of anthropogenic pollution.* Frontiers in Marine Science, 2023. **10**: p. 682.
2. Matsuoka, K., et al., *Concentrations and isotope ratios of Mo and W in Okinawa Trough hydrothermal fluids: Novel probes for hydrothermal processes in a back-arc basin.* Geochemical Journal, 2025. **59**(6): p. 283-298.

