Biological-controlled molybdenum isotope fractionation in corals reef system

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The Mo concentration and its isotope composition in coral reef system have been investigated, including 4-day time-series observation of seawater, several typical species of scleractinian corals from the Luhuitou coral reef in the northern South China Sea, and a 14-year annual resolution time-series of a Porites coral from the Great Barrier Reefs of Australia. This aims to reveal fractionation of Mo isotope between coral skeleton and seawater, seek for its mechanism and probe its potential function for tracing biological activities of coral. In the 4-day time-series observation, the seawater Mo concentration and $\delta^{98/95}$Mo, changes from 118.1 to 158.1 nmol/L, and from 2.0 to 2.2‰, respectively, showing an obviously diurnal variation. The $\delta^{98/95}$Mo exhibit significant correlation with contents of DO and DIC, pH and $\delta^{13}C_{DIC}$, suggesting that they are largely controlled by the dynamics of community metabolism. For the different coral species in Luhuitou coral reef, the Mo concentration and $\delta^{98/95}$Mo values are ranging from 21.7 to 78.0 ng/g and from 0.34 to 1.91‰, with the mean of 36.0 ng/g and 1.45‰, respectively. The Mo concentration are higher but the $\delta^{98/95}$Mo are lower than those of the surrounding seawater (12.0 ng/g and 2.05‰, respectively). The lighter and variable $\delta^{98/95}$Mo in coral might be associated with the biological nature of corals. Similarly, the GBR coral has lighter than seawater $\delta^{98/95}$Mo values, from 0.63‰ to 1.65‰ in the 14-year time series, which show significant negative correlation with TSI ($r=0.59$, $N=14$, $p<0.002$), Mo concentration ($r=-0.75$, $N=14$, $p<0.0001$). These correlations again indicate that the TSI-mediated biological activities, such as (r photosynthesis), are important process controlling Mo isotope fractionation in coral. Based on these observations, a biological fractionation model is built to interpret how the r photosynthesis process influence Mo isotope composition in the GBR coral. Meanwhile, such biological-controlled fractionation will enable Mo isotope to potentially be used as a proxy for biological activities in corals.