Molybdenum isotope time series of a *Porites* coral from the Great Barrier Reefs: Implications for biological-controlled fractionation

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Marine biological carbonate has the potential to record seawater Mo isotopic composition of geological periods. However, the Mo isotope fractionation between biological carbonate and seawater has not been well known. Given that Mo is actively involved in many biological processes, fractionation of Mo isotopes during biological calcification. We here report a 32-years Mo isotope time series of a *Porites* coral from the Great Barrier Reefs of Australia in annual resolution. The results indicate that the coral $\delta^{98/95}$Mo (relative to NIST 3134a) vary from 0.46‰ to 1.83‰. These values are all smaller than that of the seawater, represented by the IAPSO seawater standard, which was measured along with the coral samples, yielding $\delta^{98/95}$Mo of 2.08±0.18 (2SD, n=5). This suggests that significant and non-constant fractionation of Mo isotope occurs between coral and seawater, and coral is likely not adequate to reconstruct seawater Mo isotopic compositions in geological history.

The variations of the coral $\delta^{98/95}$Mo show robust negative correlation with the Mo concentrations (r=-0.82, p<0.0000001), and moderate positive correlation with sea surface temperature (r=0.50, p<0.002). Preferantial uptake of Mo from seawater by coral polyps and selective consuming Mo by zoozanthellae during photosynthesis with smaller $\delta^{98/95}$Mo are likely the key for such variations. In details, high temperature enahnces photosynthesis, and more Mo that have been taken up into the polyps is consumed, resulting in less Mo but with higher $\delta^{98/95}$Mo to be incorporated into aragonite skeleton. Such biological-controlled fractionation will enable Mo isotope to potentially be used as proxy for biological processes in corals.