Biological activity-controlled Molybdenum isotope fractionation during estuarine processes—A study from the Pearl River Estuary

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Molybdenum isotopes have been widely used as a tracer for redox state in ancient oceans on the basis of an assumption that the Mo isotope behavior is conservative at estuaries during transporting from continents to oceans. Rrecent results show that Mo is non-conservative during estuarine processes. Understanding this non-conservative behavior of Mo during estuarine processes is very important for applying Mo isotope to better quantitative changes in paleo-redox conditions from the Mo isotopes record in sediments. Due to the complexity of estuarine processes, involving a range of physical, biological and chemical processes, however, the non-conservative behavior in Mo isotope during estuarine processes are not well understood.

The variation of dissolved and particulate Mo concentration and $\delta^{98/95}$Mo in two seasons (winter and summer) along a salinity gradient in the Pearl River Estuary are measured to investigate the main controlling mechanism for the non-conservative behavior of Mo isotopes. The results show that the Mo concentrations are higher and $\delta^{98/95}$Mo are lighter than that of theoretical mixing line between seawater and freshwater endmembers, suggesting that Mo isotope was non-conservative in the Pearl River Estuary. This non-conservative behavior could result from a variety processes, such as release of suspended matter, resuspension process of sediment, anthropogenic emissions, and biodegradation process. According to evaluate the relative contribution of these process to water enrichment Mo, we conclude that anthropogenic emissions are the dominant factors in winter water Mo enrichment and lower $\delta^{98/95}$Mo, and biodegradation process are main controlling process in summer. This work is significant to evaluate the biological activity-controlled fractionation in Mo isotope composition and the contemporary isotope budget from continental to oceans.