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Revised Oceanic Mo Isotope Budget from Deep-Sea Pelagic Sediments

ZHIBING WANG[1], JIE LI[2], BANGQI HU[3], LIANG ZOU[3], XUE DING[3], LE ZHANG[1], JINLONG MA[1] AND GANGJIAN WEI[1]

[1]Guangzhou Institute of Geochemistry, Chinese Academy of Sciences
[2]State Key Laboratory of Isotope Geochemistry, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences
[3]Qingdao Institute of Marine Geology, China Geological Survey, Qingdao, China

Understanding the modern global oceanic Mo cycle and its isotopic budget is essential for establishing Mo isotopes as a quantitative proxy for oceanic oxygen levels. While oxygenated deep-sea pelagic sediments enriched with Fe-Mn oxyhydroxides serve as a primary Mo oxic sink, the isotopic composition of authigenic Mo in these deposits remains poorly constrained. Analysis of Mo isotope data from two Pacific Ocean deep-sea pelagic sediment cores reveals a depth-dependent increase in δ^{98}Mo values from –0.55 ± 0.04‰ to 0.19 ± 0.03‰, likely governed by Fe-Mn cycling during early diagenesis and/or deposition rate variations. By integrating these findings with existing data, we estimate a revised authigenic oxic Mo flux of 1.52×10^{8} mol yr^{-1}, with a δ^{98}Mo value of –0.09 ± 0.23‰. This revised flux exceeds previous estimates by more than twofold and exhibits an isotopic signature approximately 0.6‰ heavier than Fe-Mn crusts and nodules. Based on these results, we propose a revised global Mo isotope budget. These findings significantly advance our understanding of pelagic sediment contributions and enhance the precision of Mo isotope-based paleoceanographic reconstructions.