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Mercury isotope records in past 250 ka sediments of eastern Mediterranean Sea

XIAOWEI CHEN[1], RUOYU SUN[1], JIAWANG WU[2] AND GERT J. DE LANGE[3]

[1]Institute of Surface-Earth System Science, School of Earth System Science, Tianjin University
[2]Sun Yat-Sen University
[3]Utrecht University

Presenting Author: cxweffort_9@tju.edu.cn

Accurate reconstruction of the marine redox changes is crucial for understanding the elemental cycling and evolution of the environment and life. However, there is still a lack of reliable redox tracers of the deep-sea environment, and conventional tracers (e.g., green sulfur bacteria, Cd, Mo isotopes) have their uncertainties and limitations[1, 2].In recent years, mercury(Hg) stable isotope compositions in sedimentary rocks have shown a great potential in reconstructing marine palaeoenvironments including redox variations[3]. Here, we report Hg stable isotopes in marine sediments spanning the last 250 ka from the eastern Mediterranean Sea. These marine sediments were interrupted with nine layers of organic-rich sapropels, representing a dramatic change of redox and productivity of water columns. Relative to the organic-poor background sediments (mostly <30 ng/g), the sapropels are highly enriched in Hg with concentrations up to 270 ng/g. The δ^{202}Hg (representing mass dependent fractionation) values varied largely from -2.53 to 1.35‰ in background sediments, but were rather stable around -0.5‰ in sapropels. The Δ^{199}Hg and Δ^{200}Hg values (representing mass independent fractionation) were mostly positive, varying from -0.01 to 0.31‰ and -0.02 to 0.07‰, respectively. At the redox interfaces of several sapropel layers, an immediate decrease of Δ^{199}Hg and increase of δ^{202}Hg is observed with a sharp decrease of Hg concentrations. This implies a photochemical redox control of Hg isotope fractionation in water columns.

References:

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