Goldschmidt 2024 Abstract
https://doi.org/10.46427/gold2024.23564

New insights into triple oxygen isotope compositions of rainwater H_2O_2

HAO GUO[1] AND **MANG LIN**[2]

[1]Guangzhou Institute of Geochemistry, Chinese Academy of Sciences

[2]Guangzhou Institute of Geochemistry, CAS

Presenting Author: linm@gig.ac.cn

It has been known for over 26 years that the triple oxygen isotope compositions of hydrogen peroxide (H_2O_2) in rainwater exhibit a mass-independent signature, characterized by $\Delta^{17}O$ ($=\delta^{17}O-0.52*\delta^{18}O$) values ranging from 0.9‰ to 2.0‰ [1]. This fundamental understanding originated from pioneering measurements of rainwater H_2O_2 triple oxygen isotopes conducted in La Jolla, California [1]. As H_2O_2 plays a critical role as an oxidant in Earth's atmosphere, the $\Delta^{17}O$ values of atmospheric H_2O_2, initially reported in 1999 [1], have been instrumental in interpreting sulfate $\Delta^{17}O$ measurements worldwide, aiding in the quantification of atmospheric sulfate oxidation pathways [2]. However, this interpretation relies on data obtained solely from a single site [1], thus assuming spatial and temporal consistency in atmospheric H_2O_2 $\Delta^{17}O$ values, an assumption yet to be rigorously tested. Remarkably, no subsequent measurements have been conducted since the initial study over 26 years ago [1].

In this presentation, we report new triple oxygen isotope measurements of H_2O_2 in rainwater collected from Guangzhou, a megacity in South China. Our investigation serves to delve deeper into the variabilities of $\Delta^{17}O$ in atmospheric H_2O_2, offering crucial insights into the chemical intricacies of oxidation processes within the atmosphere. Furthermore, our work holds significant implications for advancing our understanding of triple oxygen isotope systematics in secondary minerals across the solar system, given H_2O_2's pivotal role in the formation of these secondary minerals on Earth, throughout geological history, and on other extraterrestrial bodies [3].

References:

[1] Savarino and Thiemens (1999), Atmospheric Environment 33, 3683-3690.

[2] Lin and Thiemens (2024), Applied Geochemistry 161, 105860.

[3] Guo and Lin (2022), Earth and Planetary Science Letters 594, 117722.