Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18940

Hg isotopes as proxy for oceanic oxygenation during the Cambrian Explosion

HAIFENG FAN

Institute of Geochemistry, Chinese Academy of Sciences

Presenting Author: fanhaifeng@mail.gyig.ac.cn

The Cambrian Explosion is a critical evolutionary milestone in life history, but the mechanistic relationship between the Cambrian explosion and rising atmospheric and oceanic oxygen levels remains controversial. Recently, Hg isotopes of marine sediments have been tentatively utilized to trace atmospheric and oceanic oxygenation. During the end-Archean "whiff" of oxygen (~ 2.5 Ga), the oxygenated interval exhibit strong Hg enrichment coupled with slightly negative Δ^{199}Hg signals, indicating increased oxidative weathering [1]. Meanwhile, a strongly negative shift of Δ^{199}Hg (from 0‰ to -0.12‰) recorded in the deglacial band iron formation could reflect oceanic oxygenation during the late Sturtian glaciation [2]. Therefore, Hg isotopes could be a proxy for atmospheric and/or oceanic oxygenation.

We measured Hg isotope compositions of the Shuijingtuo Formation (~521–514 Ma) from the Nanhua Basin, South China, where the famous Qingjiang Biotas, equal to Chengjiang Biota, was reported [3]. We proposed that, prior to Cambrian animal diversification, the Hg enrichment and slightly positive Δ^{199}Hg values could be mainly linked to upwelling of Hg associated with dissolved organic carbon (Hg-DOC) from the open ocean and/or volcanic inputs, but unrelated to high primary productivity. Subsequently, both negative shift of Δ^{199}Hg (from 0‰ to -0.12‰) and δ^{202}Hg signals (from ~ -0.5‰ to -2.7‰) are recorded in fossiliferous layer (~ 518 Ma), which could demonstrate a large-scale and/or global oceanic oxygenation event that took place during Cambrian Explosion, combined with published data. Finally, our new Hg isotope data indicates that rising molecular oxygen in seawater could be a critical driver of the Cambrian explosion.

References

1. Meixnerová J*, et al.* (2021), *Proceedings of the National Academy of Sciences* 118(33):e2107511118.
2. Sun R, Grasby SE, Shen J, Xiao J, & Yin R (2022) , *Chemical Geology* 598:120830.
3. Fu D*, et al.* (2019), *Science* 363(6433):1338-1342.