Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.31317

Tracing Fe sources in size-fractionated aerosols from the Western Philippine Sea by using elemental and isotopic composition

CHIH-CHIANG HSIEH[1], SHOTARO TAKANO[2], KUO-FANG HUANG[3] AND TUNG-YUAN HO[4]

[1]Research Center for Environmental Changes, Academia Sinica.
[2]Kyoto University
[3]Institute of Earth Sciences, Academia Sinica
[4]Institute of Oceanography, National Taiwan University

Receiving a substantial deposition of anthropogenic and lithogenic aerosols transported from East Asia, the Western Philippine Sea serves as a representative region for investigating the origins and cycling of size-fractionated aerosol Fe in the Northwestern Pacific Ocean. Our previous study in the East China Sea (Hsieh et al., 2024) suggested that Fe isotopic composition alone may not sufficiently distinguish anthropogenic aerosol Fe sources, such as coal combustion, ship emissions, and biomass burning. In this study, we analyzed the elemental and/or isotopic composition of multiple elements (Fe, Ni, V, Cu, Zn, Cd, and Pb) in size-fractionated aerosols collected from the northern South China Sea and the Western Philippine Sea to further probe Fe sources in fine aerosols. Our findings reveal that the isotopic fractionation patterns of Zn, Cd, and Pb differ significantly from that of δ^{56}Fe. However, δ^{60}Ni and δ^{65}Cu exhibit trends similar to δ^{56}Fe, with coarse aerosols showing values close to 0 ‰ and fine aerosols displaying more negative values. The lowest isotopic values observed across all measured samples were -2.36 ‰ for Fe, -1.98 ‰ for Ni, and -0.65 ‰ for Cu. However, some samples exhibited Fe and Ni isotopic values near 0 ‰, coinciding with the highest enrichment factors (EF) for Ni or V. Fine aerosols emitted from high-temperature combustion processes, such as light oil ($<C_{20}$) and coal burning, typically have negative Fe isotopic signatures. Previous studies reported that δ^{60}Ni in crude oil ranged from 0.42 to 0.75 ‰. The relatively heavy δ^{56}Fe and δ^{60}Ni signatures, coupled with elevated EF_{Ni} or EF_V values, suggest that ship emissions can also be a significant source for Fe in fine aerosols.

Reference:

Hsieh, C.-C., & Ho, T.-Y. (2024). Contribution of anthropogenic and lithogenic aerosol Fe in the East China Sea. Journal of Geophysical Research: Oceans, 129, e2024JC021113. https://doi.org/10.1029/2024JC021113