# Iron stable isotope ratios of aerosols from various sources to investigate origins of Fe transported to the North Pacific

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Iron (Fe) deficiency limits the primary production in a part of open ocean [1]. Among various Fe sources transported to the surface ocean, combustion Fe in aerosols is considered to be one of the important soluble Fe sources to the surface ocean, although its contribution is still unknown. In our previous studies, we found that Fe isotope ratio ($\delta^{56}$Fe(‰) = 1000 × [($^{56}$Fe/$^{54}$Fe)$_{sample}$/($^{56}$Fe/$^{54}$Fe)$_{IRMM\text{-}014}$] − 1) of Fe in fine aerosols collected in a suburban area is up to 4‰ lower than that of coarse aerosols, and that $\delta^{56}$Fe values can be used to distinguish sources of aerosols [2]. In this study, we comprehensively measured Fe isotope ratios for aerosols from different origins including mineral dust and aerosols emitted by biomass burning and other anthropogenic combustion sources. In addition, the Fe isotope ratios for marine aerosols collected by research cruises around the Northwest Pacific were also determined to estimate the contribution of Fe from various sources to marine aerosol based on Fe isotope ratios.

We found that $\delta^{56}$Fe as low as −5‰ was obtained in fine particles collected near anthropogenic combustion sources, such as a steel plant and vehicles, due to isotope fractionation during evaporation [3]. Iron in fly ash emitted by melting and cooling processes did not show low $\delta^{56}$Fe. In addition, Fe emitted by biomass burning did not show low $\delta^{56}$Fe because of large influence of Fe from suspended soil particles [4]. Based on these findings, the low $\delta^{56}$Fe values can be used as a tracer of Fe emitted under temperatures high enough for sufficient amount of Fe to evaporate. Marine aerosols collected near the coast were mainly originated from the direction of Asian continent and $\delta^{56}$Fe values of the fine particles were 0.5-2‰ lower than those of coarse particles (0.0‰). $\delta^{56}$Fe values were correlated with anthropogenic tracers, such as non-sea-salt sulfate, suggesting the influence of anthropogenic combustion Fe.

[1] Martin & Fitzwater (1988), *Nature* **331**, 341–343. [2] Kurisu et al. (2016), *J. Geophys. Res. Atmos.* **121**, 11119–11136. [3] Kurisu et al. (2019), *ACS Earth Space Chem., in press.* [4] Kurisu et al. (2019), *Atmosphere*, 10(2), 76.