Copper and Zn isotope geochemistry of particulate matter: From natural to anthropogenic sources

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This study assesses the potential of stable isotope ratios to study the atmospheric transport of Cu and Zn. These elements are crucial to many biogeochemical processes but their isotope geochemistry in particulate matter (PM) and in possible sources has been little studied in detail. Developing a full understanding of the major sources of PM and metal is critical to control emissions.

To address the Cu and Zn isotope signature of natural background dust, major Asian dust sources and the Sahel soil dust were analyzed. Airborne particulate matter from London and Chinese cities and potential PM sources were also studied.

We find that i) the Zn isotope ratios among natural dust from major Asian dust sources and the Sahel are similar (~+0.4‰), but the δ^{65}Cu values follow the trend of Sahel (~-0.2‰) < major Chinese dust sources (~+0.2‰) < Thar Desert (~+0.5‰); ii) Isotope ratios on various non-combustion traffic and road furniture sources largely overlap, therefore, do not allow us to identify by just using the Cu and Zn isotope systems; iii) The Cu and Zn isotopic signature of the London PM10 aerosols range from ~ 0‰ to +0.5‰ and from ~ -0.2‰ to +0.3‰, respectively. There were little differences between the high traffic and low traffic sites, suggesting similar source controls, which could be from non-combustion traffic sources and industrial emissions; iv) The Zn isotopic signature of PM in the Chinese cities ranged between ~ -0.4‰ and +0.4‰, and lighter signatures were observed during dust storm or haze events.