Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.23464

The Applications of Non Traditional Isotope Systems to Aerosols Tracing - A Critical Assessment

DOMINIK WEISS[1], CARLOS EDUARDO SOUTO DE OLIVEIRA[2], DANIEL F. ARAÚJO[3], NINA SCHLEICHER[1], DAVID GREEN[1], MENGLI CHEN[4], ADRIAN MUXWORTHY[1] AND MARLY BABINSKI[5]

[1]Imperial College London
[2]Geosciences Institute, University of São Paulo
[3]Ifremer, CCEM-Unité Contamination Chimique des Ecosystèmes Marins (CCEM)
[4]National University of Singapore
[5]Universidade de São Paulo

Presenting Author: d.weiss@imperial.ac.uk

With the development of multi collector plasma source mass spectrometry, applications of non-traditional stable isotope systems to improve our understanding of atmospheric metal cycles have been widely explored. A detailed understanding of atmospheric metal cycles at local and global scales is of greatest importance as we try to address a wide range of critical questions relevant to air quality and ecosystem functioning.

As we develop these isotope systems, maybe the most critical questions that need to be established from an application point of view are

1. Are isotope variations significant between the sources that need to be separated. This includes constraints related to the chemical analysis, e.g., are our measurements precise and accurate enough, and to the system we study, e.g., are the variabilities within the sources smaller than that between the sources.
2. What sample type does represent the source material best? Do isotope signatures change during the mobilization and transport processes. For example, if we use signatures measured in primary minerals, are these the same like those of the metal that is emitted into the atmosphere in the gas or particulate phase. Can we use isotope signatures determined in mineral dust or ore minerals to trace the metals present in the dissolved phase in surface waters (oceans, rivers, lakes).

And there is a need/interest/wonder to develop a detailed understanding of how the numerous relevant processes, e.g., combustion, smelting, weathering, or aging lead to observed signatures and identify the quantitative relationships to the controlling variables from environmental to molecular levels such as temperature, solution chemistry, speciation, reaction rates and energies, or bond strength.

From a practical point there is furthermore the critical question if isotope measurements do improve on other approaches and techniques available – this from a cost and time efficiency point of view. This is probably more critical to air pollution studies in the urban environment where often a wide range of alternative techniques are available.

In this presentation, we aim to review and assess the status of our knowledge in these key areas. The focus will be on lessons learnt from the Cu, Zn, Pb and Fe systems.