



## **Environmental sources apportionment based on lead isotopic composition**

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Lead (Pb) isotope has been extensively used to identify sources of Pb and apportion their contributions in the environment. Generally, isotope ratios are used to express Pb isotopic composition. However, the linear combination of Pb isotope ratios is not consistent with mass balance. Moreover, the graphical presentations based on Pb isotope ratios are always inconsistent when different Pb isotope ratios are used. In this study, we proposed to use fractional abundance to express Pb isotopic composition to achieve more accurate and reliable source apportionment. Rotation-projection method based on fractional abundance was developed in this research. The new method compared favorably to the isotopic ratio-based method and to another fractional abundance based method using default  $^{204}\text{Pb}$  value (0) (Walraven's method). It allows to present four-dimensional Pb isotope fractional abundance data in a three-dimensional plot. In the meantime, due to the low variation of the fractional abundance of  $^{204}\text{Pb}$  in the terrestrial ecosystem, the terrestrial Pb isotope fractional abundance data fell nearly on a plane, which further allows to plot the Pb isotope fractional abundance data on a two-dimensional diagram. Proper presentation of the isotopic composition data helps to achieve more accurate and reliable source identification and apportionment.

Keywords: Lead (Pb) Isotope ratios Isotopic compositions Isotope fractional abundances Source apportionment

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