

Zinc and lead isotopes as pollutant source tracers in tunnel dusts in São Paulo megacity, Brazil

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The characterization of the isotopic composition of some elements in the main pollutant sources is a powerful tool to trace them in the environmental reservoirs. It relies on the fact that elements maintain the isotopic signatures of their sources, a feature that supports their use as fingerprints of pollutants in the environment. In this context, lead and zinc isotopes have been used to determine the sources of these elements in a great variety of environments worldwide. São Paulo megacity is one of the most populated regions in the world, with about 20 million inhabitants in its metropolitan area, more than 8 million motor vehicles and intense traffic, mainly in rush hours. Given its importance as a major urban center in South America and the lack of information about the composition of their urban dusts, the isotopic signatures of Pb and Zn were determined in São Paulo tunnel dust samples, collected at Jânio Quadros and Maria Maluf tunnels, by Thermal Ionization Mass Spectrometry (TIMS) and Multicollector Inductively Coupled Plasma Mass Spectrometry (MC-ICP-MS). The $^{206}\text{Pb}/^{207}\text{Pb}$ ratios ranged from 1.1715 to 1.1782, and $^{208}\text{Pb}/^{206}\text{Pb}$ varied from 2.0879 to 2.0993, results compatible to those previously reported for combustion of local gasoline and diesel, tire wear and soil resuspension, indicating that these are the main sources of lead in the tunnels. The results obtained for Zn, reported in $\delta^{66}\text{Zn}$ (‰) notation, were all positive and ranged from 0.08 to 0.17, showing that the probable sources of this element are tire wear, brake wear and soil resuspension as well, according to results reported by few similar studies. These results highlight the importance of studying vehicular emissions, mostly in urban centers and megacities, since both lead and zinc can be hazardous to the environment and, mainly, to human health.