Trace metals dispersion from two smelters in the Abitibi Region: An approach coupling lead and osmium isotopes

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In the last century, the worldwide industrialisation has increased the emission and accumulation of atmospheric contaminants, including several traces metals. However, even if the monitoring of these contaminants' concentrations gives a first evaluation of air quality, it lacks the capacity to give indication about the source(s) of these contaminants. An isotope approach can help alleviate this difficulty. Lately, bioindicators (including moss and lichen) have shown their added value as passive samplers for monitoring atmospheric contaminants due to their ombrotrophic nature and their lack of protective membrane that allow them to concentrate elements to levels exceeding their physiological needs.

A preliminary survey, using lead and osmium isotopes in lichens, has been conducted on a 1000km transect between two smelters in the Abitibi region (nickel production: Sudbury, Ontario; copper production: Rouyn-Noranda, Quebec).

A plot of the $^{206}Pb/^{207}Pb$ ratio as a function of the distance from the smelters shows variations between 1.18 and 0.98. The most elevated ratio corresponds to the historical atmospheric Pb emissions in the region [1] while the lowest ratio is consistent with the Abitibi copper-ores [2] that are mainly treated at the Rouyn-Noranda smelter.

A decrease in the $^{206}Pb/^{207}Pb$ ratio is observed at both Sudbury and Rouyn-Noranda, indicating a lead input from an anthropogenic source, probably the smelters. A difference in the observed ratio (1.13-0.98) between the two cities can be explained by the different ores treated at each smelter. A first approximation of the geographical influence of the Rouyn-Noranda smelter yields a distance of 300 km. Preliminary osmium results show variable enrichment in lichens for this metal, and $^{187}Os/^{188}Os$ ratios typical of a mixture of aerosols derived from the continental crust and of mining origin.

[1] Sturges and Barrie. (1987) *Nature*, **329**, 144-146. [2] Deloule et al. (1989) *Can. J. Earth Sci.* **26**, 2529-2540.