The fate of atmospheric pollutant lead in urban ecosystem revealed from isotopic imprints and long-term blood records

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A review of yearly atmospheric pollutant lead concentrations (PbA) in North Western European cities shows a 100-300 PbA decrease between 1970s and 2000s. This decline is compared to (i) yearly averaged blood lead concentrations (PbB) reviewed from various countries where gasoline lead has been banned for at least 20 years and (ii) local PbB measured in France and Belgium as part of this investigation, in order to verify the relationship between PbA and PbB. Indeed, the phasing out of leaded gasoline offers a unique opportunity to investigate the fate of atmospheric pollutant lead within human and the role of blood as a proxy for both exogeneous and endogeneous sources of blood lead.

As expected from the phasing out of leaded gasoline, the review of PbB shows a 3-6 times decrease in the past 30 years, 20-100 times less than that of PbA suggesting another source of lead keeps contemporary PbB (as low as 1μg.dL) 100 times higher than the uncontaminated level of 0.016μg.dL. Food cannot be reasonably inferred as the "lost" source of lead to humans owing to controls compelled by European regulations that show lead intake from diet also drastically declined in the past 30 years. To investigate the origin of lead in today's blood we measured stable lead isotopes in French and Belgium population.

Combined lead and corresponding isotope imprints in blood show a transient evolution and correlate to the age of both population. The isotopic shift is consistent with changes in atmospheric imprints of urban aerosols suggesting that PbB increase with age in contemporary subjects is due to the release of "older" lead from bone tissues during normal calcium homeostasis and osteoporosis. Endogeneous lead release could be identified owing to the decline of PbA exogeneous intake and may constitute a significant source exposure to contemporary urban inhabitants.