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Bark biomonitoring: a new approach using Pb, Sr, and Nd isotopic compositions to trace industrial (steel plant) atmospheric pollution.

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During the last three decades, the emissions of heavy metals to the atmosphere caused much attention due to their toxicity for human beings as well for the environment. The monitoring and tracing of the major sources of the heavy metals associated with aerosols, and in particular lead, was carried out successfully with help of Pb isotopes.

The tracing of atmospheric lead is made by the collection of the aerosols directly on filters or indirectly by sampling rain and snow [1, 2]; but also lichens or tree barks have been successfully used in order to study air pollution and to determine the sources of atmospheric Pb [3, 4, 5, 6].

In the present investigation we collected barks (as biomonitors) as well as aerosols trapped in particle collectors and analysed their Pb, Nd and Sr. isotopic rations (^{206}Pb/^{207}Pb, ^{143}Nd/^{144}Nd, ^{87}Sr/^{86}Sr). This analytical approach is due to the combination of different isotope systems novel in the field of environmental research and enables us to identify not only the various sources of the pollutants but also their redistribution in the urban environment.

The ^{206}Pb/^{207}Pb and the ^{87}Sr/^{86}Sr of the studied steel plant dust are respectively 1.15382 and 0.70904. The sampled trees were selected to be in the prevailing wind direction (NE) of the steel plant's chimney. The ^{206}Pb/^{207}Pb ratio decreases linearly from 1.153 at the source to 1.140 at a distance of 4 km. Thus, the isotopic variation points to another second polluting source with low ^{206}Pb/^{207}Pb ratios, since the natural end member has ^{206}Pb/^{207}Pb ratios > 1.18 [7].

The ^{87}Sr/^{86}Sr ratio increases up to 0.70995 at a distance of 1.5 km. Thus, over this

distance it appears that mixing occurred between the steel works Sr and a peri-urban "natural" component with higher $^{87}Sr/^{86}Sr$ ratios [8]. However, the samples taken at a distance of 4 km plot off this trend with low $^{87}Sr/^{86}Sr$ ratio pointing to an additional atmospheric Sr component [7].

The isotope data of aerosols collected on filters indicate that more the quantity of particulate matter PM (43μg/m3) is important more these particulates have an industrial anthropogenic isotopic signature ($^{206}Pb/^{207}Pb$ $\sim$1.155) while when the quantity of particulate matter PM is low (10μg/m3) the Pb isotopic composition is closer to the natural signature ($^{206}Pb/^{207}Pb$ $\sim$1.184).

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