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Study of metallic trace elements in attic dust from two former industrial cities, Salgótarján and Ózd (Hungary)

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Anthropogenic activities such as heavy industries produced, among others, airborne pollutants, which are deposited inside the attic of houses like dust material for decades. Study of attic dust can be an efficient media to better understand long-term airborne dust contamination and distribution in urban areas. Ózd (OZD) and Salgótarján (STN) are two former industrial cities in the northeastern part of Hungary and separated by 40 km. Both cities have exposed contaminants for different time periods and sources such as coal mining, local coal fired power plant, iron/steelworks and glass factories, transportation, etc.

For this study, 40 attic dust samples from STN and 49 attic dust samples from OZD were collected in houses with attics intact for at least 30 years containing long-term industrial pollution. The concentrations of 13 metals (Ti, V, Cr, Mn, Fe, Co, Ni Cu, Zn, Ag, Sn, Mo and W) were analyzed with ICP-MS. Most of these elements are considered potentially toxic elements related to industrial activities. The main aim of the present study was to compare the concentrations, enrichment factors (EFs) in both cities. EF of each metal was calculated with the formula: EF = [M/Fe]sample/[M/Fe] background, where (M) metals concentration and Fe was used for normalization, following the suggestion in the literature [1] for industrialized cities. However, geochemical background values for both cities were taken from STN brown-forest soil.

The median concentration (mg kg^{-1}) of the studied metals for the 40 attic dust samples for STN= Fe(23000), Zn(631), Mn(422), Ti(385), Cu(67.7), Cr(26.9), V(42.0), Ni(29.7), Sn(8.70), Co(7.60), Mo(5.24), W(3.26), and Ag(0.030). Likewise, median concentration (mg kg^{-1}) for the 49 attic dust samples for OZD= Fe(48000), Zn(1338), Mn(1249), Ti(230), Cu(104), Cr(55.9), V(42.0), Ni(28.0), Sn(16.2), Co(7.20), Mo(4.68), W(3.64), Ag(0.116).

The values of median enrichment factor (EF) revealed the following order: STN=(Ti>W>Sn>Cu>Zn>Mo>Ag>Cr>V>Ni>Mn>Co) and OZD=(W>Ti>Sn>Ag>Zn>Cu>Cr>Mo>V>Mn>Ni>Co). The results for both cities are Ti, W, Sn, Cu, Ag, Zn with enrichment factor (EF)>5, which represent significant or very significant enrichment; Ni, Mn, Co show values of (EF)<2 indicating no enrichment- to minimal enrichment, and Cr has

2<(EF)<5 = moderate enrichment. Note that V shows moderate enrichment in STN samples and minimal enrichment in OZD samples. Molybdenum shows significant in STN samples and moderate enrichment in OZD samples.

The differences between OZD and STN attic dusts show the complexity of two scenarios where concentrations in OZD attic dusts are 1.5 – 4 times higher than STN ones and significant enrichment for Sn, Ag, Zn, Cu, Cr due to probably more intense steelwork activities.

Keyword: Attic dust, enrichment factor, Salgótarján, Ózd.

Reference:

[1] Luo, X. S., Xue, Y., Wang, Y. L., Cang, L., Xu, B., & Ding, J. (2015). Source identification and apportionment of heavy metals in urban soil profiles. Chemosphere, 127, 152–157. https://doi.org/10.1016/j.chemosphere.2015.01.048