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Applied Integrated Mineralogical and SEM/EDX Analysis for the Identification and Source Apportionment of Deposited Dust in Air Quality Control

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Introduction

Due to exceedings of the limit values for lead (Pb) and cadmium (Cd) in deposited dust, as regulated in the Austrian Air Quality Act, measurements have been carried out in an industrial region in Austria in winter 2003/2004. Analysis with integrated mineralogical and SEM/EDX techniques in five selected samples of deposited dust (Bergerhoff method) and four material samples of the locations have been performed. The main objective was to identify the sources of Cd and Pb, as there are several industrial plants settled in that region.

Method

Polished thin- and cross sections were prepared for mineralogical analysis, using reflected and transmitted light microscopy, as well as XRFA and EDX for semi-quantitative analysis of selected particulate pollutants. By means of scanning electron microscopy (SEM) and energy-dispersive X-ray microanalysis (EDX) structure, size and elemental composition of the particles were analysed. This methodology has already been introduced in previous studies.

Results

Pb-rich particles were identified in all five dust samples and could be related to an industrial plant in the area. (metallic Pb, Pb-Sulfate, PbO^2-Chlorides, Pb-Silicates). Additionally, C-S-rich cenospheric particles (traces of Ni and V) and partly melted plastics from combustion processes could be attributed to the same source (see Fig. 1c). No Cd-rich particles could be found in the dust samples. Therefore material samples taken directly from the industrial premises were analysed. The source of cadmium could be clearly identified: 0.2 to 0.85 % Cd was found in Pb-rich particles in filter dusts (see Fig. 1a and 1b).

References

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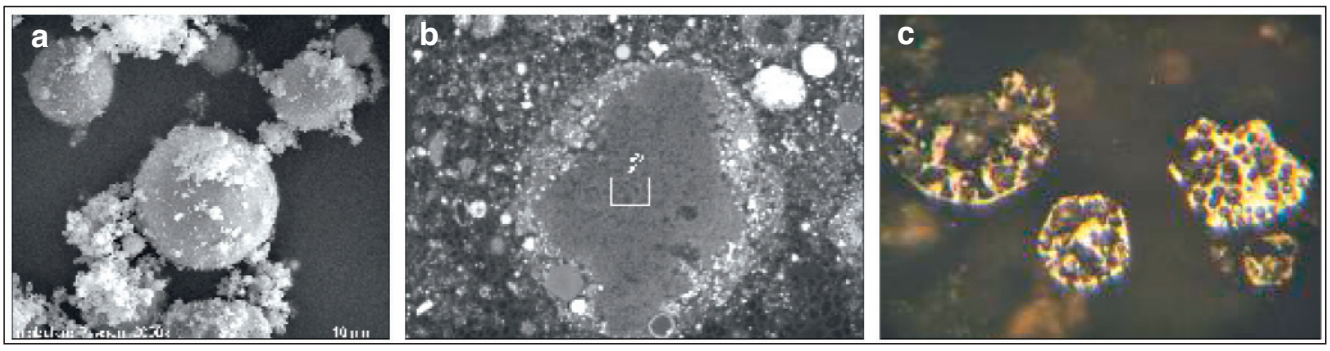

Fig. 1.
a) SEM-micrograph of spherical Pb-Silicates of a filter dust sample (Mag: 2000×).
b) XRFA-micrograph of a dust filter sample showing a PbO_2-Chloride particle with 1.5 % Cd.
c) Micrograph of a polished cross section of four C-S-rich cenospheric particles.

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