

As, Cd, Cr, Cu, Ni and Pb in PM_{2.5} in Gothenburg, Sweden

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Ambient particles smaller than 2.5 µm (PM_{2.5}) are getting more and more attention worldwide (WHO, 2006). While legal focus is on sample mass, the composition of the particles is an important research field gaining increased interest. The interest is not only connected to possible health effects of the elemental content of the particles, but the elemental determination can also add valuable information to source apportionment.

Samples were collected during 20 days in November 2007 at the campus of the chemistry department, University of Gothenburg, approximately 2 kilometers south of the city centre of Gothenburg, Sweden. Gothenburg, located on the Swedish west coast, is the second largest city in Sweden with more than 500 000 inhabitants. The main local source of PM_{2.5} at the measurement site is the 8000 cars/day on the street passing the measurement site.

At the measurement site the particles were collected using a cyclone separating out the PM_{2.5} particles from the air stream and collecting them on polycarbonate filters. The air flow was controlled by a critical orifice. Filters were changed at early afternoon every day. The particles were analyzed for particulate mass, black carbon (BC) and the elements As, Cd, Cr, Cu, Ni and Pb.

In the present study, a well-established and sensitive analytical technique, graphite furnace atomic absorption spectroscopy (GF-AAS), has been used for the determination of trace elements in the particles. The Perkin Elmer SIMAA 6000 GF-AAS is capable of simultaneous analysis of up to six elements. A Mettler Toledo TM5 microbalance was used for gravimetric determination of the sampled integrated particle mass. A photometer was used to analyze black carbon.

The results show a large variation in sample mass, BC concentration as well as in the concentrations of the analyzed elements. The variation of the different constituents does not show the same pattern. This adds to the picture of different sources for different pollutants. The highest As concentration is noted on a day when the air masses were determined to come from the south east, i.e. Poland and some other eastern Europe countries, as illustrated by the back trajectory in red in figure 1. Table 1 shows the concentration range of the different components during the measurement period.

Table 1. The concentration range of the different components.

Parameter	Range (ng/m ³)
Particle mass (µg/m ³)	0.77 – 13
Black carbon (µg/m ³)	<DL – 0.82
As	<0.40 – 19
Cd	<0.076 – 0.13
Cr	2.2 – 25
Cu	2.3 – 98
Ni	1.4 – 99
Pb	<0.90 – 4.5

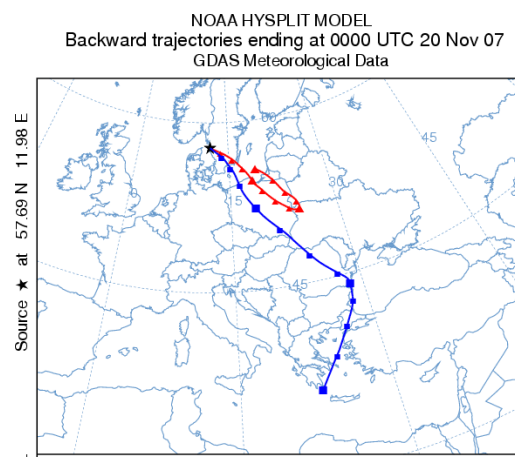


Figure 1. HYSPLIT back trajectory for November 20, 2007. The red line is a trajectory at 100 meters height upon arrival in Gothenburg while the blue was chosen to 500 m.

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References

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