Traffic and Meteorological Influence on Size Segregated Trace Elements at a Kerbside in Dresden, Germany

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High concentrations of PM_{10} have been frequently measured at air quality monitoring stations in the agglomeration areas near road traffic. To understand the reasons for the adverse health effects it is very important to know more about the chemical composition of urban aerosols at kerbsides. Traffic is often the most important source for PM_{10} and for toxic substances like antimony, copper and soot (Gerwig et al. 2006).

At roadsite (55,000 vehicles per day, 8 % heavy duty vehicles, Dresden, Schlesischer Platz) 24h Berner Impactor samples were taken on Thursdays or Fridays (9), on Sundays (2) and on new years day between Aug-2003 and Aug -2004.

Additionally 2 samples were taken from a station of urban background (400 m to north east from traffic station at least 100 m away from streets with less than 5,000 vehicles per day).

Br, Cr, Cu, Fe, Mn, Ni, Pb, Si, Ti and Zn were analysed by PIXE. Ca, K, Mg and Na were analysed by special Ion Chromtography.

Crustal enrichment factors (CEFs) are calculated to assess anthropogenic contributions. For all elements CEFs are calculated by dividing the average concentration in the stages by their average abundance in the upper continental crust (UCC). We refer to UCC as described by Mason and Moore (1985). CEFs > 10 are commonly interpreted as PM sources different from natural origin. Si was chosen as reference element, because it is main component of silicate minerals. Often Al is used as reference element (Birmili et al. 2006).

Pb, Zn and Cu had crustal enrichment factors (CEFs) above 100 for all particle sizes.

The CEFs and concentrations of Fe and Cu are higher for workdays compared to Sundays. On working days Cu and Fe showed a concentration maximum on stage 4. When working day is compared to Sunday for Cu and Fe, the maximum of the normalised mass concentration shifted from coarse particles to fine particles.

3 Types of mass size distributions were found: unimodal in fine (stage 3): K, Pb, and Zn; unimodal in coarse: Na, Mg, Ca, Al, Si, Fe, Ti and Cu; Multimodal Mn, Cr and Ni.

Higher concentrations in winter were found for: mass, Pb, Zn, K and Cr, Ni, Ti. The higher concentrations for Pb, Zn and were mainly caused by fine particles. The Pb-concentration was more than two times higher in winter compared to summer. Ca, Cu and Fe showed no relation to summer/winter as well as Si and Ti.

The anthropogenic elements Pb and K show highest concentration with air masses from the east. Greatest part of the sea salt elements Na and Mg came from northern or western air masses from the sea. The origin of air masses had almost no influence on concentrations of Cr, Cu, Zn, Ca, Ti, Si and Fe.

New Year's Day is characterised in Dresden by lowest number of vehicles during the whole year. Only 50% of the average numbers of vehicles were observed.

The daily average concentration of New Years Eve compared to the annual average was at least 3 times higher for K (24.1), Mg (6.0), Pb (5.3), Ti (4.2) and Cu (3.2). The size distribution maximum of Cu, Ti and Mg shifted from coarse particles to fine particles because of high concentration of firework burning products in the fine particulate range.

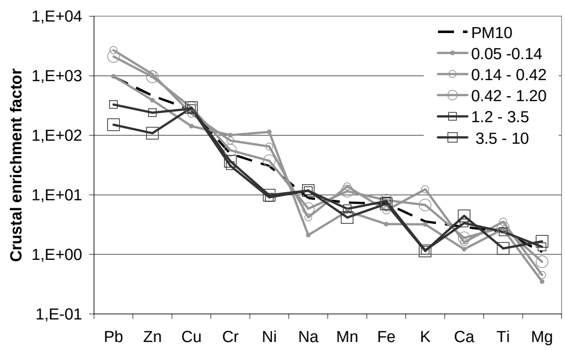

Figure 1: Crustal enrichment factors at traffic station

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