

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



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PLACE + METHOD



Fig. 1 Kerbside station Dresden, Schlesischer Platz

Place kerbside in Dresden: Schlesischer Platz (Fig.1), 55,000 vehicles per day, 8 % heavy duty vehicles

Method

- time: 8/2003 - 8/2004
- sampling: Berner, 24 h, 108 m³, 5 stages, 50 - 10.000 nm n = 12 (1 New Years Day, 6 summer, 5 winter)
- PIXE: Br, Cr, Cu, Fe, Mn, Ni, Pb, Si, Ti and Zn. special IC: Ca, K, Mg and Na [1,2]

Crustal enrichment factors (CEFs)

CEFs: dividing average concentration in the stages by their average abundance in the upper continental crust [3].

CRUSTAL ENRICHMENT FACTOR

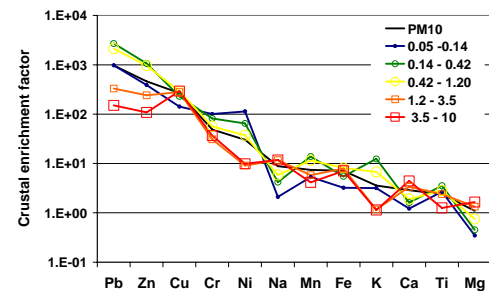


Fig. 2 Crustal enrichment factors, average of all samples without New Years Day

CEFs

are calculated to assess anthropogenic contributions [3]. 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. Also other elements are often used as reference element, like Al [4].

CEFs > 100

Pb, Zn and Cu in all particle sizes measured (50 nm – 10 µm). Pb and Zn CEFs in fine particles 10 times > in coarse particles probably from anthropogenic source traffic from small particulates from motor emissions (lead in petrol), abrasion of tailpipe (zinc).

WINTER/SUMMER + AIR ORIGIN

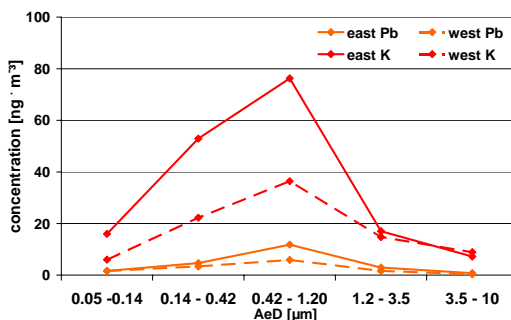


Fig. 3 Air masses from east and west: Concentration of Pb and K

Air mass [5] from east: highest conc. of anthropogenic Pb (traffic from east) and K (biomass or coal burning from east).

Air from the sea: Greatest part of the sea salt elements Na and Mg

No significant influence of air mass: Cr, Cu, Zn, Ca, Ti, Si and Fe

Winter higher conc. > 25%: mass, Pb, Zn, K (s. Fig 3) and Cr, Ni, Ti

Pb, Zn mainly caused by fine particles (LRT?)
Pb-concentration 2 times higher in winter (P>95 for difference)

No relation summer/winter: Ca, Cu, Fe, Si, Ti (P>90%)

NEW YEAR'S DAY

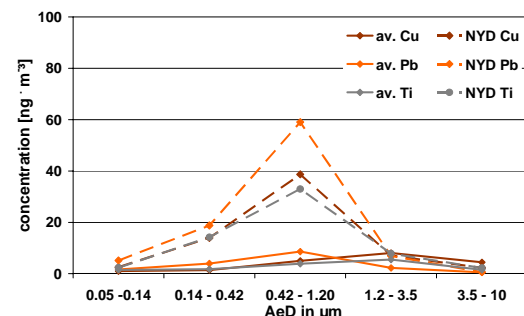


Fig. 4 Concentrations on all stages: New Year's Day compared to average of year

Vehicle numbers 50% of average compared to average of whole year

X-fold higher conc. of daily average on New Years Day > annual average
K (24.1), Mg (6.0), Pb (5.3), Ti (4.2), Cu (3.2)

Coarse to fine Cu, Ti, Mg: size distribution maximum shifted because of high concentration of firework burning products in fine particulate range
+ less emissions from car traffic of coarse particles (Fig. 4)

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SUMMARY

At a kerbside in Dresden (55,000 vehicles per day, 8 % hdv), n = 12 24h impactor samples (5 stages) were analysed for trace elements by PIXE and IC.

CEFs > 100 were found for Pb, Zn and Cu in all particle sizes. Especially Pb and Zn CEFs were 10 times higher in fine than coarse fraction. Probably because of traffic derived emissions.

More Pb was found in wintertime and over the whole year with air masses from eastern directions.

On **New Year's Day** conc. K, Mg, Pb, Ti, and Cu > 3 times higher than on average of the year.
Cu, Ti, Mg shifted max from coarse to fine fraction.