Integrated air quality assessment - $PM_{0.1}$ to PM_{10} magnetic particles

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Approach

In our multidisciplinary approach atmospheric air quality in the Greater Cologne Area (GCA, NW-Germany) was studied using pine needles as passive samplers. Here we report accumulation histories, particle size dependency and spatial distribution of remanent magnetic pollutants as to approximate the dust load. Environmental magnetic results are interpreted in conjunction with complementary trace element and persistent organic pollutant data.

Results

Variability between sites proofs to be significantly higher than within sites. Established accumulation rates predominantly reflect anthropogenic emissions. Minor natural processes comprise canopy effects and abrasive removal of particles. Emission specific concentrations and grain size distributions (Fig. 1) are readily detected by magnetic parameters and allow for source allocation in spatially highly resolved data sets.

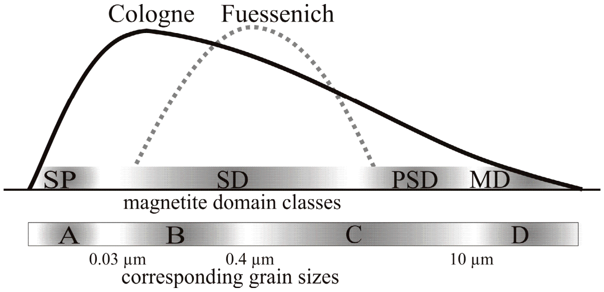

Figure 1 Hypothetical end-member grain size distribution curves for metropolitan location Cologne and rural station Fuessenich (adopted from Lehndorff *et al*. 2006)

Conclusions

The correlation of magnetic particles, trace elements and PAH yields a far more complete picture of air pollution in that source allocation is more readily achieved.

References

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Sub-μm size high precision analysis of $\delta^{18}O$ in zircon by SIMS

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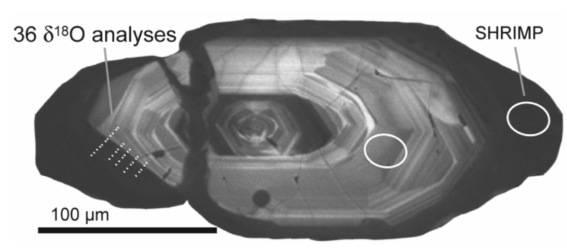
Oxygen isotopic ratios ($\delta^{18}O$) of rocks provide important insights to understand igneous and metamorphic processes. Zircon is a valuable accessory mineral to study such processes because (1) it is common in igneous, metamorphic, and sedimentary rocks, (2) it provides U-Pb ages, and (3) it is retentive of primary composition. However, because zircons are small (typically 10 to 100 μm) with internal zonation, *in situ* microanalysis is required.

An *in situ* O isotopic analysis technique with ~0.5 μm^2 spot and an analytical uncertainty of 1.0 ‰ (1σ) has been developed using a Cameca ims 1280 SIMS. This technique was applied to a zoned zircon from a partially melted metasediment (Daniel's Road, near Saratoga Springs, NY) in the granulite-facies Adirondack Highlands [1], which consists of a detrital igneous core (1353Ma) and a metamorphic overgrowth (1019Ma) with $\delta^{18}O$ values of ~ 6‰ and 12‰, respectively [2].

Five traverses with 2 μm steps, totaling 36 sub-1μm $\delta^{18}O$ analyses, were performed to determine the $\delta^{18}O$ gradient at the core/overgrowth boundary that is clearly seen by CL. The figure shows the CL image of the sample and positions of ~30 μm pits from previous SHIRIMP U-Pb analyses and ~0.8 μm dia. pits for $\delta^{18}O$ analyses of this study. We found a steep $\delta^{18}O$ gradient at the boundary that indicates O isotopic exchange between the core and the overgrowth occurred over a distance less than 2 μm. Modeled for a 50 Myr isothermal period [3], an O diffusion coefficient in zircon of ~10^{-23} cm^2/s best fits the data. The preservation of such a steep gradient and the inferred low diffusion coefficient indicate that the zircon preserved $\delta^{18}O$ from crystallization through high-grade metamorphism. We envison that sub-μm stable isotope analyses will permit new investigations of materials that are rare, precious or zoned, including those of biological origin.



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