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Magnetic quantification of urban pollution sources in atmospheric particulate matter

Spassov S., Egli R., Heller F., Nourgaliev D., Hannam J.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

A new method is presented for fast quantification of urban pollution sources in atmospheric particulate matter (PM). The remanent magnetization of PM samples collected in Switzerland at sites with different exposures to pollution sources is analysed. The coercivity distribution of each sample is calculated from detailed demagnetization curves of anhysteretic remanent magnetization (ARM) and is modelled using a linear combination of appropriate functions which represent the contribution of different sources of magnetic minerals to the total magnetization. Two magnetic components, C1 and C2, are identified in all samples. The low-coercivity component C1 predominates in less polluted sites, whereas the concentration of the higher-coercivity component C2 is large in urban areas. The same sites were monitored independently by Hüglin using detailed chemical analysis and a quantitative source attribution of the PM. His results are compared with the magnetic component analysis. The absolute and relative magnetic contributions of component C2 correlate very well with absolute and relative mass contributions of exhaust emissions, respectively. Traffic is the most important PM pollution source in Switzerland: it includes exhaust emissions and abrasion products released by vehicle brakes. Component C2 and traffic-related PM sources correlate well, which is encouraging for the implementation of non-destructive magnetic methods as an economic alternative to chemical analysis when mapping urban dust pollution. © 2004 RAS.

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Keywords

Component analysis, PM10, Road traffic emissions, Rock magnetism, Zürich