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We will present new magnetostratigraphic results from DSDP Site 608 in the North Atlantic that reveal the presence of nine short-term polarity excursions in the middle to late Miocene. These polarity excursions do not correspond to subchrons in the most recent GPTS. Four of them correspond to cryptochrons. IRM component analysis suggests that these polarity excursions represent true fluctuations of the geomagnetic field. Comparison with published results from ODP Sites 845 and 1092, and from the continental Orera Composite Section, shows that all nine polarity excursions have been observed in more than one record. A refined criterion for a short-term polarity excursion to qualify as polarity subchron defines five new subchrons in the late Miocene: C4r.2r-1n, C4Ar.1r-1n, C5r.2r-1n, C5r.2r-2n, and C5r.3r-1n. The three events within C5n and the one in C5An.2n qualify better as polarity excursions and are most likely associated with decreases in paleointensity of the geomagnetic field. These results imply that the occurrence of short-term polarity excursions in the geomagnetic field is non-uniformly distributed through time - for example, being relatively more common in the early Late Miocene and the Pleistocene but virtually absent in the latest Miocene and Pliocene - but it remains uncertain if this is related to real behavior of the geodynamo.

GP32A-07 1510h

Deeptow magnetic survey of the Pacific Jurassic Quiet Zone: Implications for the marine magnetic anomaly timescale

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We present results of a recently completed near-bottom magnetic survey of the Pacific Jurassic quiet zone located in Pigafetta Basin in the vicinity of ODP Hole 801C. A total of 1550 km of tracklines were completed during 5 lowerings of the DSL120 sidescan sonar system of the National Deep Submergence Facility equipped with two magnetometer systems. The nominal altitude of the vehicle was 100 m above the seafloor with the average sediment thickness 300 meters. We collected simultaneous vector magnetic data from a digital Honeywell HMR2300 magnetoresistor sensor and absolute total field using a Marine Magnetics Overhauser sensor provided by KORDI. The survey had four primary goals: 1) to investigate the presence or absence of magnetic lineations related to seafloor spreading around ODP Hole 801C, 2) to extend the magnetic anomaly mapping south to the Rough-Smooth (RS) boundary, thought to be the limit of the oldest Pacific crust, 3) to extend and confirm correlations of previously collected deeptow results, and 4) to investigate the M33-M34 sequence which can be clearly correlated with the timescale but also shows a period of rapid field reversal. The survey around Hole 801C was navigated within a transponder net whereas the remainder of the surveys were navigated using acoustic layback and bottom-lock doppler. From our results, we confirm that anomalies in the M33-M34 sequence are highly-lineated and well-correlated between adjacent lines with a high reversal rate. We found that anomalies older than M36 become harder to correlate to about M40 where there may be a possible change in trend of the anomaly strike. The anomaly record appears to become more linear again as Hole 801C is approached. Around Hole 801C the anomalies show a clear lineation with a strike direction of 25 degrees, although the correlation is not as consistent as the younger anomaly sequence. The decrease in anomaly amplitude that is seen from M21 through the M36 sequence appears to be low through anomaly M40 and then increases to a higher value thereafter with an average amplitude of 200 nT at deeptow altitude. South of Hole 801C towards the RS boundary we find that magnetic anomalies continue with short-wavelength anomalies superimposed on a longer wavelength anomalies making them difficult to correlate. High amplitude anomalies mark the RS boundary itself. In summary, we find evidence for seafloor spreading anomalies throughout the survey area although there are areas where correlation is difficult.

GP32A-08 1525h

Paleomagnetic data from Late Cenozoic Fort Selkirk Lavas, Yukon,significance for secular variation and tectonics

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Directions of magnetization in 33 basalt flows from Fort Selkirk, Yukon Canada, of Bruhnes, Matuyama and Gauss (1 flow only) age are well grouped. Normal and reversed magnetizations are present and it is likely therefore that secular variations have been covered. The very high accuracy within-lavas allows a good estimate of the dispersion of secular variation to be made. The circular standard deviation (theta63) of directions is 8.5deg at latitude 62.7deg N. The mean, regardless of sign, differs significantly from the geocentric axial dipole (GAD) field, indicating a 15±6deg counterclockwise rotation. Data from rocks of the same age range from the Western Cordillera of Canada and the NW USA agree well with the GAD. Recent seismic and GPS studies show that the dynamic crust in the Yukon is only 20 km thick and intensely mobile. Heat flow is high, allowing a ductile decollement for the tectonic float to transfer stress more than 1000 km inland to the currently seismic McKenzie Mountains from the indentor, the Yakutat block, which is colliding with North America. Yukon crust is moving NE and rotating counterclockwise with respect to North America as a result of this on-going collision. The geodetically determined general rotation is much less than that suggested by paleomagnetic deviation, indicating that Selkirk area may be moving seperately within the mosaic of the Yukon crust. The deviation from the GAD field is evidently tectonic not geomagnetic.

GP32B MCC: 3002 Wednesday 1600h

Bullard Lecture

Presiding: **L Tauxe,** Scripps Institution of Oceanography

GP32B-01 1610h INVITED

Progress Towards Understanding the Geodynamo from Observations and Numerical Models

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The new generation of magnetic field satellites currently in orbit hold enormous promise for understanding the generation of the Earth's magnetic field. These new data, together with earlier observations, and in combination with numerical models of the geodynamo, are enabling new insights into the dynamo process. Our approach aims to dissect the full range of behavior of the field that is observed: from high-latitude concentrations of flux that persist, at least in the time-average, over periods of several million years, to magnetic jerks, abrupt changes in the field on a timescale of a year or less. We describe a simple dynamical model of the core consistent with these observations. A number of key questions remain. How do reversals fit into this model? Are they simply a more extreme manifestation of secular variation, or do they require some separate explanation? How do we account for the different field morphologies and range of magnetic field strengths observed in the Solar System?

GP41A MCC: 2000 Thursday 0800h

Environmental Magnetism I

Presiding: **T Evans,** University of Alberta**; A Roberts,** University of Southampton

GP41A-01 0800h INVITED

Magnetic Mineral Concentrations of Recent Lake Sediments as Recorders of Climate Variations

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We have been studying the mechanism by which the variation of magnetic mineral concentrations in recent lake sediments could record local climate variations. Our earliest work showed that magnetic mineral concentrations in lakes of different productivity (eutrophic, mesotrophic, and oligotrophic) from the Pocono Mountains of northeastern Pennsylvania showed a correlation to historic records of regional rainfall over the past 100-200 years. The robustness of these correlations was hampered by the reliance on ^{210}Pb dating of the lake sediments. The varve chronology of sediments from Lake Ely in northeastern Pennsylvania afforded a more accurate downcore comparison between magnetic mineral concentrations and a local historic rainfall record. The observation of a positive correlation between ARM and SIRM and the local rainfall record over the past 60 years suggested a model in which increased precipitation supplied more nutrients to a postulated magnetotactic bacteria population in the lake and enhanced the production of magnetosomes that were preserved in the lake sediments. A detailed study of the mineral magnetism of water filtered from the water column and recent lake sediments of Lake Ely indicates that magnetosomes are definitely present at the oxic-anoxic transition in the water column and in recent lake sediments. Comparison of the ARM intensity of water column filtrate with the ARM intensity of material collected six months later from a sediment trap, does give some support to the rainfall-nutrient model, but the correlation recorded over this short period is not strong and is incomplete. Comparison of the magnetic data to the historic temperature record suggests that the duration of lake ice cover may be a mitigating factor in the magnetic mineral recording of rainfall variation, i.e. colder winters with longer periods of ice cover would minimize mixing of lake waters by wind and allow larger populations of magnetotactic bacteria to develop in the following spring and summer. Based on our studies, the best lake from which to obtain a record of climate variations using magnetic mineral concentration is one with a magnetic mineralogy dominated by magnetosomes, i.e. where the detrital input to the lake has a easily distinguished, different magnetic mineralogy from the magnetosomes or has a much lower magnetic mineral concentration. In addition, the magnetic mineral concentrations may record a combination of precipitation and temperature variations.

GP41A-02 0815h

Toward Modelling Topsoil Magnetic Susceptibility for Demining Activities

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The Landmine Monitor estimates that landmines cause up to 20,000 fatalities and casualties worldwide every year, in over 100 countries affected by landmine contamination. Although detection technologies have become more sophisticated, the metal detector still remains the most widely employed detection system in landmine affected regions. With increased use of minimum metal mines, the performance and sensitivity of metal detectors are increasingly challenged. In addition to mine constituents, depth of burial and orientation, soil properties significantly affect metal detection capabilities. Soils with high magnetic susceptibility, in particular those dominated by viscous components, interfere with the response signal in both frequency and time domain metal detection systems. Using Bosnia and Herzegovina (BiH) as a pilot region, we created an expert system to predict topsoil susceptibility from environmental information within a SOTER data base.

Initially, the knowledge base is constructed from published relationships of environmental parameters and magnetic susceptibility and knowledge of experts in the field of soil magnetism. The knowledge base is underpinned by environmental conditions that are known to enhance or reduce magnetic susceptibility in topsoils. Where semi-quantitative data exists, transfer-functions are used to provide first approximations of susceptibility classes and offer a basis for a probability score for the susceptibility class. As a first approximation, susceptibility values are categorized into five continuous classes delimited by published magnetic susceptibility ranges in topsoils. The predicted susceptibility maps result in regional contrasts, delineated by the spatial scale of the environmental information. Further development of the model using a Baysean rule-based system with fuzzy boundaries is anticipated. Validation of the model is proposed using archived soil survey samples from BiH. In addition to providing essential data for effective planning of mine clearance in mine affected regions, prediction of topsoil magnetic susceptibility for demining missions provides a novel application of environmental magnetism.

GP41A-03 0830h

Complex Magnetic Study of Anthropogenic Soil Pollution in the Krkonose National Park (Czech Republic)

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The Krkonose National Park belongs to comparatively less polluted regions in the Czech Republic. Detailed investigations (magnetic parameters, magnetomineralogy, SEM) of pedozones from different depths proved the prevalence of magnetite of anthropogenic origin in the top-soil OL/OF layers. Therefore, the use of magnetic method for estimating industrial contamination in this region is fully justified. Preliminary map of top/soil magnetic susceptibility showed two areas with significantly increased values. Subsequent detailed mapping pointed to tourist centres as local sources of pollution and outlined the corresponding impact to their neighbourhood. Concentration of heavy metals (Fe, Zn, Pb, Co, Cr, Cd, As) in top soil as well as in different pedozones was determined using AAS. Comparison with vertical distribution of magnetic susceptibility enabled us to determine those heavy metals (Pb, Zn, and probably Cd), whose enhancement can be attributed with atmospheric deposition.

GP41A-04 0845h INVITED

Organic Matter and Wind Strength: the *Two* Workhorses Shaping Magnetic Susceptibility Fluctuations in Loess Deposits of Central Alaska

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The Holocene soils at Halfway House (HH) and Gold Hill Steps (GHS) in Central Alaska are poorly developed, comprising only of an A-horizon, where organic matter is concentrated at the top and decreases with depth. The contact between the A-horizon and the underlying parent material (C-horizon) is smeared across an interval of oxidized parent material (Cox-horizon). We have focused on the Holocene soil and the underlying parent material because: 1) the enhanced magnetic susceptibility of the Holocene soil's A-horizon is in disagreement with the Alaskan-type end-member model; and 2) maghemitization occurs both as a pedogenic process in the soil and a diagenetic process in the parent material. The pedogenic in-situ formation of maghemite in the soil and the diagenetic maghemitization of (titano)magnetite particles at depth below the soil drive the magnetic susceptibility profile to increase and decrease, respectively. Our results suggest that these processes alone can explain the apparent discrepancy between the magnetic susceptibility high measured in active developing soils and the magnetic susceptibility low measured in inactive buried soils of Central Alaska. We do not dismiss the possibility that other diagenetic processes might occur, e.g., delayed reduction, iron dissolution in buried soils, but these other diagenetic processes appear to occur homogeneously and hence causing no apparent relative evolution of the susceptibility profile.

GP41A-05 0900h

A 3-Myr Mineral Magnetic Record of Saharan Dust Input Into the Eastern Mediterranean: Linking Magnetic Data With Climate Variability Over Northern Africa

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We have produced a high resolution, 3-million-year mineral magnetic record for eastern Mediterranean sediments from Ocean Drilling Program Site 967. Rock magnetic analyses indicate that hematite dominates the high coercivity fraction of the sediments. We have developed a proxy (IRM0.9T@AF120mT) for the concentration of hematite by AF demagnetizing the IRM0.9T at 120 mT. A comparison of this proxy with Ti/Al data and other geochemical data indicates that variations in the concentration of hematite are related to the input of aeolian Saharan dust, regardless of non-steady-state diagenetic processes associated with organic-rich (sapropel) layers. We deduce that the eolian hematite in eastern Mediterranean sediments derives from the northern Sahara and relate dust production in this area with penetration of the African summer monsoon front to the north of the central Saharan watershed. Long-term variations in the penetration of the monsoon front would have led to changes in soil humidity and vegetation cover, and hence in the amount of dust production. Spectral analyses of our dust record reveal strong power at the precession, obliquity and eccentricity bands, which indicates that the northward penetration of the African monsoon, and thus northern African climate, is driven by a combination of low and high latitude mechanisms. We also observe a marked increase in dust supply and sub-Milankovitch variability around the mid-Pleistocene transition (0.95 Ma), which suggests a link between millennial-scale climate variability, including monsoon dynamics, and the size of northern hemisphere ice sheets.

GP41A-06 0915h

Paleomagnetic and Environmental Magnetic Results from ODP Leg 195, Site 1202, Okinawa Trough

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We have been studying the paleomagnetic and environmental magnetic record of a suite of u-channel samples that span the upper 140 meters of ODP Site 1202. This site was drilled during Leg 195 in the southernmost Okinawa Trough off the east coast of Taiwan. The southern Okinawa Trough currently has a high rate of sedimentation due to the enormous input of terrigenous material from the East China shelf and Taiwan. The sampled section yields a reliable paleomagnetic record and an environmental magnetic record that has five distinct zones. Analysis of hysteresis parameters and anhysteretic remanent magnetization behavior indicate that the sediments satisfy the requirements for paleointensity determination and that either susceptibility or ARM can be used as normalization parameters. Using either method, we can correlate the upper 50 meters of Site 1202 with the Holocene paleointensity record from Fish Lake, Oregon. The remaining 90 meters can be correlated with the NAPIS-75 paleointensity stack. These correlations show that the base of the studied section is only 50,000 years old and that Site 1202 represents one of the highest resolution records of geomagnetic field behavior and environmental change ever reported.

GP41A-07 0930h

Environmental Magnetism of Corals from Moorea, French Polynesia

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We have examined the environmental magnetic record of cores from corals on the island of Moorea in French Polynesia. The cores were collected by diamond core drilling in a nearshore environment, and each core represents about twenty years of coral accretion. The cores were sub-sampled to produce continuous strips of material that were placed in u-channels and measured with an automated long-core cryogenic magnetometer. Not surprisingly, the overall concentration of magnetic material in the cores is at or below the detection limits of the magnetometer. However, several cores contain thin layers with considerably higher levels of magnetic material. We have studied the behavior of these layers during the acquisition of a saturation isothermal remanent magnetization as well as the alternating field demagnetization of that magnetization and an anhysteretic remanent magnetization. This behavior can be compared with that of soils collected from the island itself. We find a good match between the magnetic properties of the layers in the corals and the soils developed on strongly weathered volcanic rock. We suggest that the layers in the corals were created when large amounts of soil were washed from the island into nearby lagoons. If that hypothesis is correct, then the environmental magnetic record of corals can provide new information about the occurrence of very large storm events on tropical volcanic islands.

GP41A-08 0945h INVITED

A Sedimentary Magnetic Record of Cenozoic Antarctic Environmental Changes from the Victoria Land Basin, Ross Sea

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Magnetic properties of peri-Antarctic sedimentary sequences can provide useful indications of variations in the weathering regime, and therefore of paleoclimatic conditions, on the Antarctic continent. The Victoria Land Basin (VLB) faces the Transantarctic Mountains in the Ross Sea and contains a sedimentary record of Cenozoic erosion from Antarctica. We synthesize environmental magnetic results from multiple analyses on samples taken at an average spacing of 0.5 - 1 m from a suite of sediment cores drilled since the 1980's over a total stratigraphic thickness of 2.2 km, which span an age range from 37 m.y. to 17 m.y. We critically examine whether the magnetic properties contain a record of paleoclimatic, diagenetic or provenance variations or a mixture of signals resulting from these processes. We recognize variations in the concentration, grain-size and composition of the magnetic minerals in the VLB sequences, on time scales of tens of thousands of years to a few million years, which delineate a magnetic property zonation for the cores. The magnetic properties of the VLB cores are dominated by large-scale variations in magnetite concentration. A consistent overall upward fining of magnetite particles is also observed, together with an increase in the relative concentration of high-coercivity minerals. In the Late Eocene and Early Oligocene, variations in magnetite concentration coincide with variations in detrital smectite concentration associated with paleoclimate cycles across the threshold favoring physical versus chemical weathering of source rocks (high magnetite and smectite concentrations indicate warmer and wetter continental climates and vice versa). Smaller scale variations in smectite/magnetite concentrations also occur in younger sediments, which suggests that there were significant fluctuations in weathering regime during the Late Oligocene and Early Miocene. However, after 24 Ma, increased activity of the McMurdo Volcanic Group dominates the magnetic properties of the VLB sediments and becomes the main source for the younger magnetite and smectite, compared to a Ferrar Dolerite

source for the older sediments. This demonstrates that provenance variations are just as important as paleoclimate in controlling clay mineralogy and magnetic properties in the VLB.

GP41B MCC: Level 1 Thursday 0830h

Environmental Magnetism II Posters

Presiding: **T Evans,** University of Alberta**; A Roberts,** University of Southampton

GP41B-0045 0830h POSTER

Determining of Grainsizes of Susceptibility and Anhysteretic Remanent Magnetization Carriers in Chinese Loess-Paleosol Ssequences

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Detailed rock magnetic studies show that susceptibility (mass-specific χ) and anhysteretic remanent magnetization (ARM) of the Chinese loess/paleosol sequences are carried by almost identical magnetic carriers. Therefore, the ratio $\Delta\chi/\chi_{ARM}$ (or equivalently $\chi_{ARM}/\Delta\chi$, where $\Delta\chi$ is background-corrected χ, and χ_{ARM} is field normalized ARM) can be used to quantify the grainsize of χ and ARM carriers. By determining this ratio for three Chinese loess/paleosol profiles (Jiuzhoutai, Yuanbao, and Yichuan) characterized by different degrees of environmentally controlled pedogenesis and sedimentation rates, we show that the lower grainsize limit of aeolian magnetic particles in the less pedogenically-altered loess units is about 100-300 nm, in the finer-grained pseudo-single domain (PSD) grainsize range. In contrast, the grainsizes of pedogenically-produced magnetic particles for mature paleosols dominantly cover both the superparamagnetic (SP) and single-domain (SD) ranges. Based on plots of $\Delta\chi/\chi_{ARM}$ against $\Delta\chi$, the samples can be divided into four regions (I, II, II, and IV). Region I corresponds to the least pedogenically-altered primary loess samples, with $\Delta\chi/\chi_{ARM}$ of 0.165-0.24. Samples in region II, a transition zone between the least altered loess and the onset of development of paleosols, have χ values identical to those in region I, but have lower $\Delta\chi/\chi_{ARM}$ of 0.09-0.165. With increasing susceptibility in zone III, $\Delta\chi/\chi_{ARM}$ is positively correlated with χ, indicating the gradually-increasing influence of SP particles. Finally, in zone IV with $\Delta\chi$ higher than $6.5\times10^{-7}m^3kg^{-1}$, $\Delta\chi/\chi_{ARM}$ is independent of the variations in $\Delta\chi$, suggesting that the $\Delta\chi/\chi_{ARM}$ is totally controlled by the pedogenic finest-grained particles, and the size distribution of these particles remains almost constant. The development of soils in the Chinese loess revealed by these three profiles from three sites can be clearly explained by a continuous process of pedogenesis, increasing from zone I to zone IV. Based on further comparison of our results with European loess records (Evans and Heller, 2003), we propose that the loess units of the European profile have a higher pedogenic degree than that of the Chinese loess, and correspond to Zones (>) II. The definition of the pedogenic zones can help to improve our understanding of the underlying mechanisms and variability of pedogenesis, and thus could enable more successful and accurate separation of the authentic pedogenic signals from the background signal of the aeolian inputs at different loess sites worldwide.

GP41B-0046 0830h POSTER

Quaternary Mineral Magnetic and Free Iron Records of Climatic Change from Chinese Loess/Paleosol Sequence

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A high-resolution investigation of mineral magnetism, iron geochemistry and soil physics was carried out on a loess/paleosol sequence from Jiaodao, the central Loess Plateau of China. Our multi-parameter records reveal a gradual decrease in paleo-weathering intensity, and hence a gradual aridification of the Asian continental interior over the past 2.6 Ma, with some fluctuations. The mineral magnetic variations of the lithogenic components could be used to find the links among uplift of the Tibetan Plateau and its adjacent regions, weathering processes in source region, and dust deposition in the Loess Plateau. The changes in free iron (FeD) content and rubification were closely related to long-term paleo-weathering intensity variations in the Jiaodao loess/paleosol sequence during the entire Quaternary, thus attesting to the fact that they are good proxies of summer monsoon evolution. The gradual decrease of FeD content and rubification from the upper part of the Tertiary red clay to the last glacial loess apparently reflects a trend toward greater aridity of the climate system in eastern Asia during the Pleistocene. In addition, the FeD and rubification variations can be described as an asymmetrical saw-tooth pattern. From the upper part of the red clay to the upper sandy loess layer L9, this saw-toothed pattern is consistent with the Earth's eccentricity record of the 400-ka period. The features may suggest that the climate system in the Asian continental interior, especially the regional climate controlling atmospheric dust deposition in the Chinese Loess Plateau, is very sensitive to the direct forcing of the 400-ka Earth's eccentricity period.

GP41B-0047 0830h POSTER

Preliminary Results of Two-Year Magnetic Monitoring of Roadside Dust in Seoul, Korea

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Various mineral magnetic measurements for roadside dust samples have been carried out in Seoul, Korea, in order to reveal the spatial and temporal pollution features based on magnetic properties of dust. A total of 1,956 dust samples were collected monthly from June 1998 to June 2000 at eight locations divided into industrial areas, heavy traffic density areas and a park area. The major magnetic phase of the roadside dust was identified to be ferrimagnetic minerals, based on the results of S-ratio, isothermal remanent magnetization (IRM) acquisition pattern and hysteresis parameters. Spatial and temporal variations of magnetic concentrations were traced using the values of low field susceptibility (χ_{LF}), anhysteretic remanent magnetization (ARM) and saturation IRM (SIRM). Spatially, samples from the industrial areas show the highest values of each parameter, whereas those from a park area show the lowermost ones. Samples from the heavy traffic density areas reveal relatively low to intermediate value ranges. The highest content of magnetic materials in samples from the industrial areas can be attributed to input of the high fraction of magnetic materials emitted from nearby factories. Temporally, magnetic concentration parameters indicate that the magnetic concentration in the roadside dust is relatively higher in winter (the dry season) than in summer (the rainy season). These temporal variations of magnetic concentrations could represent the increase of fossil fuel uses in winter time. In addition, the extensive influence of the Asian dust can be detected by the maximum magnetic concentration in March, 2000. Spatial and temporal variations of magnetic grain sizes of dust were determined by interparametric ratios of ARM/χ_{LF} and ARM/SIRM. There are no distinctive spatial differences in the study area. However, values of ARM/χ_{LF} and ARM/SIRM are high in summer and low in winter, indicating that the mean grain size of magnetic materials in dust is relatively coarser in winter than in summer. This temporal pattern of magnetic grain size in dust can be ascribed to the increase of coarse-grained magnetic materials from anthropogenic sources during winter time and to the washout effect of coarse grains by heavy rainfalls during summer time. Geochemical analyses (Cr, Cu, Fe, Mn, Pb and Zn) for selected samples were performed to examine any relationship between heavy metals and magnetic parameters. Some of the analyzed elements (Cr, Cu, Fe and Zn) show similar spatial pattern to those of magnetic concentration parameters such as χ_{LF}, ARM and SIRM. Especially, the concentrations of Cr, Cu, Fe and Zn show relatively high correlation coefficient (R^2 = 0.68-0.90) with χ_{LF}. These results suggest that mineral magnetic parameters can be used as rapid proxy indicators for the degree of heavy metal pollution in urban areas, and that a combination of magnetic and geochemical methods provide more complete information than would be obtained by an individual method.

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The magnetic way of quantifying road traffic pollution in atmospheric particulate matter

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The steadily increasing number of motor vehicles requires continuous air quality monitoring in large urban and sub-urban areas. We present a fast and simple method for analysing samples of atmospheric particulate matter (PM) based on magnetic measurements, which is suitable for systematic pollution monitoring of extensive areas at low costs. Representative samples have been collected in Switzerland at sites with variable exposure to pollution sources. Atmospheric PM consists of natural and of anthropogenic components which both contain magnetic mineral fractions with specific magnetic properties. Our method relies on the analysis of the remanent magnetisation of PM samples. Detailed demagnetisation curves of anhysteretic remanent magnetisation (ARM) of these samples have been modelled using a linear combination of appropriate model functions, which represent the contribution of different magnetic mineral sources to the total magnetisation. Two magnetic components C1 and C2 with well-defined magnetic properties have been 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. Once the coercivity distributions of C1 and C2 have been characterised, a simple method has been developed to quantify C1 and C2. This method is based on four-step demagnetisation curves, which can be measured in 12 minutes using a 2G cryogenic magnetometer with an in-line AF degausser. Our results are confirmed by independent chemical investigations at the same sites. The magnetic contribution of C2 is shown to be proportional to the chemically estimated total PM10 mass contribution of exhaust emissions. The mass concentration of traffic related elements in PM10 such as Fe, Ba, Cu, Mo, Br and elemental carbon also correlates with our results. Traffic is the most important PM pollution source in Switzerland: it includes exhaust emissions and abrasion products released by vehicle brakes. The good correlation found between component C2 and traffic-related PM sources underlines the usefulness of the fast and non-destructive magnetic methods for the quantitative estimation of urban pollution as a low-cost alternative to chemical analysis.

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COERCIVITY DISTRIBUTIONS OF SOFT-MAGNETIC COMPONENTS AND THEIR OCCURRENCE IN SEDIMENTS ANS SEDIMENTARY ROCKS

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