The use of magnetic susceptibility and colour on dune samples for forensic purposes

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Soils and sediments can provide trace evidence in forensic investigations since they display unique physical and chemical signatures. A technique used to determine the nature of the magnetic carriers in sediments is magnetic susceptibility measurement, which is directly proportional to the quantity and grain size of ferromagnetic materials. Another important characteristic used to distinguish soils and sediments is colour measurement. Therefore, both techniques can be applyied for forensic proposes.

In order to investigate the variability of these properties in three different coastal dune sites from different geological contexts (limestones, granites and metasediments), three samples were collected at each site and prepared for magnetic susceptibility and colour analysis. Magnetic susceptibility (MS) was measured on 15g of dry bulk samples using a Kappabridge KLY4S equipment. Colour measurements were performed on bulk, sieved (<150µm or <63µm), and ashed (850ºC) samples, using a Konica Minolta CM-2600d spectrophotometer. The MS values range between $0.59x10^{-8}m^3/kg$ and $34.33x10^{-8}m^3/kg$, with higher values obtained on samples from dunes in metamorphic area (mean value of $27.34x10^{-8}$ m^3/kg), and lowest values (mean value of $1.05x10^{-8}$ m^3/kg) on dune in sedimentary areas. Intermediate values were obtained on samples from dunes surrounded by granites (mean value of $19.67x10^{-8}$ m^3/kg). Concerning the L*a*b* system colour sphere: the L* values measured varied between 48.50 (measured on <150µm size fraction) and 66.81 (measured on ashed samples); a* varied between 1.44 (measured on <150µm size fraction) and 9.03 (measured on ashed samples); b* between 4.84 (measured on <150µm size fraction) and 14.76 (measured measured on ashed samples). L*a*b* lowest values were always observed on samples from dune with limestone on its surroundings and the highest values on samples from dunes surrounded by metasediments. As a conclusion we have found that each technique discriminates the dune samples of the three selected sites.

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Bioavailability and potential human health impacts of Hg, As and other potentially toxic elements soil contamination near mining sites: Current knowledge and future priorities

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Summary

This study provides evidence of severe contamination of agricultural soils surrounding 3 mining areas in the South-West of Portugal. It also showed that soil contamination by Hg, As and other elements affects crop quality leading to potential human health risks. Since no National contaminated land management strategy has been implemented so far in Portugal [1] these findings raise important questions on how to develop a suitable risk management approach that includes bioavailability aspects and focus on links between soil contamination and human exposure to be used as a basis for future interventions and remedial actions.

Case-studies

In 2008, a total of 97 soil and 100 plant samples (*Lolium perenne, Brassica oleracea, Secale cereale*) were collected from agricultural fields surrounding three mining areas in South-West, Portugal (sulphides, pyrites, and Cu extraction). Soils are characterized by pH values of 3-7, a low organic carbon content (<5%) and clay content from 2 to 33%. Total soil Hg ranged from 0.01 to 98 mg/kg, crop Hg levels ranged from 0.01 to 42 mg/kg. Soil As varied from 0.2 to 1325 mg/kg; plant As ranged from 0.1 to 56 mg/kg. Maximum Cu, Pb and Zn contents in soils were 7635, 11546 and 1139 mg/kg and 543, 572 and 432 mg/kg, respectively in crops.

[1] Rodrigues *et al.*(2009) *Environ Int* **35** 214-225.