An Application of Discriminant Analysis to Pattern Recognition of Selected Contaminated Soil Features in Thin Sections

A soil contaminated with copper, chromium and arsenic from an industrial site was characterized with respect to heavy metal (Cu, Cr) and metalloid (As) total content, and for metal speciation by sequential chemical extraction. The contaminated soil contained a negligible proportion of Cu, As and Cr in the soluble and exchangeable phase, these elements being associated primarily with amorphous-crystalline Fe-oxides, organic matter and/or resistant phases. The results obtained with sequential extraction were the prerequisite to the attempt to identify the Cr and As distribution in the solid phase. If high concentrations of contaminants are indicated by chemical wet analysis, these contaminants must occur directly in the solid phase. Thin sections of soil aggregates were scanned for Cu, Cr and As using an electron microprobe, and qualitative analysis was made on selected areas. Microphotographs of thin sections of domains (or parts of them), obtained with plane polarized light, and which the electron microprobe showed to be of interest, were saved on a Kodak photo CD. These relevant identified soil features were shown to be iron-aluminium-silicon, which always had a yellowish colour and showed the common qualitative microprobe results: present elements Al, Si, Cr, Fe, As (associated with others). Selected groups of calibrated images (same light conditions and magnification) submitted to discriminant analysis, in order to find a pattern of recognition in the soil features corresponding to contamination already identified in the thin sections. The authors present a procedure to study the spatial distribution of contaminants in images of contaminated soil features taken from thin sections.

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