

Multi-element analyses in heterogeneous soils

Clare Wilson, SBES, University of Stirling, c.a.wilson@stir.ac.uk

Soil chemistry has traditionally involved analysis of homogenised “bulk” soil samples, whilst soil micromorphology provides a means of studying undisturbed soils on scales that allow analysis of physical structure and void patterns. However, the two approaches have rarely been combined. SEM mounted equipment for x-ray analysis of chemical composition (including EDS, WDS, XRF) are becoming increasingly standard. These techniques offer a powerful, yet widely available and relatively cheap, means of analysing and mapping soil chemistry at scales from μm 's to cm 's in both soil thin sections and fresh soil aggregates. This talk will outline the available methods, their benefits, drawbacks and applications and then detail two case studies of on-going SAGES research that provide examples of their use and integration in studies of the soil chemical environment on both micro- and macro-scales.

The first is the combination of SEM-EDS with X-ray micro-CT to produce 3-D characterisations of the physical and chemical soil microenvironment. The aim is to develop methods for the study of heterogeneous chemical and physical soil characteristics resulting from processes such as organic matter decomposition and soil contamination in relation to the 3-D soil structure. The second case study is a project combining SEM-EDS and bulk soil chemistry to study the micro-spatial heterogeneity of SOC, Fe and Al in gleyed soils. The aim is to gain a better understanding of the role of mineral interactions in SOC sequestration. This study combines sequential extraction of bulk soils with sequential dissolution from thin sections and repeat SEM-EDS analysis to determine SOC distributions and concentrations associated with weakly and strongly crystalline Fe-oxides. The talk will conclude with a summary of the possible developments, opportunities and challenges facing future applications of these technologies.

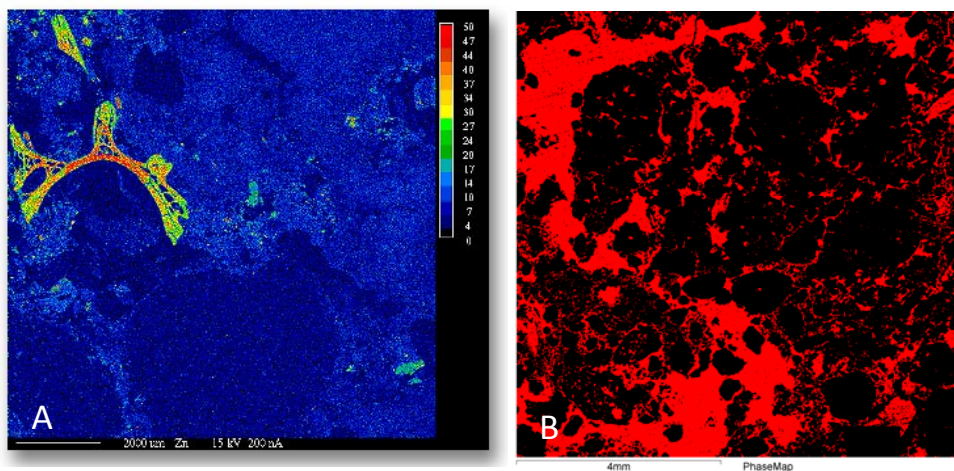


Figure A: Zinc concentrations associated with bone in agricultural soils; B: Chemical phase analysis to identify resin / void soil component.