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The use of $^{87}Sr/^{86}Sr$ ratios, Trace Elements and Biological Profiling for Forensic Provenancing of Soils

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Geological samples, including soils, are frequently analysed by forensic laboratories by comparing a suspect sample to an especially collected control. Soils, as yet, cannot be matched to a central database, unlike other samples, unless the area in question has already been identified. There is a need for a method of soil profiling that allows an unknown sample to be tested and assigned a quantitative likelihood that it originated from a given region. Spatial models can then be created using geographical information systems (GIS) to house data relating to multiple variables and be used to map soils across geographical areas.

Generally, the more variables available with which to compare any two items, the greater the certainty a forensic analyst can have when asserting their similarity and the same applies to geological materials. This poster aims to show results of ongoing research at the Centre for Forensic Provenancing, England, involving the analysis of soil samples collected from across the county of Norfolk. A number of chemical and biological profiling methods have been used to build up a unique signature for soils from different locations. $^{87}Sr/^{86}Sr$ ratios have been measured using MC-ICP-MS, and trace element concentrations measured using ICP-MS. The $^{87}Sr/^{86}Sr$ ratios are significantly different at each of the sample locations across Norfolk; although there is some variation in the multiple samples collected at each location this variation is shown to be smaller than the regional variation. There is a poor correlation between the isotope chemistry of the topsoil and the underlying geology indicating that other sources such as land use, vegetation cover and additions to the soil contribute to the $^{87}Sr/^{86}Sr$. Therefore, trace element concentrations have also been used to spatially discriminate samples and also to investigate the effect of fertilisers on the elemental composition of the topsoil.

The biological techniques used to aid soil discrimination are pollen analysis and the creation of vegetation maps for Norfolk showing all of the plant species recorded in the area since 1975; with our results highlighting the correlations between the pollen data and the recorded plant species, and also the individual and groups of species indicative of the sample areas. Each additional independent dataset allows for an increasingly unique signature of each sample to be built up.